



Industrial capability

OPTINOVA® CABLEOPT™

ELECTRONICS AND CABLE SOLUTIONS

The Cableopt™ package by Optinova is the all-in-one solution for the global electronics and cable industry. Wherever a cable manufacturer needs fluoropolymer products for their application, Optinova can supply the desired product from one source only.

- Different conductor types
- Unique range of insulated wires
- PTFE Dielectric Coaxial Core
- Spiral cut tubing for bundles
- Fluoropolymer and dual heat shrink solutions
- PTFE UL-AWG tubing
- Fluoropolymer tubes, rods, and monofilaments

Optinova can produce virtually any kind of fluoropolymer tubing and customized profiles as well as filled PTFE Heavy Duty HD Liners for control cables or Bowden cable construction with high loads. Please visit our website or contact your nearest sales office for more information.

CAPABILITIES

- Copper Wire Overview
- PTFE Dielectric Coaxial Core
- PTFE/FEP/PFA/ETFE Insulated Wire Solutions
- Spiral Cut Tubing
- Heat Shrink Solutions
- PTFE UL-AWG Tubing
- PTFE AWG Tubing

QUALITY APPROVALS

- UL 94 VO, UL 224, UL & CSA Wire Style Conformity
- MIL-W-16878/4, 5, 6, 23, 25 & 27, and MIL-I-22129C
- FDA or USP VI classification available
- AMS 3295, 3654, 3655 & 3653
- ISO 9001:2015, ISO 14001:2015, and IATF 16949

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COPPER WIRE SIZES, STRANDING, PLATING AND WEIGHT

AWG Size	Number of strands	Strand size (inches)	Plating	Nom. Cond. Dia. (inches)	≈ Cond. Weight (Lbs/Kft)
26	19	38	Tin	.020	0.98
24	19	36	Tin	.025	1.62
22	7	30	Nickel	.030	2.32
	19 Unilay	34	Tin, Silver, Nickel	.030	2.36
20	7	28	Tin, Nickel	.038	3.60
	7	.012	Nickel	.037	3.46
	19	32	Nickel	.038	4.02
18	7	.0152	Tin	.0456	5.04
	7	26	Silver, Nickel	.048	5.49
	16	30	Tin	.045	4.94
	19 Unilay	30	Tin, Silver, Nickel	.048	5.86
16	19 Unilay	29	Nickel	.059	7.45
14	7	.0242	Tin	.0726	12.76
	19 Unilay	27	Tin, Nickel	.068	11.8
	41	30	Tin	.0715	12.66
12	19 Unilay	25	Nickel	.085	18.72
	19 Unilay	.0185	Tin	.0925	20.15
	65	30	Tin	.102	20.2
10	37	26	Tin	.110	29
	105	30	Tin	.130	32.6
8	70	26	Tin	.181	55
6	114	.0152	Tin	.210	88.4
	133	27	Tin	.212	82.2
4	133	25	Tin	.267	132
3	133	.0199	Tin	.300	168
2	259	26	Tin	.336	210
1	259	25	Tin	.378	265
1/0	259	24	Tin	.424	336
2/0	259	23	Tin	.477	425

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WIRE STYLES

Style	Insulation	Size range	Wall thickness	Rating
1164	PTFE	#32-#10	0.013	150°C 300V
1180	PTFE	#32-#10	0.013	200°C 300V
1198	PTFE	#30-#10	0.020	150°C 600V
		#8-#2	0.030	
		#1-4/0	0.045	
1199	PTFE	#30-#10	0.020	200°C 600V
		#8-#2	0.030	
		#1-4/0	0.045	
1212	PTFE	#36-#16	0.008	80°C
1213	PTFE	#36-#16	0.008	105°C
1226	FEP	#32-#20	0.008	80°C
		#19-#14	0.013	
1227	FEP	#32-#20	0.008	105°C
		#19-#10	0.013	
1292	FEP (1)	#26-#20	0.006	105°C
1330	FEP	#30-#10	0.020	200°C 600V
		#8-#2	0.030	
		#1-4/0	0.045	
1331	FEP	#30-#10	0.020	150°C 600V
		#8-#2	0.030	
		#1-4/0	0.045	
1332	FEP	#30-#10	0.013	200°C 300V
1333	FEP	#30-#10	0.013	150°C 300V
1371	PTFE / FEP	#36-#20	0.0055	105°C
		#19-#16	0.008	
		#15-#10	0.013	
		#9-#6	0.020	
1419	PTFE / FEP (2)	#30-#16	0.024	105°C
1508	ETFE	#32-#20	0.0055	105°C
1513	ETFE	#36-#20	0.005	105°C
1516	ETFE	#36-#20	0.004	105°C
1517	ETFE	#32-#20	0.006	105°C
1523	ETFE	#32-#20	0.005	105°C
1538	PTFE/FEP/PFA	#36-#20	0.0055	105°C 125V
		#19-#15	0.008	
		#14-#10	0.013	
		#9-#6	0.020	
1542	Polyethylene (3)	#24-#10	0.040	80°C 10KVAC 20KVDC

(1) with nylon jacket 0.003 (2) with shielding and PTFE or FEP jacket (3) with PVC jacket 0.020

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1577	PTFE/FEP	#32-#16	0.012	200°C
1586	ETFE	#36-#20	0.0055	105°C
		#19-#16	0.008	
		#15-#10	0.013	
		#9-#6	0.020	
1609	ETFE	#36-#20	0.0055	105°C 125V
		#19-#16	0.008	
		#15-#10	0.013	
		#9-#6	0.020	
1659	PTFE	#26-#10	0.020	250°C 600V
		#8-#2	0.030	
		#1-4/0	0.045	
1709	PFA	#32-#10	0.013	200°C 300V
1710	PFA	#32-#10	0.020	200°C 600V
		#8-#2	0.030	
		#1-4/0	0.045	
1716	PTFE/FEP/PFA	#40-#20	0.0055	150°C 150V
		#19-#15	0.008	
		#14-#10	0.013	
		#9-#6	0.020	
1726	PFA, MFA	#32-#10	0.013	250°C 300V
		#8-#6	0.020	
		#4-#2	0.030	
		#1-4/0	0.045	
1727	PFA Type PF Included	#32-#10	0.020	250°C 600V
			0.030	
			0.045	
1815	PTFE	#30-#10	0.013	250°C 300V
		#8-#2		
		#1-4/0		
1901	FEP	#30-#10	0.014	200°C 600V
		#8-#2	0.020	
		#1-4/0	0.030	
1911	PTFE	#24-#10	0.028	250°C 25kVdc
1929	PFA	#32-#10	0.013	200°C 300V
1930	PFA	#30-#10	0.020	200°C 600V
		#8-#2	0.030	
		#1-4/0	0.045	
10050	FEP	#30-#10	0.018	150°C 600V
		#8-#2	0.030	
		#1-4/0	0.045	
10086	ETFE	#36-#14	0.010	150°C 200°C 600V
		#12-#10	0.015	
		#8-#4	0.025	
		#3-#1	0.035	

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10109	ETFE	#36-#18	0.006	150°C 200°C 300V
		#16-#14	0.008	
		#12-#10	0.010	
		#8-#2	0.030	
		#1-4/0	0.045	
10125	ETFE	#36-#18	0.006	150°C 300V
		#16-#14	0.008	
		#12-#10	0.010	
		#8-#2	0.030	
		#1-4/0	0.045	
10126	ETFE	#36-#14	0.010	150°C 600V
		#12-#10	0.015	
		#8-#4	0.025	
		#3-#1	0.035	
		1/0-4/0	0.045	
10185	ETFE	#24-#10	0.014	150°C 200°C 10KVAC 25KV Peak
PFAH	PFA	#14-#10	0.020	250°C 600V
		#9-#2	0.030	
		#1-4/0	0.045	
Type Z	ETFE	#14-#12	0.015	150°C 200°C 600V
		#10	0.020	
		#9-#4	0.025	
		#3-#1	0.035	
		1/0-4/0	0.045	
CSA	ETFE	#32-#20	0.005	105°C 150V
CSA	ETFE	#30-#10	0.010	105°C 300V
CSA	ETFE	#32-#18	0.006	150°C/200°C 300V
		#16-#14	0.008	
		#12-#10	0.010	
		#8-#2	0.030	
		#1-4/0	0.045	
CSA	ETFE	#32-#14	0.010	150°C/200°C 600V
		#12-#10	0.015	
		#8-#2	0.030	
		#1-4/0	0.045	
CSA	PTFE	#26-#16	0.010	150°C 150V
CSA	PTFE	#32-#10	0.013	200°C 300V
CSA	PTFE	#30-#10	0.020	200°C 600V
		#8-#2	0.030	
CSA	PTFE	#32-#10	0.013	250°C 300V
CSA	PTFE	#26-#10	0.020	250°C 600V
		#8-#2	0.030	
		#1-4/0	0.045	
CSA	FEP	#32-#16	0.010	150°C 150V

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CSA	FEP	#28-#10	0.015	180°C 300V
CSA	FEP	#28-#10	0.030	180°C 600V
CSA	FEP	#32-#10	0.013	150°C/200°C 300V
CSA	FEP	#32-#10	0.020	150°C/200°C 600V
		#8-#2	0.030	
CSA	PFA	#32-#10	0.013	200°C/250°C 300V
CSA	PFA	#32-#10	0.020	200°C/250°C 600V
		#8-#2	0.030	
		#1-4/0	0.045	
All CSA ratings include flame test rating FT1				

WIRE STYLES EXPLAINED

For every equipment, appliance and fixture design, there is one or more styles that will efficiently and economically provide the required performance. Since Underwriters' Laboratories (UL) and Canadian Standards Association's (CSA) requirements constantly change to reflect the needs of industry, new styles will be added as applicable.

The range of UL wire styles is from 1164 to 10185 and include, as the CSA styles, insulation with PTFE, FEP, PFA, ETFE, PE or combinations of those for temperature range between 100°C and 250°C depending on desired Voltage. See separate overview with all listed wire styles in our capability range. A complete overview with wire styles can be provided upon request.

APPLIANCE WIRING CONDUCTORS

In most instances, appliance wiring conductors are constructed of either solid or stranded copper, nickel or special alloys. When copper is used, it is usually required to have a coating of tin, silver or nickel either clad or plated.

For 150°C rated construction, individual wires within the conductor normally shall not be smaller than AWG #30, except solid conductors and some business machine wires which are defined by the applicable style requirements.

200°C wires require strands no smaller than AWG #26. Unless special requirements or ratings exist, Optinova supplies tinned copper conductor in labeled constructions.

Optinova's standard range of copper wires contains sizes from AWG 26 to 0 with plating made of tin, nickel, or silver. Other sizes or alloys are available upon request and are subject to longer lead times depending upon supply situation.

FIXTURE & EQUIPMENT WIRING CONDUCTORS

Fixture and equipment wiring conductors are constructed of either solid or stranded nickel or copper. When copper is used, it shall have a coating of tin, silver or nickel with individual wires within conductors to be AWG #26 to #36 inclusive. Unless special requirements or ratings exist, Optinova supplies tinned copper conductor in labeled constructions.

SPECIAL CONSIDERATIONS

All constructions described in the data page are available with labels indicating their listing as recognized wiring materials by Underwriters' Laboratories and Canadian Standards Association and as such, incorporate all necessary markers, jackets, stripes, etc., to conform to applicable style requirements. Where these labels are not required, Optinova can supply these configurations or similar constructions in custom materials designed to meet your exacting requirements.

PTFE DIELECTRIC COAX CORE

Optinova supplies PTFE Dielectric Coax Core as a component to manufacturers of flexible and semi-rigid coaxial cables.

Conductors are stranded or solid silver-plated copper or copper weld. Dielectric values are tightly controlled to meet the requirements of each finished cable as specified by the cable producer.

Longer lengths are available thanks to ultra-long extruders. Our coaxial core solution is designed for superior dielectric and dimensional performance and control. A variety of conductors are available for this product.

Available in all standard sizes and dimensions, our high-performance fluoropolymer tubing can also be customized to meet your unique needs to ensure maximum protection, reliability, and performance.

KEY ADVANTAGES

- Longer length means less scrap during cable manufacturing
- Higher yields and more electrically stable cable constructions
- 83% minimum dielectric concentricity

APPLICATIONS

High performance flexible and semi-rigid coaxial cables are used in both military and commercial wireless communication systems and other high frequency test and measurement equipment.

SIZES AND COMPARISONS

Size, AWG	Conductor Diameter (in/mm)	Dielectric Diameter Tolerance (in/mm)	Dielectric Concentricity
32-28	0.0080/0.203 - 0.0126/0.0320	0.001/0.025	83% min
28-24	0.0126/0.320- 0.0201/0.511	0.002/0.051	83% min
24-18	0.0201/0.511- 0.0403/1.024	0.002/0.051	90% min
18-12	0.0403/1.024- 0.0808/2.052	0.003/0.076	90% min
12-9	0.0808/2.052- 0.1144/2.906	0.005/.0127	90% min
117/0.0314"	0.096/2.438	0.005/0.127	90% min

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PTFE MATERIAL PROPERTIES

	Property	Specification	Unit	
General	Continuous service temperature	Maximum	°C	260
		Maximum	°F	500
	Chemical resistance			Excellent
	Specific gravity	D 792		2.15
Electrical	Dielectric constant	D 150 at 10 ³ Hz		2.1
		D 150 at 10 ⁶ Hz		2.1
	Dielectric dissipation factor	D 150 at 10 ³ Hz		0.0002
		D 150 at 10 ⁶ Hz		0.0002
	Dielectric strength	D 149	Volt/mil	> 1 400
	Volume resistivity	D 257	Ohm • cm	> 10 ¹⁸
Environmental	Water absorption	D 570	%	< 0.01
	Weather resistance			Excellent
	Oxygen index	D 2863	%	> 95
	Flammability	UL 94		V-0
Mechanical	Tensile strength	D 1708, D 638	psi	3 500
	Elongation	D 1708, D 638	%	300
	Compressive strength	D 695	psi	3 500
	Impact strength	D 256 at 23°C	Ft-Lb/in	3.5
	Flexural modulus	D 790 at 23°C	psi	90 000
	Tensile modulus	D 638	psi	80 000
	Hardness	D 2240		D-60
Thermal	Melting point		°C	327
			°F	620
	Thermal conductivity	C-177	BTU/hr/ft ² /°F.in	1.7
	Deflection temperature			
	66 psi	D 648	°C	122
	264 psi	D 648	°C	55
	Deflection temperature			
	66 psi	D 648	°F	252
	264 psi	D 648	°F	131

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PTFE INSULATED WIRE SOLUTION



KEY ADVANTAGES

- Operating temperatures at -70 to 250°C
- Non-aging and resistance against oil, flame, chemicals, and alcohols
- Meets or exceeds specifications for different industrial applications
- PTFE remains flexible at low temperatures
- Full range of colors and conductors available with surface treated for bonding or encapsulation

DIMENSIONS

We offer AWG #22 to #16 on 1 000 ft spools, #14 and #12 on 500 ft spools, and #22 to #18 supplied on drums up to 60 000 ft with marked splices.

We also produce PTFE, PFA, and ETFE insulated wire tubing as well as PTFE Coaxial Core for microwave applications. Please visit our website or contact your nearest sales office for more information.

APPLICATIONS

- Automotive oxygen and NOx sensors
- Gas igniters in ovens and dryers
- Outdoor warmers
- Gas lamps and mosquito killers
- Medical and scientific instruments
- Computers
- Aircraft and marine systems subjected to harsh operating conditions

SPECIFICATIONS

- Commercial specifications: Contact us for a complete listing of available UL and CSA styles. Conductor is made of tin-, silver- or nickel-plated copper.
- Military specifications: PTFE insulated wire tubing exceeds MIL-W-16878/4, 5, 6, 23, 25, and 27 requirements

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COMMERCIAL SPECIFICATIONS

AWG Size	Number of strands	Strand size (inches)	Plating
1199	22-16	.020	200°C / 600 VDC
1213	22-16	.008	105°C
1577	22-16	.012	200°C
1659	22-12	.020	250°C / 60 VDC
1716	22-12	.0055/.013	150°C / 150 VDC
1815	22-12	.013	250°C / 300 VDC
1911	22-12	.028	250°C / 25 KVDC
CSA	22-16	.010	150°C / 150 VDC
CSA	22-12	.020	250°C / 300 VDC
CSA	22-12	.030	200°C / 600 VDC

Optinova High Voltage Appliance Wire, rated at 25 KVDC per UL 758 is listed under UL 1911 and is commonly used for internal wiring of gas igniter systems. Minimum tensile strength: 4,000 psi (2,758 N/cm²) before and 3,400 psi (2,344 N/cm²) after heat aging 60 days at 260 C°. Elongation: 175% before and 149% after heat aging. Tensile and elongation measured at a speed of 20 +/-1 in/min, or 500 +/-25 mm/min. Horizontal flame test applies. Conductor is nickel plated copper.

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MATERIAL PROPERTIES

PTFE	Property	Specification	Unit	
General	Continuous service temperature	Maximum	°C	260
		Maximum	°F	500
	Chemical resistance			Excellent
	Specific gravity	D 792		2.15
Electrical	Dielectric constant	D 150 at 10 ³ Hz		2.1
		D 150 at 10 ⁶ Hz		2.1
	Dielectric dissipation factor	D 150 at 10 ³ Hz		0.0002
		D 150 at 10 ⁶ Hz		0.0002
	Dielectric strength	D 149	Volt/mil	> 1 400
	Volume resistivity	D 257	Ohm • cm	> 1018
Environmental	Water absorption	D 570	%	< 0.01
	Weather resistance			Excellent
	Oxygen index	D 2863	%	> 95
	Flammability	UL 94		V-0
Mechanical	Tensile strength	D 1708, D 638	MPa	3 500
	Elongation	D 1708, D 638	%	300
	Compressive strength	D 695	MPa	3 500
	Impact strength	D 256 at 23°C	Ft-Lb/in	3.5
	Flexural modulus	D 790 at 23°C	MPa	90 000
	Tensile modulus	D 638	MPa	80 000
	Hardness	D 2240		D-60
Thermal	Melting point		°C	327
			°F	620
	Thermal conductivity	C-177	BTU/hr/ft ² /°F.in	1.7
	Deflection temperature			
		66 psi	°C	122
	264 psi	D 648	°C	55
		D 648		
	Deflection temperature			
		66 psi	°F	252
	264 psi	D 648	°F	131

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FEP INSULATED WIRE SOLUTION



KEY ADVANTAGES

- Operating temperatures at -65 to 200°C
- Non-aging and resistance against oil, flame, chemicals, and alcohols
- Meets or exceeds specifications for different industrial applications
- Full range of colors and conductors available with surface treated for bonding or encapsulation

DIMENSIONS

We offer AWG #22 to #16 on 1 000 ft spool. AWG #14 and #12 on 500 ft spool. AWG #22 to #18 supplied on drums up to 60 000 ft with marked splices.

We also produce PTFE, PFA, and ETFE insulated wire tubing as well as PTFE Coaxial Core for microwave applications. Please visit our website or contact your nearest sales office for more information.

APPLICATIONS

- Medical and scientific instruments
- Transformers
- Outdoor warmers
- Gas lamps and mosquito killers
- Computers
- Aircrafts and marine systems subjected to harsh operating conditions

SPECIFICATIONS

- Commercial specifications: Contact us for a complete listing of available UL and CSA styles. Conductor is made of tin-, silver- or nickel-plated copper.
- Military specifications: FEP insulated wire tubing exceeds MIL-W-16878/11, 12 & 13 requirements

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COMMERCIAL SPECIFICATIONS

AWG Size	Number of strands	Strand size (inches)	Plating
1371	26-20 19-16	.0055 .008	105°C
1330	26-10 8-2 1-4/0	.020 .030 .045	200°C/600 VDC
1332	26-10	.013	200°C/300 VDC
1577	26-16	.012	200°C
1901	26-16 8-2 1-4/0	.014 .020 .030	200°C/600 VDC
CSA	26-16	.010	150°C/150 VDC
CSA	26-10	.015	180°C/300 VDC
CSA	26-10	.030	180°C/600 VDC
CSA	26-10	.015	150°C/200°C/300 VDC
CSA	26-10 8-2	.030 .045	150°C/200°C/600 VDC

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MATERIAL PROPERTIES

FEP	Property	Specification	Unit	
General	Continuous service temperature	Maximum	°C	200
		Maximum	°F	392
	Chemical resistance			Excellent
	Specific gravity	D 792		2.15
Electrical	Dielectric constant	D 150 at 10 ³ Hz		2.1
		D 150 at 10 ⁶ Hz		2.1
	Dielectric dissipation factor	D 150 at 10 ³ Hz		0.0001
		D 150 at 10 ⁶ Hz		0.0008
	Dielectric strength	D 149	Volt/mil	2 000
	Volume resistivity	D 257	Ohm • cm	> 10 ¹⁸
Environmental	Water absorption	D 570	%	< 0.01
	Weather resistance			Excellent
	Oxygen index	D 2863	%	> 95
	Flammability	UL 94		V-0
Mechanical	Tensile strength	D 1708, D 638	MPa	24.1
	Elongation	D 1708, D 638	%	300
	Compressive strength	D 695	MPa	15.2
	Impact strength	D 256 at 23°C	Ft-Lb/in	No Break
	Flexural modulus	D 790 at 23°C	MPa	654.6
	Tensile modulus	D 638	MPa	344.5
	Hardness	D 2240		D-55
Thermal	Melting point		°C	270
			°F	518
	Thermal conductivity	C-177	BTU/hr/ft ² /°F.in	1.4
	Deflection temperature			
	66 psi	D 648	°C	59
	264 psi	D 648	°C	57
	Deflection temperature			
	66 psi	D 648	°F	138
	264 psi	D 648	°F	134

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ETFE INSULATED WIRE SOLUTION



KEY ADVANTAGES

- Operating temperatures at -100 to 150°C
- Non-aging and resistance against oil, flame, chemicals, and alcohols
- Greater mechanical toughness and lighter weight compared to FEP insulation
- ETFE remains flexible at low temperatures
- Full range of colors and conductors available with surface treated for bonding or encapsulation

DIMENSIONS

We offer AWG #22 to #10 on 2 500 ft spools. AWG #8 and #4 on 500 ft spools. AWG #2 to #4/0 on 250 ft spools.

We also produce PTFE, PFA, and FEP insulated wire tubing as well as PTFE Coaxial Core for microwave applications. Please visit our website or contact your nearest sales office for more information.

APPLICATIONS

- Motors and sensors
- Appliances
- Process instrumentation
- Medical and scientific instruments
- Computers
- Marine systems subjected to repeated flexing in harsh operating conditions

SPECIFICATIONS

- Commercial specifications: Contact us for a complete listing of available UL and CSA styles. Conductor is made of tin-, silver- or nickel-plated copper.

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COMMERCIAL SPECIFICATIONS

AWG Size	Number of strands	Strand size (inches)	Plating
1516	24-20	.004	105°C
1609	24-20	.0055	105°C/125 VDC
	19-16	.008	
	15-10	.013	
	9-6	.020	
10086	24-14	.010	150°C/200°C/600 VDC
	12-10	.015	
	8-4	.025	
	3-1	.035	
	1/0-4/0	.045	
10125	24-18	.006	150°C/300 VDC
	16-14	.008	
	12-10	.010	
	8-4	.025	
	3-1	.035	
	1/0-4/0	.045	
10185	24-10	.014	200°C/10 KVAC
CSA	24-14	.010	150°C/200°C/600 VDC
	12-10	.015	
	8-2	.030	
	1-1/0	.045	

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MATERIAL PROPERTIES

ETFE	Property	Specification	Unit	
General	Continuous service temperature	Maximum	°C	150
		Maximum	°F	302
	Chemical resistance			Very Good
	Specific gravity	D 792		1.73
Electrical	Dielectric constant	D 150 at 10 ³ Hz		2.6
		D 150 at 10 ⁶ Hz		2.6
	Dielectric dissipation factor	D 150 at 10 ³ Hz		0.0008
		D 150 at 10 ⁶ Hz		0.0005
	Dielectric strength	D 149	Volt/mil	> 2 000
	Volume resistivity	D 257	Ohm • cm	> 10 ¹⁷
Environmental	Water absorption	D 570	%	< 0.03
	Weather resistance			Excellent
	Oxygen index	D 2863	%	> 30
	Flammability	UL 94		V-0
Mechanical	Tensile strength	D 1708, D 638	MPa	6 500
	Elongation	D 1708, D 638	%	230-300
	Compressive strength	D 695	MPa	7 000
	Impact strength	D 256 at 23°C	Ft-Lb/in	No Break
	Flexural modulus	D 790 at 23°C	MPa	200 000
	Tensile modulus	D 638	MPa	120 000
	Hardness	D 2240		D-75
Thermal	Melting point		°C	260
			°F	500
	Thermal conductivity	C-177	BTU/hr/ft ² /°F.in	1.6
	Deflection temperature			
		66 psi	°C	104
	Deflection temperature	264 psi	°C	71
	Deflection temperature			
		66 psi	°F	220
		264 psi	°F	160

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PFA INSULATED WIRE SOLUTION



KEY ADVANTAGES

- Operating temperatures at -70 to 250°C
- Non-aging and resistance against oil, flame, chemicals, and alcohols
- Meets and exceeds specifications for different industrial applications
- PFA remains flexible at low temperatures
- Full range of colors and conductors available with surface treated for bonding or encapsulation

DIMENSIONS

We offer AWG #22 to #10 on 2 500 ft spools. AWG #8 and #4 on 500 ft spools. AWG #2 to #4/0 on 250 ft spools.

We also produce PTFE, ETFE, and FEP insulated wire tubing as well as PTFE Coaxial Core for microwave applications. Please visit our website or contact your nearest sales office for more information.

APPLICATIONS

- Automotive oxygen and NOx sensors
- Gas igniters in ovens and dryers
- Outdoor warmers
- Gas lamps and mosquito killers
- Medical and scientific instruments
- Computers
- Aircraft and marine systems subjected to harsh operating conditions

SPECIFICATIONS

- Commercial specifications: Contact us for a complete listing of available UL and CSA styles. Conductor is made of tin-, silver- or nickel-plated copper.

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COMMERCIAL SPECIFICATIONS

AWG Size	Number of strands	Strand size (inches)	Plating
1716	24-20 19-15 14-10 19-6	.0055 .008 .013 .020	150°C/150 VDC
1726	24-10 8-6 4-2 1-4/0	.013 .020 .030 .045	250°C/300 VDC
1727 includes PF fixture rating	24-10 8-2 1-4/0	.020 .030 .045	250°C/600 VDC
PFAH	14-10 9-2 1-4/0	.020 .030 .045	250°C/600 VDC
1929	24-10	.013	200°C/300 VDC
1930	24-10 8-2 1-4/0	.020 .030 .045	200°C/600 VDC

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MATERIAL PROPERTIES

PFA	Property	Specification	Unit	
General	Continuous service temperature	Maximum	°C	260
		Maximum	°F	500
	Chemical resistance			Excellent
	Specific gravity	D 792		2.15
Electrical	Dielectric constant	D 150 at 10 ³ Hz		2.1
		D 150 at 10 ⁶ Hz		2.1
	Dielectric dissipation factor	D 150 at 10 ³ Hz		0.0002
		D 150 at 10 ⁶ Hz		0.0002
	Dielectric strength	D 149	Volt/mil	> 2 000
	Volume resistivity	D 257	Ohm • cm	> 1018
Environmental	Water absorption	D 570	%	< 0.01
	Weather resistance			Excellent
	Oxygen index	D 2863	%	> 95
	Flammability	UL 94		V-0
Mechanical	Tensile strength	D 1708, D 638	MPa	4 000
	Elongation	D 1708, D 638	%	300
	Compressive strength	D 695	MPa	2 200
	Impact strength	D 256 at 23°C	Ft-Lb/in	No Break
	Flexural modulus	D 790 at 23°C	MPa	100 000
	Tensile modulus	D 638	MPa	40 000
	Hardness	D 2240		D-60
Thermal	Melting point		°C	305
			°F	581
	Thermal conductivity	C-177	BTU/hr/ft ² /°F.in	1.3
	Deflection temperature			
		66 psi	°C	74
	264 psi	D 648	°C	48
		D 648		
	Deflection temperature			
		66 psi	°F	166
	264 psi	D 648	°F	118

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SPIRAL CUT TUBING



Spiral cut tubing is the ideal solution for wrapping cables. It is expandable, durable, and highly flexible.

The spiral wrap tubing provides a strong grip thanks to its memory properties. Spiral cut tubing helps reduce cable chafing and wear. The operating temperature is from -260°C to +260°C.

The tubing is produced primarily in PTFE. It does not age, burn or emit smoke. The natural color is off-white or translucent.

We also produce PFA, FEP, and ETFE spiral cut tubing to meet various product requirements and applications. Please visit our website or contact your nearest sales office for more information.

KEY ADVANTAGES

- Resistant to most chemicals and solvents
- Wide range of colors available
- Excellent dielectric properties
- UV resistant for outdoor applications

APPLICATIONS

- Aerospace and automotive
- Bundling of cables
- Cable Harnesses and plenum cables
- Color coding of cables
- Robotics

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SPECIFICATIONS

Sizes (mm)		Wall (mm)	Pitch (mm)	Max. bundle diameter (mm)
OD	ID			
3	2	0.5	5	10
4	3	0.5	5	15
5	4	0.5	5	20
6	5	0.5	9.5	30
8	6	1.0	9.5	40
10	8	1.0	11	50
12	10	1.0	11	65
14	12	1.0	14	75
22	19	1.5	20	80

Sizes (inch)		Wall (inch)	Pitch (inch)	Max. bundle diameter (inch)
OD	ID			
1/8	1/16	0.03	1/4	1/2
3/16	1/8	0.03	1/4	1
1/4	3/16	0.03	3/8	2
5/16	1/4	0.03	3/8	2-1/2
3/8	5/16	0.03	7/16	3
1/2	7/16	0.03	9/16	4
5/8	9/16	0.03	5/8	5
3/4	11/16	0.03	7/8	6
1/8	1/16	0.03	1/4	1/2

Optinova can also produce sizes and colors according to customer requirements.

When ordering, please state: Quantity, OD, material PTFE (standard) or PFA, FEP, ETFE and color.

INDUSTRIAL HEAT SHRINK TUBING SOLUTIONS

Optinova heat shrink tubing solutions are best suited to offer a protective jacket for applications in extreme environments of heat, corrosion, shock and moisture.

Optinova heat shrink tubing solutions are produced in PTFE, FEP or in a combination of both. Their applications range from transportation, electronics and cable to food and beverage processing. We can also produce heat shrink tubing solutions in PFA and ETFE upon request.

PTFE and FEP tubes are available in 2:1 and 4:1 and 1.3:1 and 1.6:1 Shrink Ratio respectively. Custom dimensions and lengths can be made upon request.

Technical advice: We recommend using heat gun or oven to shrink the tube. You must maintain good ventilation when heating fluoropolymers. The fumes are invisible, odorless and at high temperatures can be unpleasant or cause nausea and flu-like symptoms.

KEY ADVANTAGES

- FDA or USP class VI approved raw materials
- Useful in high temperature applications
- Great chemical resistance to all common solvents, acids and bases
- Virtually unaffected by oxygen, ozone and UV light
- Non-stick and relatively frictionless
- Shrinking temperature: 100 °C – 340 °C

APPLICATIONS

- Insulation and jacketing
- Food and pharmaceutical packaging
- Encapsulation of sensor elements
- Covering of probes and antennas
- Roll covers for textile and paper industries
- Corrosion protection for metal parts
- Shutter protection for lamps

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DIMENSIONS

PTFE Heat Shrink Tubing 2:1 AWG Sizes

AWG Size	Exp. ID (min)	Rec. ID (max)	Light wall recovered after max. shrinkage		Thin wall recovered after max. shrinkage		Standard wall recovered after max. shrinkage	
			tol. +/-	nom.	tol. +/-	nom.	tol. +/-	nom.
	mm							
30	0.97	0.38	0.15	0.05	0.23	0.05	0.23	0.05
28	1.17	0.48	0.15	0.05	0.23	0.05	0.23	0.05
26	1.27	0.56	0.15	0.05	0.23	0.05	0.23	0.05
24	1.40	0.67	0.15	0.05	0.25	0.07	0.31	0.07
22	1.52	0.81	0.15	0.05	0.25	0.07	0.31	0.07
20	1.65	1.02	0.15	0.05	0.31	0.07	0.31	0.07
19	1.93	1.10	0.15	0.05	0.31	0.07	0.41	0.07
18	2.15	1.25	0.15	0.05	0.31	0.07	0.41	0.07
17	2.35	1.38	0.15	0.05	0.31	0.07	0.41	0.07
16	2.80	1.55	0.15	0.05	0.31	0.07	0.41	0.07
15	3.05	1.70	0.15	0.05	0.31	0.07	0.41	0.07
14	3.55	1.88	0.20	0.05	0.31	0.07	0.41	0.07
13	3.81	2.08	0.20	0.05	0.31	0.07	0.41	0.07
12	4.32	2.31	0.20	0.05	0.31	0.07	0.41	0.07
11	4.85	2.57	0.20	0.05	0.31	0.07	0.41	0.07
10	5.20	2.85	0.20	0.05	0.31	0.07	0.41	0.07
9	6.10	3.15	0.20	0.05	0.38	0.07	0.51	0.10
8	6.85	3.58	0.20	0.05	0.38	0.07	0.51	0.10
7	7.67	4.01	0.20	0.05	0.38	0.07	0.51	0.10
6	8.10	4.52	0.25	0.07	0.38	0.07	0.51	0.10
5	9.40	5.03	0.25	0.07	0.38	0.07	0.51	0.10
4	9.90	5.69	0.25	0.07	0.38	0.07	0.51	0.10
3	10.90	6.33	0.25	0.07	0.38	0.07	0.51	0.10
2	11.45	7.06	0.25	0.07	0.38	0.07	0.51	0.10
1	11.94	7.90	0.30	0.07	0.38	0.07	0.51	0.10
0	0.97	8.81	0.31	0.07	0.38	0.08	0.51	0.10

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DIMENSIONS

PTFE Heat Shrink Tubing 4:1			
Order nr	Expanded ID mm	Rec. ID mm	Wall mm
	mm		
5/64"	1.98	0.64	0.22
1/8"	3.18	0.94	0.25
3/16"	4.75	1.27	0.30
1/4"	6.35	1.60	0.30
5/16"	7.92	2.00	0.30
3/8"	9.52	2.44	0.30
7/16"	11.13	2.85	0.30
1/2"	12.70	3.66	0.38
9/16"	14.27	3.94	0.38
5/8"	15.88	4.52	0.38
11/16"	17.45	5.03	0.38
3/4"	19.05	5.70	0.38
7/8"	22.23	6.20	0.38
1"	25.40	7.06	0.38

Expanded diameters are not tolerated. Wall thickness and recovered IDs can differ if full shrinkage according to shrink ratio is not achieved.

DIMENSIONS

FEP Heat Shrink Tubing 1.3:1 AWG Sizes

AWG Size	Exp. ID (min)	Rec. ID (max)	Wall thickness			Exp. ID (min)	Rec. ID (max)	Wall thickness		
inch						mm				
Min. Nom. Max.						Min. Nom. Max.				
24	0.031	0.027	0.006	0.008	0.010	0.79	0.69	0.15	0.20	0.25
22	0.036	0.032	0.006	0.008	0.010	0.91	0.81	0.15	0.20	0.25
20	0.045	0.039	0.006	0.008	0.010	1.14	0.99	0.15	0.20	0.25
18	0.060	0.049	0.006	0.008	0.010	1.52	1.25	0.15	0.20	0.25
16	0.075	0.061	0.007	0.009	0.011	1.91	1.55	0.18	0.23	0.28
14	0.092	0.072	0.007	0.009	0.011	2.34	1.83	0.18	0.23	0.28
12	0.115	0.089	0.007	0.009	0.011	2.92	2.26	0.18	0.23	0.28
10	0.141	0.114	0.007	0.010	0.013	3.58	2.90	0.18	0.25	0.33
9	0.158	0.124	0.007	0.010	0.013	4.01	3.15	0.18	0.25	0.33
8	0.180	0.143	0.007	0.010	0.013	4.57	3.63	0.18	0.25	0.33
7	0.197	0.158	0.007	0.011	0.015	5.00	4.01	0.18	0.28	0.38
6	0.225	0.180	0.007	0.011	0.015	5.72	4.57	0.18	0.28	0.38
5	0.248	0.198	0.007	0.011	0.015	6.30	5.03	0.18	0.28	0.38
4	0.290	0.226	0.007	0.011	0.015	7.37	5.74	0.18	0.28	0.38
3	0.310	0.249	0.007	0.011	0.015	7.87	6.32	0.18	0.28	0.38
2	0.365	0.280	0.008	0.012	0.016	9.27	7.11	0.20	0.30	0.41
1	0.400	0.311	0.008	0.012	0.016	10.16	7.90	0.20	0.30	0.41
0	0.400	0.349	0.008	0.012	0.016	11.18	8.86	0.20	0.30	0.41

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DIMENSIONS

FEP Fractional Tubing 1.3:1												
Frac.	Dec.	Exp. ID (min)	Rec. ID (max)	Wall thickness			Dec.	Exp. ID (min)	Rec. ID (max)	Wall thickness		
inch							mm					
Min. Nom. Max.							Min. Nom. Max.					
3/8	0.375	0.500	0.383	0.011	0.015	0.019	9.53	12.70	9.73	0.28	0.38	0.48
7/16	0.438	0.580	0.448	0.016	0.020	0.024	11.13	14.73	11.38	0.41	0.51	0.61
1/2	0.500	0.666	0.510	0.016	0.020	0.024	12.70	16.92	12.95	0.41	0.51	0.61
5/8	0.625	0.830	0.637	0.021	0.025	0.029	15.88	21.08	16.18	0.53	0.64	0.74
3/4	0.750	1.000	0.764	0.026	0.025	0.034	19.05	25.40	19.41	0.66	0.76	0.86
7/8	0.875	1.170	0.891	0.031	0.030	0.039	22.23	29.72	22.63	0.79	0.89	0.99
1	1.000	1.330	1.020	0.031	0.035	0.039	25.40	33.78	25.91	0.79	0.89	0.99
1 1/8	1.125	1.500	1.145	0.031	0.035	0.039	28.58	38.10	29.08	0.79	0.89	0.99
1 1/4	1.250	1.666	1.270	0.031	0.035	0.039	31.75	42.32	32.26	0.79	0.89	0.99
1 3/8	1.375	1.833	1.390	0.031	0.035	0.039	34.93	46.56	35.31	0.79	0.89	0.99
1 1/2	1.500	2.000	1.520	0.031	0.035	0.039	38.10	50.80	38.61	0.79	0.89	0.99

Expanded diameters are not tolerated. Wall thickness and recovered IDs can differ if full shrinkage according to shrink ratio is not achieved.

MATERIAL PROPERTIES

	PTFE	FEP
Shrink temperature	Ca 330 °C (626 °F)	Ca 100 °C (212 °F)
Shrink Ratio	2:1 and 4:1	1.3:1 and 1.6:1
Length change	+/- 12%	+/- 12%
Working temperature	-260 °C to 260 °C -436 °F to 500 °F	-100 °C to 205 °C -148 °F to 401 °F
Chemical resistance	Excellent	Very good
Flammability	UL 94 V0	UL 94 V0
Shelf life	Infinite	Infinite
Water absorption	>0,01%	>0,01%
Hardness	D60	D55
UV resistance	Unaffected	Unaffected
Ozone resistance	Unaffected	Unaffected
Sterialization	EtO, Steam	EtO, Steam
Food grade materials	Available	Available

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AWG SIZES (MM)

- AWG sized tubing is produced according to the specifications mentioned below
- Standard color is clear, other colors available upon request
- Special custom specifications quoted upon request

AWG Size	Inside Diameter			Light Wall		Thin Wall		Standard Wall		Heavy Wall	
	min	nom	max	wall	+/-	wall	+/-	wall	+/-	wall	+/-
32	0.18	0.23	0.28	0.15	0.05	0.23	0.05				
30	0.25	0.32	0.38	0.15	0.05	0.23	0.05	0.23	0.05		
28	0.33	0.40	0.48	0.15	0.05	0.23	0.05	0.23	0.05		
26	0.41	0.48	0.56	0.15	0.05	0.23	0.05	0.23	0.05		
24	0.51	0.59	0.67	0.15	0.05	0.25	0.07	0.31	0.07	0.41	0.07
23	0.58	0.66	0.74	0.15	0.05	0.25	0.07	0.31	0.07	0.41	0.07
22	0.64	0.72	0.81	0.15	0.05	0.25	0.07	0.31	0.07	0.41	0.07
21	0.74	0.82	0.89	0.15	0.05	0.25	0.07	0.31	0.07	0.46	0.07
20	0.81	0.92	1.02	0.15	0.05	0.31	0.07	0.41	0.07	0.46	0.07
19	0.91	1.01	1.11	0.15	0.05	0.31	0.07	0.41	0.07	0.51	0.10
18	1.02	1.14	1.25	0.15	0.05	0.31	0.07	0.41	0.07	0.51	0.10
17	1.14	1.26	1.37	0.15	0.05	0.31	0.07	0.41	0.07	0.51	0.10
16	1.30	1.42	1.55	0.15	0.05	0.31	0.07	0.41	0.07	0.51	0.10
15	1.45	1.58	1.70	0.15	0.05	0.31	0.07	0.41	0.07	0.51	0.10
14	1.63	1.76	1.88	0.20	0.05	0.31	0.07	0.41	0.07	0.51	0.10
13	1.83	1.96	2.08	0.20	0.05	0.31	0.07	0.41	0.07	0.51	0.10
12	2.06	2.18	2.31	0.20	0.05	0.31	0.07	0.41	0.07	0.51	0.10
11	2.31	2.44	2.57	0.20	0.05	0.31	0.07	0.41	0.07	0.51	0.10
10	2.59	2.72	2.85	0.20	0.05	0.31	0.07	0.41	0.07	0.64	0.12
9	2.90	3.02	3.15	0.20	0.05	0.38	0.07	0.51	0.10	0.64	0.12
8	3.28	3.43	3.58	0.20	0.05	0.38	0.07	0.51	0.10	0.76	0.12
7	3.66	3.84	4.01	0.20	0.05	0.38	0.07	0.51	0.10	0.76	0.12
6	4.12	4.32	4.52	0.25	0.07	0.38	0.07	0.51	0.10	0.76	0.12
5	4.62	4.82	5.03	0.25	0.07	0.38	0.07	0.51	0.10	0.81	0.12
4	5.18	5.44	5.69	0.25	0.07	0.38	0.07	0.51	0.10		
3	5.82	6.08	6.33	0.25	0.07	0.38	0.07	0.51	0.10		
2	6.55	6.80	7.06	0.25	0.07	0.38	0.07	0.51	0.10		
1	7.34	7.62	7.90	0.25	0.07	0.38	0.07	0.51	0.10		
0	8.26	8.54	8.81	0.31	0.07	0.38	0.07	0.51	0.10		

References

ASTM D3295, AMS 3653, AMS 3654, AMS 3655, MIL-I-22129

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AWG SIZES (INCH)

- AWG sized tubing is produced according to the specifications mentioned below
- Standard color is clear, other colors available upon request
- Special custom specifications quoted upon request

AWG Size	Inside Diameter			Light Wall		Thin Wall		Standard Wall		Heavy Wall	
	min	nom	max	wall	+/-	wall	+/-	wall	+/-	wall	+/-
32	0.007	0.009	0.011	0.006	0.002	0.009	0.002				
30	0.010	0.013	0.015	0.006	0.002	0.009	0.002	0.009	0.002		
28	0.013	0.016	0.018	0.006	0.002	0.009	0.002	0.009	0.002		
26	0.016	0.019	0.021	0.006	0.002	0.009	0.002	0.009	0.002		
24	0.020	0.023	0.026	0.006	0.002	0.010	0.003	0.012	0.003	0.016	0.003
23	0.023	0.026	0.029	0.006	0.002	0.010	0.003	0.012	0.003	0.016	0.003
22	0.025	0.028	0.032	0.006	0.002	0.010	0.003	0.012	0.003	0.016	0.003
21	0.029	0.032	0.035	0.006	0.002	0.010	0.003	0.012	0.003	0.018	0.003
20	0.032	0.036	0.040	0.006	0.002	0.012	0.003	0.016	0.003	0.018	0.003
19	0.036	0.040	0.044	0.006	0.002	0.012	0.003	0.016	0.003	0.020	0.004
18	0.040	0.045	0.049	0.006	0.002	0.012	0.003	0.016	0.003	0.020	0.004
17	0.045	0.050	0.054	0.006	0.002	0.012	0.003	0.016	0.003	0.020	0.004
16	0.051	0.056	0.061	0.006	0.002	0.012	0.003	0.016	0.003	0.020	0.004
15	0.057	0.062	0.067	0.006	0.002	0.012	0.003	0.016	0.003	0.020	0.004
14	0.064	0.069	0.074	0.008	0.002	0.012	0.003	0.016	0.003	0.020	0.004
13	0.072	0.077	0.082	0.008	0.002	0.012	0.003	0.016	0.003	0.020	0.004
12	0.081	0.086	0.091	0.008	0.002	0.012	0.003	0.016	0.003	0.020	0.004
11	0.091	0.096	0.101	0.008	0.002	0.012	0.003	0.016	0.003	0.020	0.004
10	0.102	0.107	0.112	0.008	0.002	0.012	0.003	0.016	0.003	0.025	0.005
9	0.114	0.119	0.124	0.008	0.002	0.015	0.003	0.020	0.004	0.025	0.005
8	0.129	0.135	0.141	0.008	0.002	0.015	0.003	0.020	0.004	0.030	0.005
7	0.144	0.151	0.158	0.008	0.002	0.015	0.003	0.020	0.004	0.030	0.005
6	0.162	0.170	0.178	0.010	0.003	0.015	0.003	0.020	0.004	0.030	0.005
5	0.182	0.190	0.198	0.010	0.003	0.015	0.003	0.020	0.004	0.032	0.005
4	0.204	0.214	0.224	0.010	0.003	0.015	0.003	0.020	0.004		
3	0.229	0.239	0.249	0.010	0.003	0.015	0.003	0.020	0.004		
2	0.258	0.268	0.278	0.010	0.003	0.015	0.003	0.020	0.004		
1	0.289	0.300	0.311	0.010	0.003	0.015	0.003	0.020	0.004		
0	0.325	0.336	0.347	0.012	0.003	0.015	0.003	0.020	0.004		

References

ASTM D3295, AMS 3653, AMS 3654, AMS 3655, MIL-I-22129

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UL-AWG PTFE SIZES (MM)

ID for all voltage						600 V						300 V						150 V					
						wall	tol.	wall	OD	OD	OD	wall	tol.	wall	OD	OD	OD	wall	tol.	wall	OD	OD	OD
min	nom	max	Tol+	Tol-		min	+/-	nom	min	nom	max	min	+/-	nom	min	nom	max	min	+/-	nom	min	nom	max
30	0,25	0,30	0,38	0,08	0,05	0,23	0,07	0,30	0,71	0,90	1,12	0,23	0,07	0,30	0,35	0,90	1,12	0,11	0,05	0,16	0,47	0,61	0,78
29	0,28	0,33	0,41	0,08	0,05	0,23	0,07	0,30	0,74	0,93	1,15	0,23	0,07	0,30	0,74	0,93	1,15	0,11	0,05	0,16	0,50	0,64	0,81
28	0,33	0,38	0,46	0,08	0,05	0,23	0,07	0,30	0,79	0,98	1,20	0,23	0,07	0,30	0,79	0,98	1,20	0,11	0,05	0,16	0,55	0,69	0,86
27	0,38	0,43	0,50	0,07	0,05	0,23	0,07	0,30	0,84	1,03	1,24	0,23	0,07	0,30	0,84	1,03	1,24	0,11	0,05	0,16	0,60	0,74	0,90
25	0,46	0,51	0,61	0,10	0,05	0,31	0,07	0,38	1,08	1,27	1,51	0,23	0,07	0,30	0,92	1,11	1,35	0,11	0,05	0,16	0,68	0,82	1,01
24	0,51	0,56	0,66	0,10	0,05	0,31	0,07	0,38	1,13	1,32	1,56	0,23	0,07	0,30	0,97	1,16	1,40	0,11	0,05	0,16	0,73	0,87	1,06
23	0,56	0,64	0,72	0,08	0,08	0,31	0,07	0,38	1,18	1,40	1,62	0,23	0,07	0,30	1,02	1,24	1,46	0,11	0,05	0,16	0,78	0,95	1,12
22	0,64	0,69	0,79	0,10	0,05	0,31	0,07	0,38	1,26	1,45	1,69	0,23	0,07	0,30	1,10	1,29	1,53	0,11	0,05	0,16	0,86	1,00	1,19
21	0,72	0,79	0,87	0,08	0,07	0,38	0,08	0,46	1,48	1,71	1,95	0,23	0,07	0,30	1,18	1,39	1,61	0,11	0,05	0,16	0,94	1,10	1,27
20	0,81	0,86	0,97	0,11	0,05	0,38	0,08	0,46	1,57	1,78	2,05	0,23	0,07	0,30	1,27	1,46	1,71	0,11	0,05	0,16	1,03	1,17	1,37
19	0,91	0,97	1,07	0,10	0,06	0,38	0,08	0,46	1,67	1,89	2,15	0,23	0,07	0,30	1,37	1,57	1,81	0,11	0,05	0,16	1,13	1,28	1,47
18	1,01	1,07	1,17	0,10	0,06	0,38	0,08	0,46	1,77	1,99	2,25	0,23	0,07	0,30	1,47	1,67	1,91	0,11	0,05	0,16	1,23	1,38	1,57
17	1,14	1,19	1,32	0,13	0,05	0,41	0,08	0,49	1,96	2,17	2,46	0,23	0,07	0,30	1,60	1,79	2,06	0,11	0,05	0,16	1,36	1,50	1,72
16	4,29	1,34	1,47	0,13	0,05	0,41	0,08	0,49	2,11	2,32	2,61	0,23	0,07	0,30	1,75	1,94	2,21	0,11	0,05	0,16	1,51	1,65	1,87
15	1,45	1,50	1,65	0,15	0,05	0,41	0,08	0,49	2,27	2,48	2,79	0,23	0,07	0,30	1,91	2,10	2,39	0,11	0,05	0,16	1,67	1,81	2,05
14	1,62	1,68	1,83	0,15	0,06	0,41	0,08	0,49	2,44	2,66	2,97	0,23	0,07	0,30	2,08	2,28	2,57	0,17	0,05	0,22	1,96	2,12	2,37
13	1,83	1,93	2,05	0,12	0,10	0,41	0,08	0,49	2,65	2,91	3,19	0,23	0,07	0,30	2,29	2,53	2,79	0,17	0,05	0,22	2,17	2,37	2,59
12	2,05	2,16	2,31	0,15	0,11	0,41	0,08	0,49	2,87	3,14	3,45	0,23	0,07	0,30	2,51	2,76	3,05	0,17	0,05	0,22	2,39	2,60	2,85
11	2,31	2,41	2,57	0,16	0,10	0,41	0,08	0,49	3,13	3,39	3,71	0,23	0,07	0,30	2,77	3,01	3,31	0,17	0,05	0,22	2,65	2,85	3,11
10	2,59	2,69	2,84	0,15	0,10	0,41	0,08	0,49	3,14	3,67	3,98	0,23	0,07	0,30	3,05	3,29	3,58	0,17	0,05	0,22	2,93	3,13	3,38
9	2,90	3,00	3,15	0,15	0,10	0,48	0,08	0,56	3,86	4,12	4,43	0,28	0,07	0,35	3,46	3,70	3,99	0,17	0,05	0,22	3,24	3,44	3,69
8	3,28	3,38	3,53	0,15	0,10	0,48	0,08	0,56	4,24	4,50	4,81	0,28	0,07	0,35	3,84	4,08	4,37	0,17	0,05	0,22	3,62	3,82	4,07
7	3,65	3,76	3,94	0,18	0,11	0,48	0,08	0,56	4,61	4,88	5,22	0,28	0,07	0,35	4,21	4,46	4,78	0,18	0,05	0,23	4,01	4,22	4,50
6	4,11	4,22	4,41	0,19	0,11	0,48	0,08	0,56	5,07	5,34	5,69	0,28	0,07	0,35	4,67	4,92	5,25	0,20	0,07	0,27	4,51	4,76	5,09
5	4,62	4,72	4,95	0,23	0,10	0,48	0,08	0,56	5,58	5,84	6,23	0,28	0,07	0,35	5,18	5,42	5,79	0,20	0,07	0,27	5,02	5,26	5,63
4	5,18	5,28	5,53	0,25	0,10	0,48	0,08	0,56	6,14	6,40	6,81	0,28	0,07	0,35	5,74	5,98	6,37	0,20	0,07	0,27	5,58	5,82	6,21
3	5,81	5,94	6,20	0,26	0,13	0,48	0,08	0,56	6,77	7,06	7,48	0,28	0,07	0,35	6,37	6,64	7,04	0,20	0,07	0,27	6,21	6,48	6,88
2	6,55	6,68	6,93	0,25	0,13	0,48	0,08	0,56	7,51	7,80	8,21	0,28	0,07	0,35	7,11	7,38	7,77	0,20	0,07	0,27	6,95	7,22	7,61
1	7,34	7,47	7,75	0,28	0,13	0,48	0,08	0,56	8,30	8,59	9,03	0,28	0,07	0,35	7,90	8,17	8,59	0,23	0,07	0,30	7,80	8,07	8,49

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Optinova Thailand approval: File E151086

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