



MICRO DUCT CABLE

AR-1MICRO-D xxxF G652D

OPTICAL FIBER CABLE SPECIFICATION

1. General

This specification covers the design and performance of the single mode optical cables to be used in air blown micro duct application.

1.1 Cable Description

- 12/24/36/48/72/96/144/192/216/288 /432/576 FO G.652D SM-fibers.
- Loose tubes SZ-stranded.
- Suitable for air blown installation in micro-duct .

1.2 Quality

ARTIC ensures a continuing level of quality in our cable products through several programs including ISO 9001, ISO 14001 and ROHS.

1.3 Reliability

ARTIC ensures product reliability through rigorous qualification testing of each product family. Both initial and periodic qualification testing are performed to assure the cable's performance and durability in the field environment.

1.4 Reference

ITU-T G.652D	Characteristics of a single-mode optical fiber
IEC 60794-1-1	Optical fiber cables- part1-1-Generic specification-General
IEC 60794-1-2	Optical fiber cables- part1-2-Generic specification-Basic optical cable test procedure
IEC 60794-3	Optical fiber cables- part3-Sectional specification- Outdoor cables
IEC 60794-5	Optical fiber cables- part5-Sectional specification- Microduct cabling for installation by blowing

1.5 Working Condition

Transportation and storage temperature: $-30^{\circ}\text{C} \sim +70^{\circ}\text{C}$

Installation temperature: $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$

Operation temperature: $-30^{\circ}\text{C} \sim +70^{\circ}\text{C}$

1.6 Minimum Allowable Bending Radius

Static: 10D

Dynamic: 20D

D is the out diameter of the cable

1.7 Life Time

Optical fiber cables supplied in compliance with the specifications can be capable of withstanding the typical service condition for a period of twenty-five (25) years without detriment to the transmission or operation and maintenance characteristics of the cable.

2. Optical Fiber In Cable(ITU-G652D)

Optical properties of the SM fiber are achieved through a germanium doped silica based core with a pure silica cladding which meets ITU-T G652D, UV curable acrylate protective coating is applied over the glass cladding to provide the necessary maximum fiber lifetime. Geometrical, optical, and mechanical characteristics of fiber in cable as the following table:

Category	Description	Specification
Geometrical Characteristics	Cladding diameter	$125.0 \pm 1.0 \mu\text{m}$
	Cladding non-circularity	$\leq 1.0 \mu\text{m}$
	Core concentricity error	$\leq 0.6\%$
	Coating diameter	$245 \pm 10 \mu\text{m}$ (Before Colored)
		$250 \pm 15 \mu\text{m}$ (Colored)
Coating/cladding concentricity error	$\leq 12 \mu\text{m}$	

Category	Description	Specification
Optical Characteristics	Mode field diameter at 1310 nm	$9.2 \pm 0.4 \mu\text{m}$
	Point discontinuity	$\leq 0.05 \text{ dB}$
	Attenuation at 1310 nm	$\leq 0.36 \text{ dB/km}$
	Attenuation at 1383 nm	$\leq 0.35 \text{ dB/km}$
	Attenuation at 1550 nm	$\leq 0.22 \text{ dB/km}$
	Dispersion in 1288 – 1339 nm	$\leq 3.5 \text{ ps/ (nm-km)}$
	Dispersion in 1271 – 1360 nm	$\leq 5.3 \text{ ps/ (nm-km)}$
	Dispersion at 1550 nm	$\leq 18 \text{ ps/ (nm-km)}$
	Zero dispersion wavelength	1300 - 1324 nm
	Zero dispersion slope	$\leq 0.092 \text{ ps/ (nm}^2\text{-km)}$
	Cable cut-off wavelength	$\leq 1260 \text{ nm}$
	Polarization mode dispersion individual fiber	$\leq 0.2 \text{ ps } \sqrt{\text{km}}$
	Polarization mode dispersion design link value (M=20, Q=0.01%)	$\leq 0.1 \text{ ps } \sqrt{\text{km}}$
	Macro-bend loss (100 turns, 30mm radius, 1550/1625nm)	$\leq 0.1 \text{ dB}$
Mechanical Specification	Proof stress level	$\leq 100 \text{ kpsi (0.69 GPa)}$
	Coating strip force(peak value)	1.3~8.9 N
	Fiber curl (Radius)	$\geq 4 \text{ m}$

3. Optic Cable

3.1 General Design

Optical fibers are housed in loose tubes that are made of high-modulus plastic and filled with waterproof compounds.

FRP is applied as central strength member.

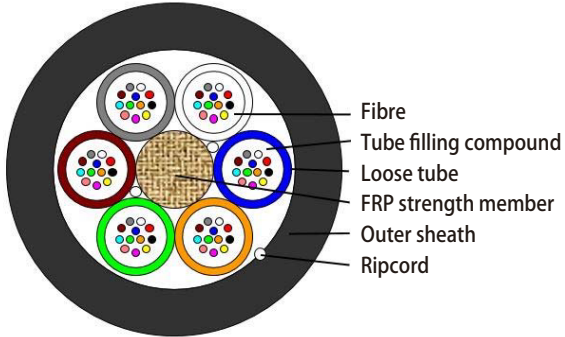
Loose tubes are SZ-stranded around the strength member.

Water blocking yarns are used in and over the cable core to prevent it from water ingress.

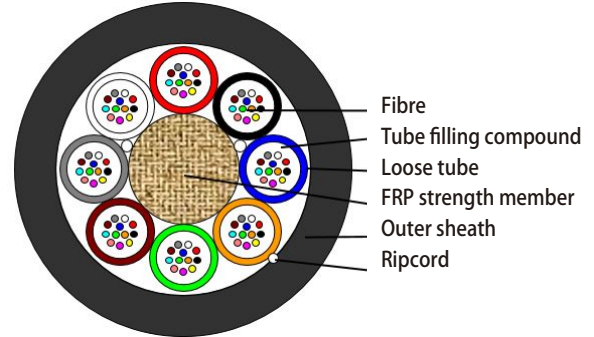
Polyethylene sheath is applied over the cable core as the outer sheath.

3.2 Construction

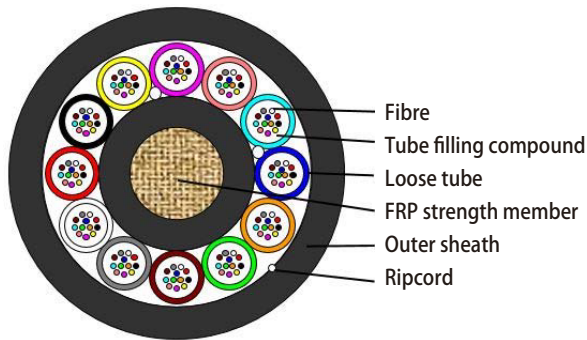
3.2.1 Cross Section of Cable



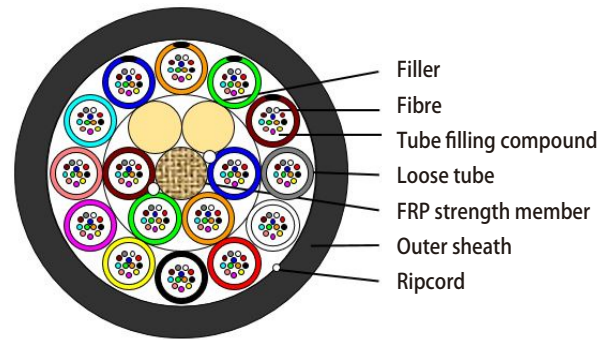
AR-1MICRO-D 12/72F G652D



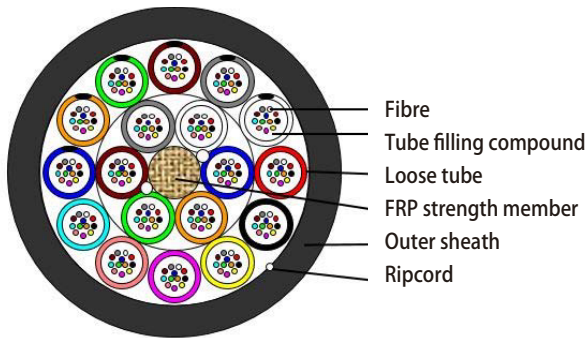
AR-1MICRO-D 96F G652D



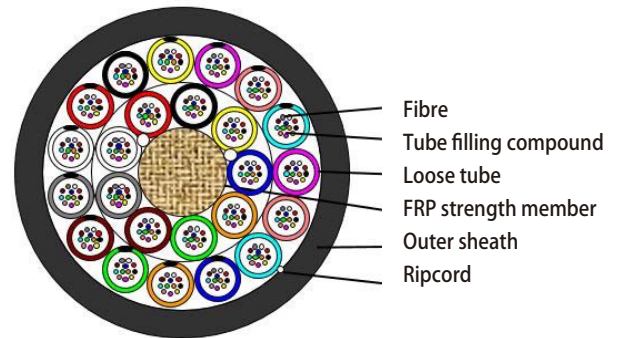
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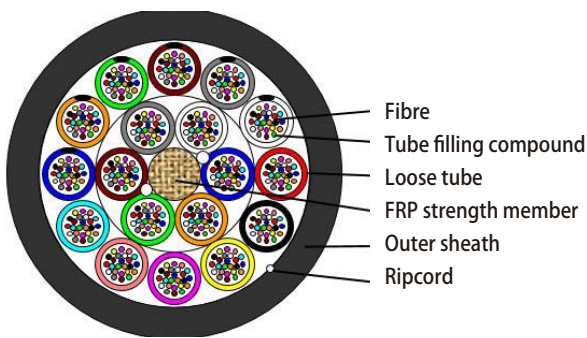
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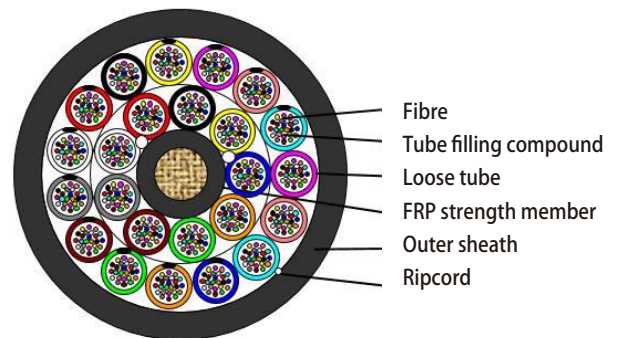
AR-1MICRO-D 216F G652D



AR-1MICRO-D 288F G652D



AR-1MICRO-D 432F G652D



AR-1MICRO-D 576F G652D

3.2.2 Dimensions and Descriptions of Cable Constructions

Item	contents	Value															
		12	24	36	24	48	72	96	144	192	216	288	144	192	288	432	576
Loose tube	Number	2	4	6	2	4	6	8	12	16	18	24	6	8	12	18	24
	Outer diameter ±0.1mm	1.2			1.45						2.1						
Filler	Number	4	2	0	4	2	0	0	0	2	0	0	0				
Counts per tube	G.652D	6			12						24						
Central strength (mm)	Material	FRP															
	Diameter	1.2			1.6			2.4	2.4	1.6	2.8	2.25	2.8	2.8	2.25	2.8	
	Diameter of PE lay	/			/			/	4.1	/	/	/	3.5	6.1	/	4.1	
Outer sheath	Material	HDPE															
	Color	Black															
	Thickness (mm)	Approx.0.5															
Cable diameter (± 0.2mm)	4.5			5.4			6.1	7.9			9.3	7.3	8.8	11.4	11.4	13.4	
For micro –duct inside (mm)	6~8			8~12			8~12	10~14			12~14	10~14	12~14	14~16		16~20	
Max. tensile strength (N)	200			600			800		600		1000	800	1000	1200	1000	1200	
Crush(N/100mm)	Short term: 500 Long term: 200																
Cable weight(kg/km) Approx.	16			26			36	52	52	80	42	76	110	105	140		

3.2.3 Color Code of the Fiber

Each fiber can be identifiable throughout the length of the cable in accordance with the following color sequence. Fiber color in each tube starts from No. 1 Blue.

Fiber color code	6 fibers per tube	1	2	3	4	5	6
		● Blue	● Orange	● Green	● Brown	● Slate	○ White
12 fibers per tube		1	2	3	4	5	6
	● Blue	● Orange	● Green	● Brown	● Slate	○ White	
		7	8	9	10	11	12
	● Red	● Black	● Yellow	● Violet	● Pink	● Aqua	

Fiber color code	24 fibers per tube	1	2	3	4	5	6
		● Blue	● Orange	● Green	● Brown	● Slate	○ White
		7	8	9	10	11	12
		● Red	● Black	● Yellow	● Purple	● Pink	● Aqua
		13	14	15	16	17	18
		● Blue with black ring	● Orange with black ring	● Green with black ring	● Brown with black ring	● Slate with black ring	○ White black ring
		19	20	21	22	23	12
● Red with black ring	○ Nature	● Yellow with black ring	● Purple with black ring	● Pink with black ring	● Aqua with black ring		

3.2.4 Color Code of the Loose Tube and Filler

The loose tubes will be identifiable in accordance with the following color sequence.

Tube color code	1	2	3	4	5	6
	● Blue	● Orange	● Green	● Brown	● Slate	○ White
	7	8	9	10	11	12
	● Red	● Black	● Yellow	● Purple	● Pink	● Aqua

Tube color code	18 tube	Inner 1	Inner 2	Inner 3	Inner 4	Inner 5	Inner 6
		● Blue	● Orange	● Green	● Brown	● Slate	○ White
		Outer 1	Outer 2	Outer 3	Outer 4	Outer 5	Outer 6
		● Red	● Black	● Yellow	● Purple	● Pink	● Aqua
		Outer 7	Outer 8	Outer 9	Outer 10	Outer 11	Outer 12
	● Blue with black Stripe	● Orange with black Stripe	● Green with black Stripe	● Brown with black Stripe	● Slate with black Stripe	○ White blackStripe	

Tube color code	16 tube + 2 Filler	Inner 1	Inner 2	Inner 3	Inner 4	Inner 5	Inner 6
		● Blue	● Orange	● Green	● Brown	Filler	○ White
		Outer 1	Outer 2	Outer 3	Outer 4	Outer 5	Outer 6
		● Slate	○ White	● Red	● Black	● Yellow	● Purple
		Outer 7	Outer 8	Outer 9	Outer 10	Outer 11	Outer 12
		● Pink	● Aqua	● Blue with black Stripe	● Orange with black Stripe	● Green with black Stripe	● Brown with black Stripe

Tube color code	24 tube	Inner 1	Inner 2	Inner 3	Inner 4	Inner 5	Inner 6
		● Blue	● Orange	● Green	● Brown	● Slate	○ White
		Inner 7	Inner 8	Inner 9	Inner 10	Inner 11	Inner 12
		● Red	● Black	● Yellow	● Purple	● Pink	● Aqua
		Outer 4	Outer 5	Outer 6	Outer 7	Outer 8	Outer 9
		● Blue with black Stripe	● Orange with black Stripe	● Green with black Stripe	● Brown with black Stripe	● Slate with black Stripe	○ White black Stripe
		Outer 10	Outer 11	Outer 12	Outer 13	Outer 14	Outer 15
● Red with black Stripe	● Black with black Stripe	● Yellow with black Stripe	● Purple with black Stripe	● Pink with black Stripe	● Aquawith black Stripe		

3.3 Mechanical, Electrical and Environmental Test Characteristics

The finished cables can be subjected to the following mechanical, electrical and environmental conditions.

Item	Test Method	Requirements
Tensile performance	IEC 60794-1-2-E1 Load: according to short term tensile described in 3.2.2. Cable length under tension: Not less than 50m. Duration of load sustain: 1 min. Velocity of transfer device: 10mm/min	The maximum fiber strain less than 0.6% under maximum tensile short term load. The maximum increase in attenuation less than 0.1dB. No change in attenuation after test at 1550nm. Under visual examination without magnification, no damage to the sheath or to the cable elements after test.
Crush	IEC 60794-1-2-E3 Load: 500N Duration of load: 1 min	No change in attenuation after test at 1550nm. Under visual examination without magnification, no damage to the sheath or to the cable elements. The imprint of the striking surface on the sheath is not considered mechanical damage.
Bend	IEC 60794-1-2-E11A Mandrel radius: 10 times cable diameter Turns:10. Cycles: 5	No change in attenuation at 1550nm after test. Under visual examination without magnification, no damage to the sheath or to the cable elements.
Repeated bending	IEC 60794-1-2-E6 Bending radius: 20 times cable diameter Cycles: 25. Load: 25N. Duration of cycle: Approximately 2s.	No change in attenuation at 1550nm after test. Under visual examination without magnification, no damage to the sheath or to the cable elements.
Torsion	IEC 60794-1-2-E7 Cycles:5 Length under test: 1m Turns: $\pm 180^\circ$ Load: 40N	The variation on attenuation for each fiber less than 0.05dB at 1550nm Under visual examination without magnification, no damage to the sheath or to the cable elements. No permanent change in attenuation after test
Temperature cycling	IEC 60794-1-2-F1 Sample length: at least 1000m Temperature range: $-30^\circ\text{C} \sim +70^\circ\text{C}$ Cycles: 2 Temperature cycling test dwell time: 12 hours	There is no change in attenuation coefficient at 1550nm after the test.
Water Penetration	IEC 60794-1-2-F5B Time : 24 hours Sample length : 3m Water height : 1m	No water leakage

Item	Test Method	Requirements
Compound flow	IEC 60794-1-2-E14 Sample count:5 Sample length:300+/- 5 mm, Remove length: 130 +/- 2,5 mm, Time:24h	No filling compound dripped.
Other parameters	According to IEC 60794 ,YD/T 1460.4-2006	

4. Cable Sheath Marking

Unless otherwise specified, the cable sheath marking shall be as follows:

- Color: white
- Contents: ARTIC, the year of manufacture, the type of cable, length marking
- Interval: 1m

5. Packaging and Shipping

5.1 Reel Length

Standard reel length: 2/3/4/5/6 km/reel

5.2 Cable Drum

The cables are packed in wooden drums

5.3 Labeling

The direction of rotation of the color scheme is shown by marking the clockwise and anti-clockwise ends with red and green adhesive tape respectively.

The markings are on both sides of the flanges as follows:

- Cable Type/Size
- Cable Length
- Gross Weight.
- ARTIC
- Shipping mark.

5.4 Cable Packing

Both cable ends are provided with protections against water penetration and firmly secured to the drum, so the cable cannot move and the turns cannot.