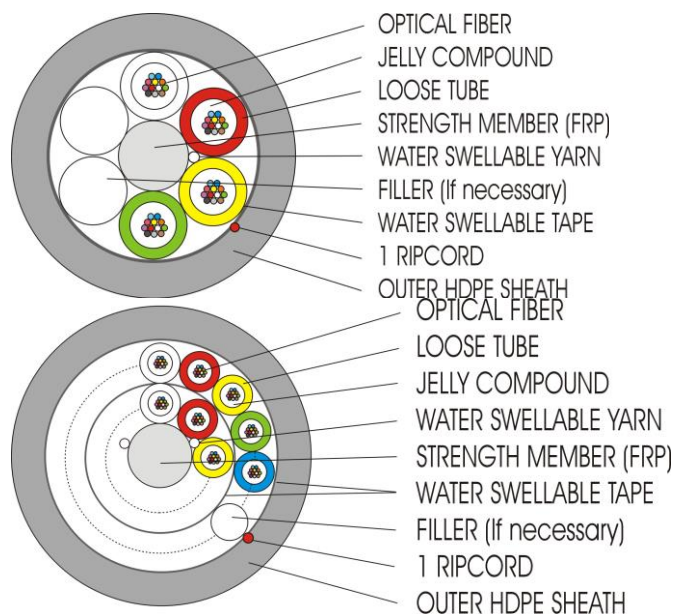


■ SMALL DIAMETER DUCT INSTALLATION CABLE (4C ~ 312C)



[4C ~ 144C]

[192C ~ 312C]

- SINGLE MODE OPTICAL FIBER (ITU-T G.652D, ITU-T G.657A1)
- LOOSE TUBE (JELLY FILLED)
- CENTRAL STRENGTH MEMBER (FRP)
- DRY CORE TYPE, SZ STRANDING (Metal free)
- SMALL DIAMETER OPE SHEATH FOR DUCT INSTALLATION (SD_OPE Sheath, Halogen free PE)

Fiber Counts		4C	12C~36C	48C, 72C	96C	144C
Nom. cable diameter (mm)		9.1		9.1	10.5	13.4
Fibers per tube		4	12	12	12	12
Nom. loose tube diameter (mm)		2.2		2.2	2.2	2.2
Nom. outer sheath thickness (mm)		1.0		1.0	1.0	1.0
Min. bend radius (mm)	No load	91		91	105	134
	Under load	182		182	210	268
Max. pulling tension (N)	Installation	1700		1700	2400	3300
	Operation	850		850	1200	1600
Cable weight (kg/km)		59		62	84	137

Fiber Counts		192C	240C	288C	312C
Nom. cable diameter (mm)		14.8	14.8	16.0	16.8
Fibers per tube		12	12	12	12

SMALL DIAMETER DUCT CABLE (SD_OPE Sheath – Metal free, Halogen free)

- ITU-T G.652D or G.657A1, [Single layer : 4C, 12C, 24C, 36C, 48C, 72C, 96C, 144C]
- ITU-T G.652D or G.657A1, [Double layer : 192C, 240C, 288C, 312C]

Nom. loose tube diameter (mm)		2.2	2.2	2.2	2.2
Nom. outer sheath thickness (mm)		1.0	1.0	1.0	1.0
Min. bend radius (mm)	No load	148	148	160	168
	Under load	296	296	320	336
Max. pulling tension (N)	Installation	3300	3300	3800	3800
	Operation	1650	1650	1900	1900
Cable weight (kg/km)		151	155	186	204

● Recommended Temperature Range

- 40℃ ~ +70℃ (Transportation & Storage)
- 10℃ ~ +50℃ (Installation)
- 40℃ ~ +70℃ (Operation)

● Mechanical and Environmental Properties

Item	Test Method	Test Condition	Acceptance Criteria
Tensile strength	IEC 794-1-E1	- Load: over 1.5 times 1km cable weight	Note 1), 2)
Crush	IEC 794-1-E3	- Load: 1000 N/100mm	Note 1), 2)
Impact	IEC 794-1-E4	- Impact energy : 0.5kg×1m - Impact diameter: 25mm	Note 1), 2)
Repeated bending	IEC 794-1-E6	- Bending radius: 20×cable diameter - Bending cycles: 20	Note 1), 2)
Torsion	IEC 794-1-E7	- Test length: 2m - Twist angle: ±180 degrees - Twist cycles: 10	Note 1), 2)
Temperature cycling	IEC 794-1-F1	- Temperature change: -40℃→+70℃	Note 3)
Water penetration	IEC 794-1-F5	- Cable length: 3m, Water height: 1m - Duration time: 24 hrs	No water leak

Note 1) Attenuation : ≤ 0.1dB

2) No mechanical damage

3) Attenuation : ≤ 0.2dB/km (each procedure), ≤ 0.1dB/km (after test)

Annex 1. Color Code of Optical Fiber and Loose Tube

SMALL DIAMETER DUCT CABLE (SD_OPE Sheath – Metal free, Halogen free)

- ITU-T G.652D or G.657A1, [Single layer : 4C, 12C, 24C, 36C, 48C, 72C, 96C, 144C]
- ITU-T G.652D or G.657A1, [Double layer : 192C, 240C, 288C, 312C]

No.	1	2	3	4	5	6	7	8	9	10	11	12	13~16
Color	White	Red	Yellow	Green	Blue	Grey	Brown	Black	Violet	Turquoise	Orange	Pink	Natural

Annex 2. Optical Fiber Cable Unit Composition

Cable Core		The count of optical fiber per loose tube and unit composition															
		U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U11	U12	U13	U14	U15	U16
4C		4	F	F	F	F	F										
12C		12	F	F	F	F	F										
24C		12	12	F	F	F	F										
36C		12	12	12	F	F	F										
48C		12	12	12	12	F	F										
72C		12	12	12	12	12	12										
96C		12	12	12	12	12	12	12	12								
144C		12	12	12	12	12	12	12	12	12	12	12	12				
192C	1layer	12	12	12	12	12	12	12									
	2 layer	12	12	12	12	12	12	12	12	12	F	F	F	F			
240C	1 layer	12	12	12	12	12	12	12									
	2layer	12	12	12	12	12	12	12	12	12	12	12	12	12			
288C	1layer	12	12	12	12	12	12	12	12	12							
	2 layer	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
312C	1 layer	12	12	12	12	12	12	12	12	12	12						
	2 layer	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12

Note) F: PE Filler (Natural color)

SMALL DIAMETER DUCT CABLE (SD_OPE Sheath – Metal free, Halogen free)

- ITU-T G.652D or G.657A1, [Single layer : 4C, 12C, 24C, 36C, 48C, 72C, 96C, 144C]
- ITU-T G.652D or G.657A1, [Double layer : 192C, 240C, 288C, 312C]

Annex 3. Optical Properties of Cable

1. Optical Properties of ITU-T G.652D (LWPF : Low Water Peak Fiber)

Items of Properties		Value
Geometrical Characteristics	Effective group index (step index) @1310nm	1.467
	@1550nm & 1625nm	1.468
	Mode field diameter @1310nm	$9.2 \pm 0.4 \mu\text{m}$
	Core/Clad concentricity error	$\leq 0.5 \mu\text{m}$
	Cladding diameter	$125 \pm 0.7 \mu\text{m}$
	Cladding non-circularity	$\leq 1.0 \%$
Optical Characteristics	Coating diameter (Uncolored)	$245 \pm 5 \mu\text{m}$
	Cutoff wavelength (λ_{cc})	$\leq 1260\text{nm}$
	Attenuation coefficient @1310nm Maximum (Typical) @1383nm Maximum @1550nm Maximum (Typical) @1625nm Maximum	$\leq 0.35 \text{ dB/km}$ ($\leq 0.34 \text{ dB/km}$) $\leq 0.31 \text{ dB/km}$ $\leq 0.22 \text{ dB/km}$ ($\leq 0.20 \text{ dB/km}$) $\leq 0.24 \text{ dB/km}$
	Bending loss @1625nm 30mm mandrel radius, 100 turns	$\leq 0.05 \text{ dB}$
	Attenuation uniformity	$\leq 0.05 \text{ dB}$
	Chromatic dispersion coefficient @1285~1330nm @1290~1330nm @1550nm	$\leq 3.2 \text{ ps/nm.km}$ $\leq 2.8 \text{ ps/nm.km}$ $\leq 18 \text{ ps/nm.km}$
	Zero dispersion wavelength	1300~1322nm
	Zero dispersion slope	$\leq 0.092 \text{ ps/nm}^2.\text{km}$
	PMD Link design value	$\leq 0.08 \text{ ps}/\sqrt{\text{km}}$
	PMD (maximum individual fiber)	$\leq 0.2 \text{ ps}/\sqrt{\text{km}}$
Mechanical Characteristics	Proof test level	115 kpsi (0.8Gpa).
	Coating strip (Nominal)	3.0 N/3cm
Environmental Characteristics (Uncabled fiber)	Temperature dependence (-60°C~+85°C)	$\leq 0.05\text{dB/km}$ (@1310nm/@1550nm)
	Temperature-Humidity Cycling (-10°C~+85°C/98% relative humidity)	$\leq 0.05\text{dB/km}$ (@1310nm/@1550nm)

SMALL DIAMETER DUCT CABLE (SD_OPE Sheath – Metal free, Halogen free)

- ITU-T G.652D or G.657A1, [Single layer : 4C, 12C, 24C, 36C, 48C, 72C, 96C, 144C]
- ITU-T G.652D or G.657A1, [Double layer : 192C, 240C, 288C, 312C]

2. Optical Properties of ITU-T G.657A1 (LBRF : Low Bending Radius Fiber)

Items of Properties		Value
Geometrical Characteristics	Effective group index (step index) @1310nm	1.468
	@1550nm & 1625nm	1.469
	Mode field diameter @1310nm	$8.8 \pm 0.4 \mu\text{m}$
	Core/Clad concentricity error	$\leq 0.7 \mu\text{m}$
	Cladding diameter	$125 \pm 0.7 \mu\text{m}$
	Cladding non-circularity	$\leq 0.7 \%$
Optical Characteristics	Coating diameter (Uncolored)	$245 \pm 5 \mu\text{m}$
	Cutoff wavelength (λ_{cc})	$\leq 1260\text{nm}$
	Attenuation coefficient @1310nm Maximum (Average) @1383nm Maximum @1550nm Maximum (Average) @1625nm Maximum	$\leq 0.35 \text{ dB/km}$ ($\leq 0.34 \text{ dB/km}$) $\leq 0.31 \text{ dB/km}$ $\leq 0.22 \text{ dB/km}$ ($\leq 0.20 \text{ dB/km}$) $\leq 0.24 \text{ dB/km}$
	Bending loss (@1550nm/@1625nm) Φ 30mm mandrel, 10 turns Φ 20mm mandrel, 1 turn	$\leq 0.25 \text{ dB}$ / $\leq 1.00 \text{ dB}$ $\leq 0.75 \text{ dB}$ / $\leq 1.50 \text{ dB}$
	Attenuation uniformity	$\leq 0.05 \text{ dB}$
	Chromatic dispersion coefficient @1285~1330nm @1290~1330nm @1550nm	$\leq 3.2 \text{ ps/nm.km}$ $\leq 2.8 \text{ ps/nm.km}$ $\leq 18 \text{ ps/nm.km}$
	Zero dispersion wavelength	1300~1322nm
	Zero dispersion slope	$\leq 0.092 \text{ ps/nm}^2.\text{km}$
	PMD Link design value	$\leq 0.08 \text{ ps}/\sqrt{\text{km}}$
	PMD (maximum individual fiber)	$\leq 0.2 \text{ ps}/\sqrt{\text{km}}$
Mechanical Characteristics	Proof test level	115 kpsi (0.8Gpa)
	Coating strip (Nominal)	3.0 N/3cm
Environmental Characteristics (Uncabled fiber)	Temperature dependence (-60℃~+85℃)	$\leq 0.05\text{dB/km}$ (@1310nm/@1550nm)
	Temperature-Humidity Cycling (-10℃~+85℃/98% relative humidity)	$\leq 0.05\text{dB/km}$ (@1310nm/@1550nm)

SMALL DIAMETER DUCT CABLE (SD_OPE Sheath – Metal free, Halogen free)

- ITU-T G.652D or G.657A1, [Single layer : 4C, 12C, 24C, 36C, 48C, 72C, 96C, 144C]
- ITU-T G.652D or G.657A1, [Double layer : 192C, 240C, 288C, 312C]

Revision Table

Rev. No	Date	Page	Description
R0	Apr.23.2018	1~3	● Initial release Spec No : MC-2018-DUCATEL-SD_OPE(4~312C)-R0 - G.652D 4, 12, 24, 36, 48, 72, 96, 144, 192, 240, 288, 312C
R1	Feb.19.2019	1~6	● Add the Annex 3. Optical Properties (ITU-T G.652D, G.657A1) Spec No : MC-2018-DUCATEL-SD_OPE(4~312C)-R1 - G.652D 4, 12, 24, 36, 48, 72, 96, 144, 192, 240, 288, 312C - G.657A1 4, 12, 24, 36, 48, 72, 96, 144, 192, 240, 288, 312C ● Add the Revision Table
R2	Mar.27.2019	1~6	● Add the cable properties "Metal free" Spec No : MC-2018-DUCATEL-SD_OPE(4~312C)-R2

SMALL DIAMETER DUCT CABLE (SD_OPE Sheath – Metal free, Halogen free)

- ITU-T G.652D or G.657A1, [Single layer : 4C, 12C, 24C, 36C, 48C, 72C, 96C, 144C]
- ITU-T G.652D or G.657A1, [Double layer : 192C, 240C, 288C, 312C]