New Products

Low-Frictional, Abrasion-Resistant Optical Drop Cable with Rectangular Strength Member

1. INTRODUCTION

Recently, fiber to the home (FTTH) subscribers are increasing, not only in homes but also in multi-dwelling unit (MDU). In MDU, optical fiber is wired to an ONU (Optical Network Unit), its installation method consists of passing it through an abrasion-resistant-low frictional optical drop cable within a wiring conduit line. (Figure 1)

A special plastic, with superior abrasion-resistivity and low-frictional properties, is applied to the optical drop cable as a sheath material. This sheath decreases the frictional resistance and the abrasion damages on the optical drop cable coating, which are caused by its contact with the existing cables and inner surface of the wiring conduit line. Usually, these special plastics are high in strength and rigidity, therefore cables sheathed with these special plastics are hard to be bent. Then, these cables have bending problems when storing in rosettes or cabinets.

Now, we designed a new rectangular (tape-shaped) strength member, which bends easily and has mechanical strength equal to traditional strength members. By using this strength member, a low-frictional abrasion-resistant optical cable is developed and solves the problem.

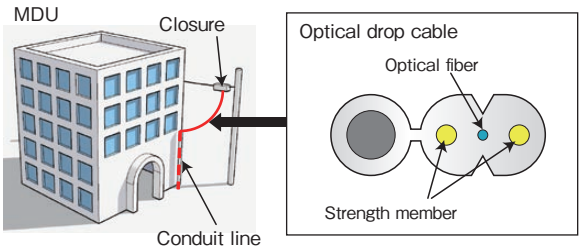


Figure 1 Optical drop cable installation.

2. FEATURES

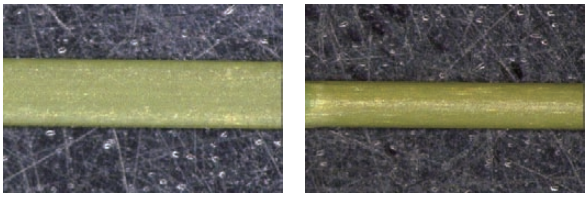
2.1 RECTANGULAR STREBGTH MEMBER

Comparison of features of traditional strength member and newly developed rectangular strength member is shown in Table 1. Comparisons of appearance and of construction are shown in Figure 2 and 3.

Table 1 Comparison of features of strength members.

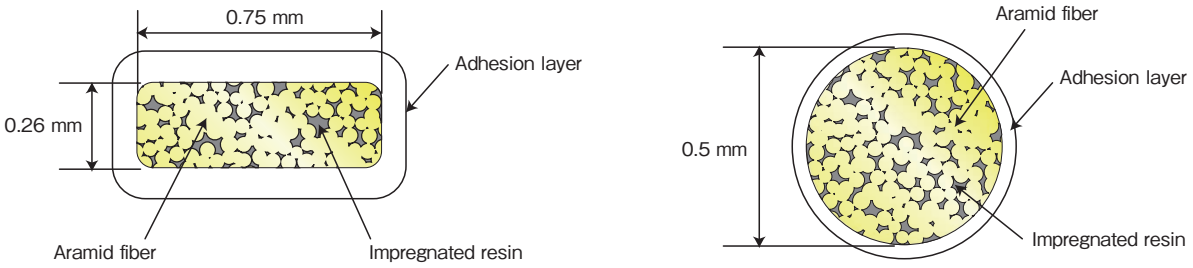
Items	Rectangular strength member	Traditional strength member
FRP dimension (mm)	0.75×0.26	ϕ0.5
Aramid fiber amount (relative value)	1 (Same as traditional one)	1
Rupture strength (N)	300	300
Modulus of elongation (MPa)	49,000	49,000
Repulsion at 15 mm radius (Bending rigidity, relative value)	0.77	1

While thickness, in bending radius direction, of traditional strength member is 0.5 mm, that of the newly developed rectangular strength member is as small as 0.26 mm. With this construction, the bending rigidity can be decreased. The strength member is composed of the same materials as the traditional strength member.



a) Rectangular strength member. b) Traditional strength member.

Figure 2 Appearance of strength member.



a) Construction of rectangular strength member. (Aramid fiber FRP)

b) Construction of traditional strength member. (Aramid fiber FRP)

Figure 3 Structure comparison of strength member.

2.2 EASE OF CABLE BENDING

Repulsive force (bending rigidity) measurement on cable portion of both optical drop cables, in which traditional strength member and rectangular strength member are used, is performed. Test method is shown in Figure 4 and test result is shown in Figure 5. At every bending radius the cable portion with rectangular strength member shows 20 to 25 % lower value than that of the traditional cable.

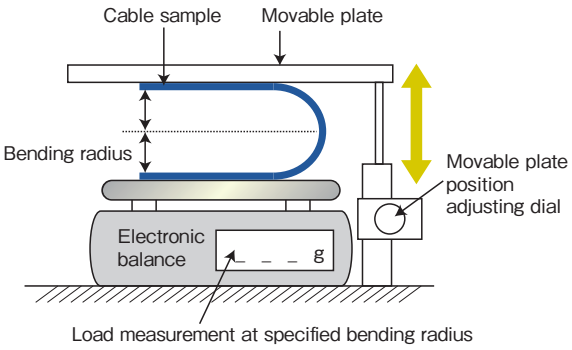


Figure 4 Test method of bending rigidity.

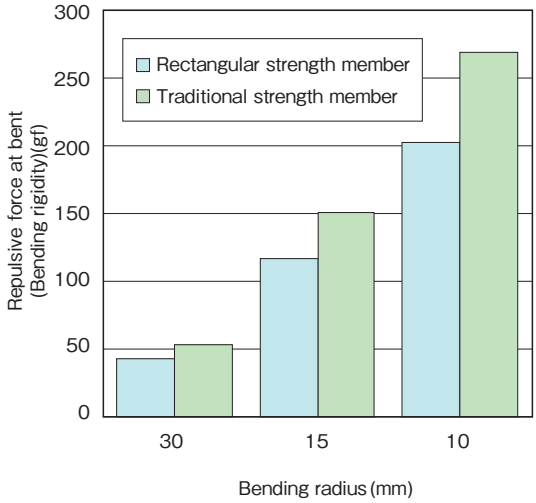


Figure 5 Test result of bending rigidity.

The cable portion of the low-frictional abrasion-resistant optical drop cable, with rectangular strength member, accommodated in optical rosette is shown in Figure 6. In a rosette, a cable shall be bent in small radius. The developed cable can be easily accommodated because of its superior flexibility.

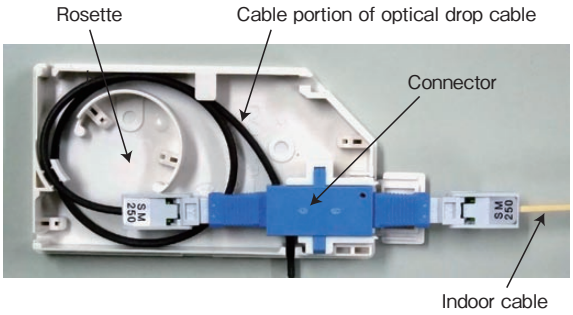


Figure 6 Accommodation in optical rosette.

2.3 LINE-UP

Constructions of low-frictional and abrasion-resistant optical drop cable (1, 2, 4, and 8 cores types) are shown in Figure 7, and characteristics are shown in Table 2. The outer shape and dimension of the developed cable are the same as those of the traditional optical drop cable, and the developed cable can be installed in traditional peripheral connecting parts.

Furthermore, single mode type optical fiber (Flexi Wave), which can be bent in 15 mm radius, is used.

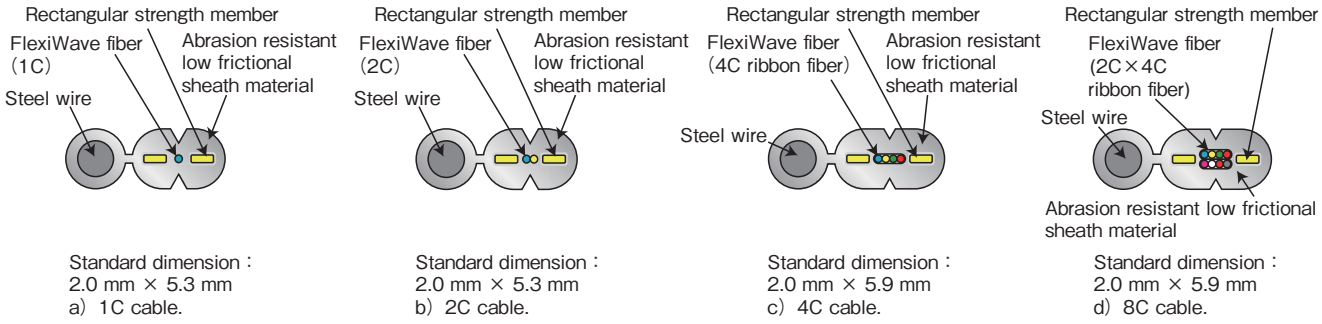


Figure 6 Structures of optical drop cable with rectangular strength member.

Table 2 Cable characteristics.

Test item	Test condition	1 core	2 cores	4 cores	8 cores
Transmission loss	Test wave length λ = 1310 nm Test wave length λ = 1550 nm	< 0.35 dB/km < 0.21 dB/km	< 0.35 dB/km < 0.21 dB/km	< 0.34 dB/km < 0.21 dB/km	< 0.35 dB/km < 0.22 dB/km
Tension	1000 N	< 0.1 dB	< 0.1 dB	< 0.1 dB	< 0.1 dB
Bending	R=15 mm × 10 Cycles (1C · 2C) R=30 mm × 10 Cycles (4C · 8C)	< 0.1 dB	< 0.1 dB	< 0.1 dB	< 0.1 dB
Lateral pressure	1200 N/25 mm (1C · 2C) 1960 N/100 mm (4C · 8C)	< 0.1 dB	< 0.1 dB	< 0.1 dB	< 0.1 dB
Impact	300 g × 1 m	< 0.1 dB	< 0.1 dB	< 0.1 dB	< 0.1 dB
Temperature characteristics	−30 ~ 70°C	< 0.05 dB/km	< 0.05 dB/km	< 0.05 dB/km	< 0.05 dB/km
Fire retardancy	JIS C 3005 declination	Natural extinguishing	Natural extinguishing	Natural extinguishing	Natural extinguishing
	JIC C 3521 vertical tray	–	–	Damaged length < 1.8 m	Damaged length < 1.8 m

Test wave length λ =1550 nm

3. IN CONCLUSION

Low-frictional and abrasion-resistant (1, 2, 4 and 8cores types) optical drop cable is developed. This cable is easy to be bent in small radius and easily installed in a rosette and in a cabinet. Furthermore, as outside diameter and cable characteristics are same as the traditional cable, this cable is treated in the same manner as the traditional cable.

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