

Telecom/OSP & INTERCONNECTION SOLUTIONS

Rosenberger Asia Pacific Electronic Co., Ltd.

A photograph of a person rappelling down a rope from a natural rock arch. The arch is made of dark, layered rock. The sun is shining brightly through the opening of the arch, creating a lens flare. The background shows a mountain valley with forested slopes and distant peaks. The text "Welcome to Rosenberger" is overlaid in the center.

Welcome to Rosenberger

Agenda

- 1. General introduction**
- 2. PCM Cable Products**
- 3. Fiber Optical Products**

General introduction

Rosenberger Global Plants – OSP Telecom Products



Augsburg, Germany



**Rosenberger Domex
Telecom, Brazil**



Shanghai, China



Taksony, Hungary





Rosenberger Global Partnership

Global Partner since 1994



Rosenberger®

Rosenberger®
OSI FIBER-OPTICS

 IBM GLOBAL SERVICES Fiber Trans Fiber Connect <u>OSI Augsburg</u> <u>OSI Hungary</u> have successfully completed the single-mode SC-DC and MTP fiber connectors This certificate is issued based on <ul style="list-style-type: none"> • Completion of all required IBM qualification tests • Test data analysis performed by IBM • Product passed all testing per data analysis • IBM inspection audit of the manufacturing facility Date Issued: July 25, 2002 Mark Lewis IBM FTS Global Product manager Martin van Liang IBM ACS Global Business Manager	 IBM GLOBAL SERVICES Fiber Transport Services Fiber Connector Qualification <u>OSI Augsburg, Germany</u> & <u>OSI Hungary Kft</u> have successfully completed the IBM FTS qualification testing for single-mode SC-DC and MTP fiber connectors This certificate is issued based on <ul style="list-style-type: none"> • Completion of all required IBM qualification tests • Test data analysis performed by IBM • Product passed all testing per data analysis • IBM inspection audit of the manufacturing facility Date Issued: July 25, 2002 Mark Lewis IBM FTS Global Product manager Martin van Liang IBM ACS Global Business Manager
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Rosenberger Key Customers on Telecom/OSP Products

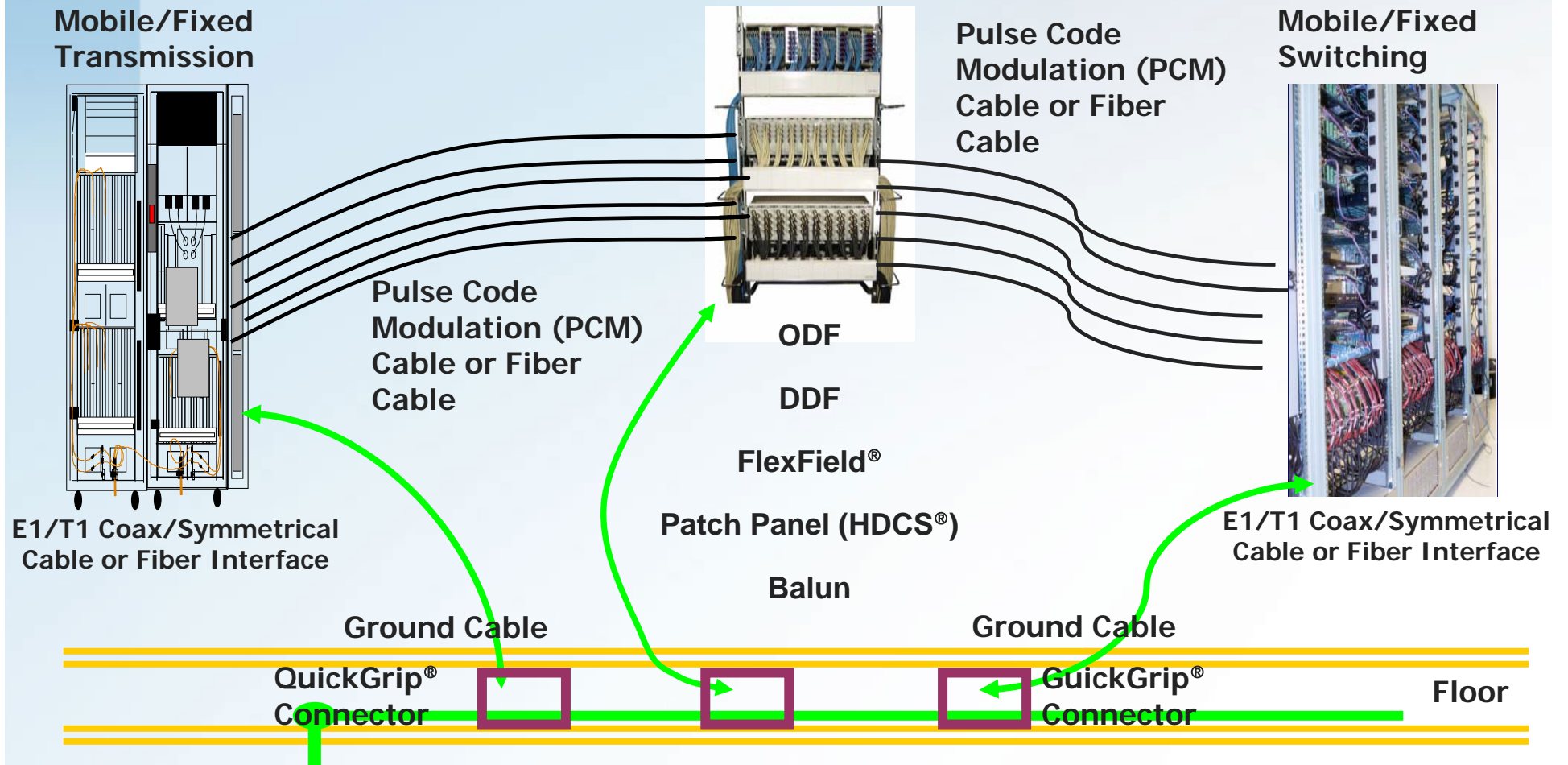


Rosenberger Key Advantages On Telecom/OSP

1. Customer tailored design
2. Wide range of products for different Telecom markets
3. Total Solution
4. Global manufacturing capacities

PCM Cable

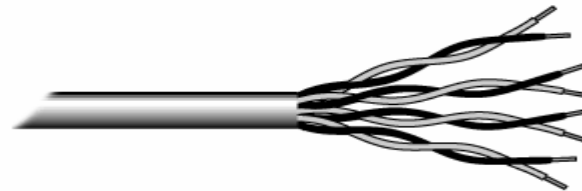
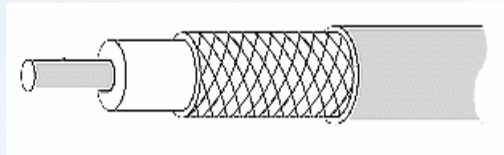
Telecom Switching Room Interconnection Products



Telecom Switching Room Interconnect Products - PCM Cable

PCM: Pulse Code Modulation

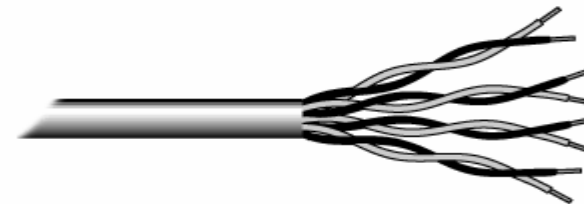
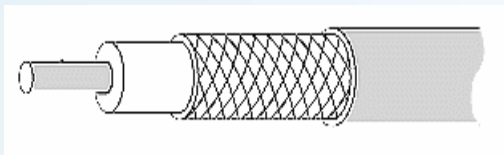
1. Symmetrical (120 Ohm pair)
2. Coaxial type (75 Ohm).



Telecom Switching Room Interconnect Products - PCM Cable

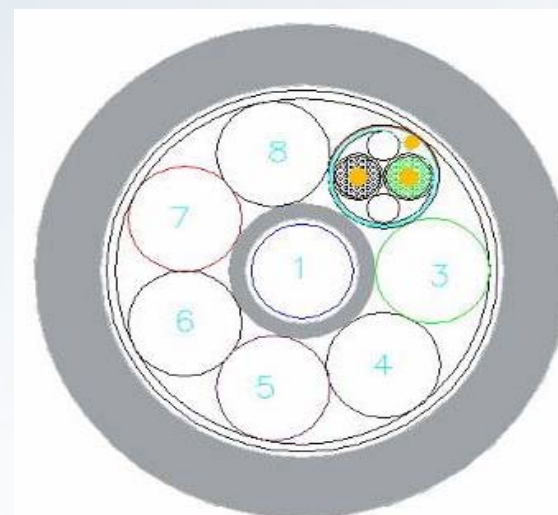
E1 :Transmit 32 channels with 2.048Mbps in Europe standard ;

T1 :Transmit 24 channels with 1.544Mbps in American standard.



Telecom Switching Room Interconnect Products - PCM CABLE 24AWG 120 Ω WITH FILLING

Conductor: AWG 24 solid copper
 Insulation: Foamed PE with skin
 Filling: Solid PE wire
 Shield: Double Aluminum foil
 Drain: Tinned copper wire AWG 24
 Sheath: PVC ,or LSZH
 Colour: Grey RAL7035
 Pairs: 1,2,8.....up to 100pairs

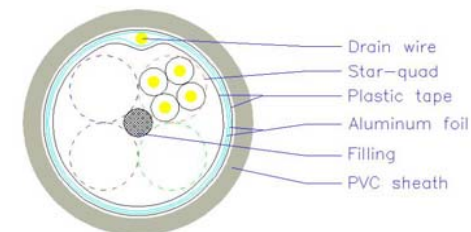


Order Number	Description
98K114-02	PCM cable 8 Pairs 24AWG 120 Ω with filling
98K114-03	PCM cable Single Pair 24AWG 120 Ω with filling
98K114-04	PCM cable 2 Pair 24AWG 120 Ω with filling

Telecom Switching Room Interconnect Products

**We have capability to customize PCM for customer;
The following information is necessary:**

1. **How many pairs?** 1pair, 8pairs, 50pairs? Or others...
2. **What is characteristic impedance?** 120ohm or 75ohm?
3. **What is wire gauge?** 23AWG, 24 AWG OR 26AWG, or others?
4. **What is type of conductor?** Symmetrical or Coaxial type?
5. **Material of jacket?** PVC, LSZH, Riser, Plenum, or specify?
6. **Grounding?** Single grounding wire for overall ? Single grounding for each pairs (subunit)?
7. **Screen shield:** Double foil screen for unit and overall? Single shield foil for overall? Double foil for overall...?
8. **Construction:** Star-quad type(4 wires twisted to form a subunit)?
2 twisted pairs in one subunit...?

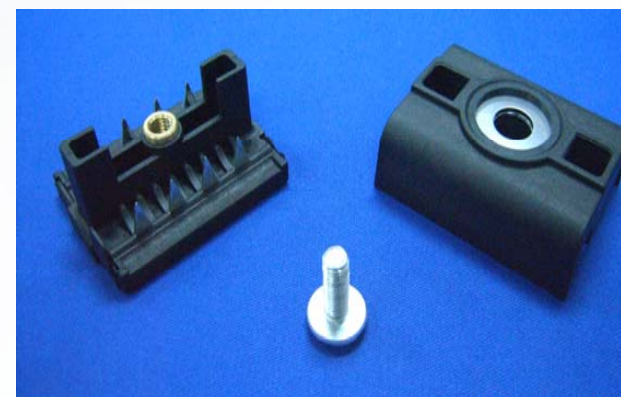


Telecom Switching Room Products - Grounding Connector

QuickGrip® Ground wire connector is for feed thru and tap joints. For insulated ground wire size AWG 2 to AWG 4, and 2 grounding wires may be joined quickly.

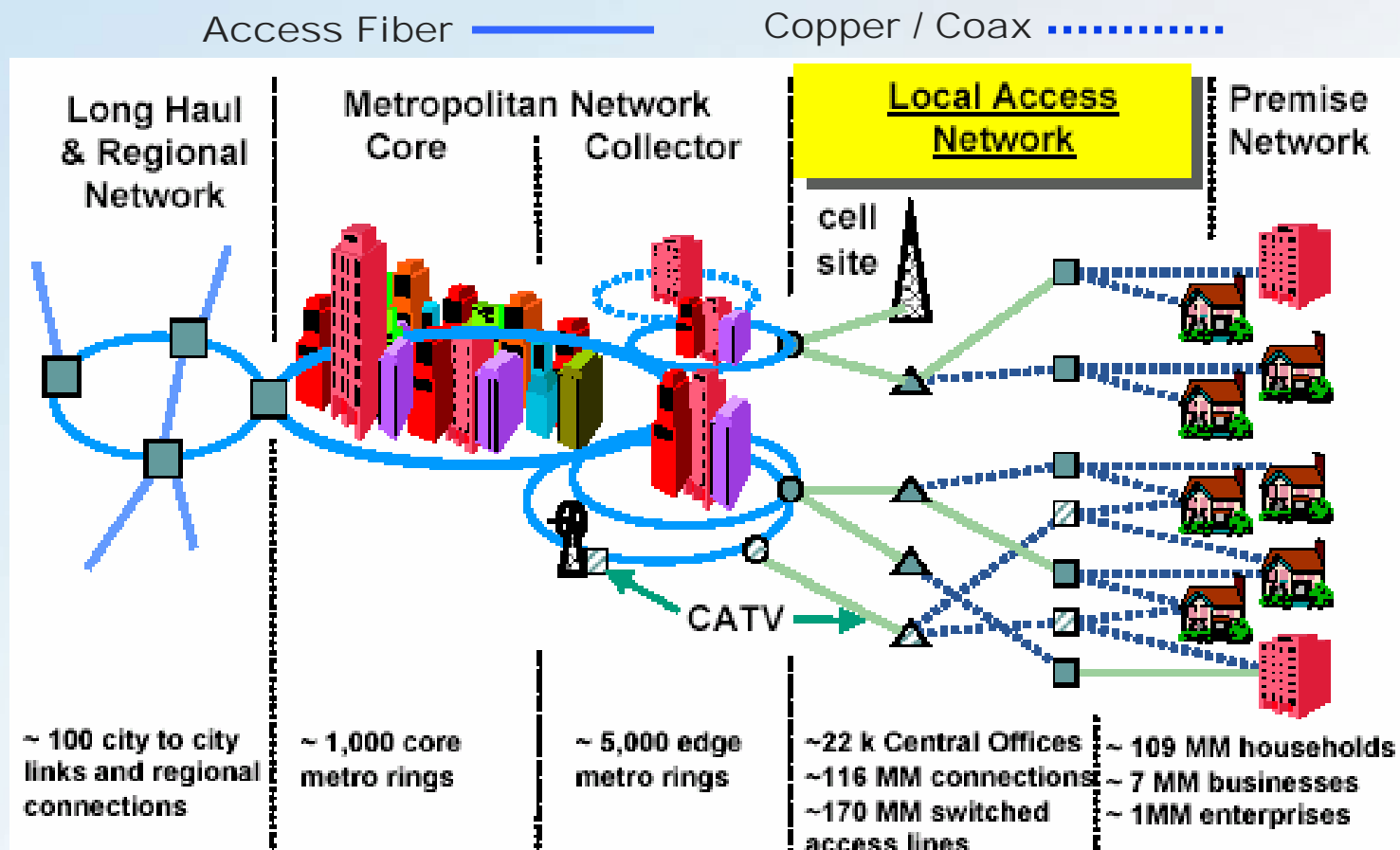
Features & Benifits

- Toolless installation
- No stripping of cable is required
- Quickest installation
- Always correct installation
- Life time > 30 years
- UL Certified quality
- Approved quality for use in telecom market
- Patented insulation piercing technique



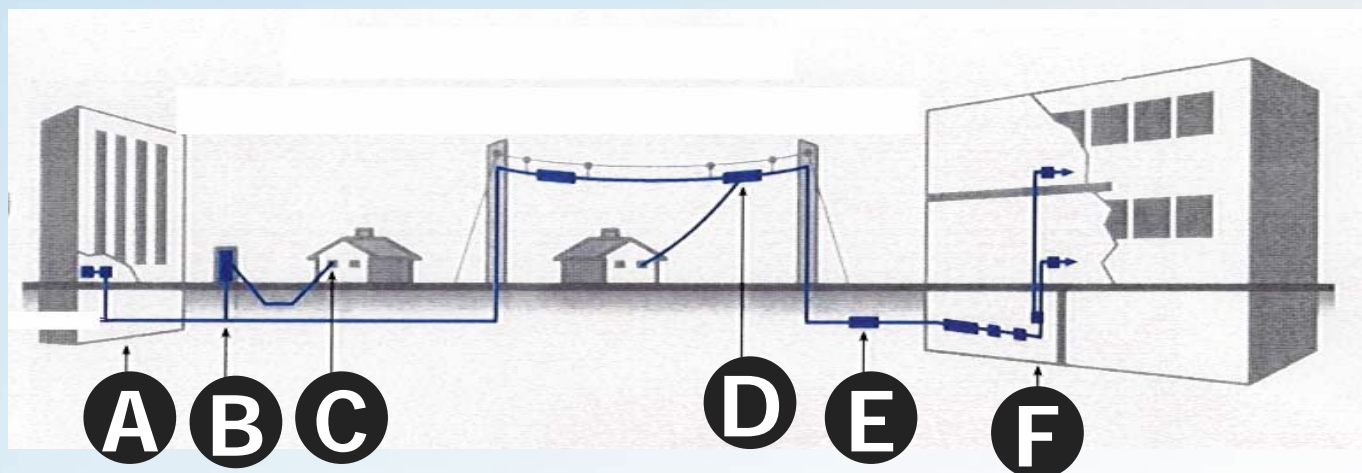
Fiber Optics

The Overall Telecommunications Network



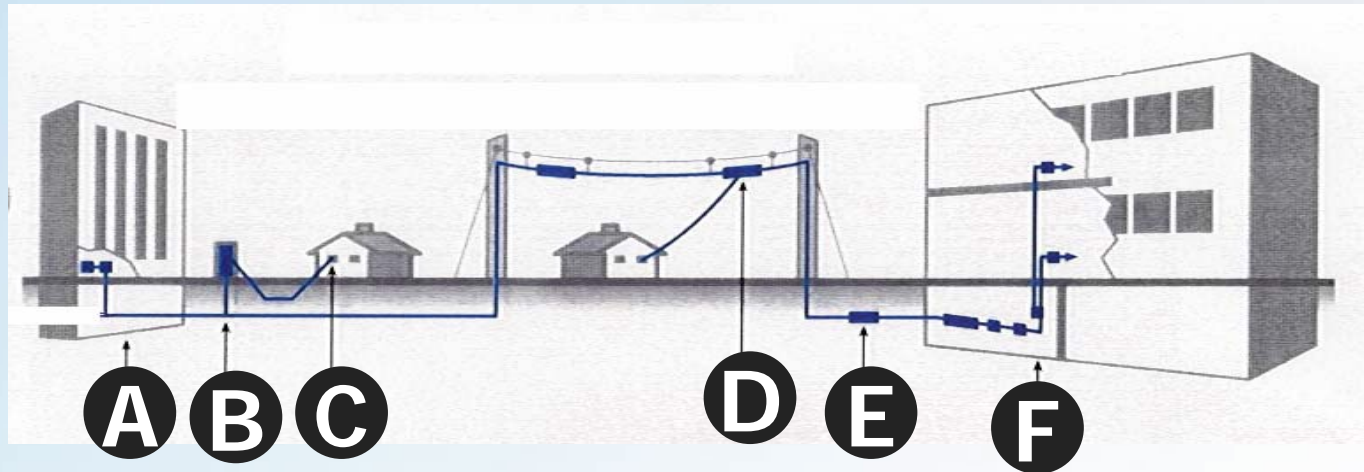
Source: Corning

OSP & Interconnection Product Portfolio



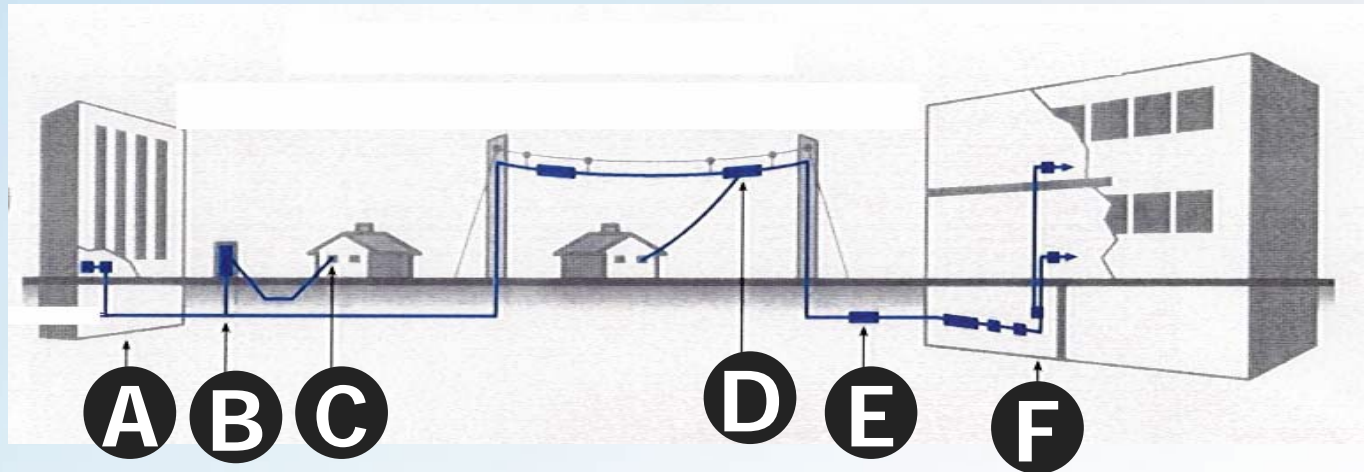
- A. Central Office/CATV Head End Room
- B. Pedestal Equipment
- C. Residential Building
- D. Aerial and Pole Equipment
- E. Burial Environment
- F. Commercial Building

OSP & Interconnection Product Portfolio



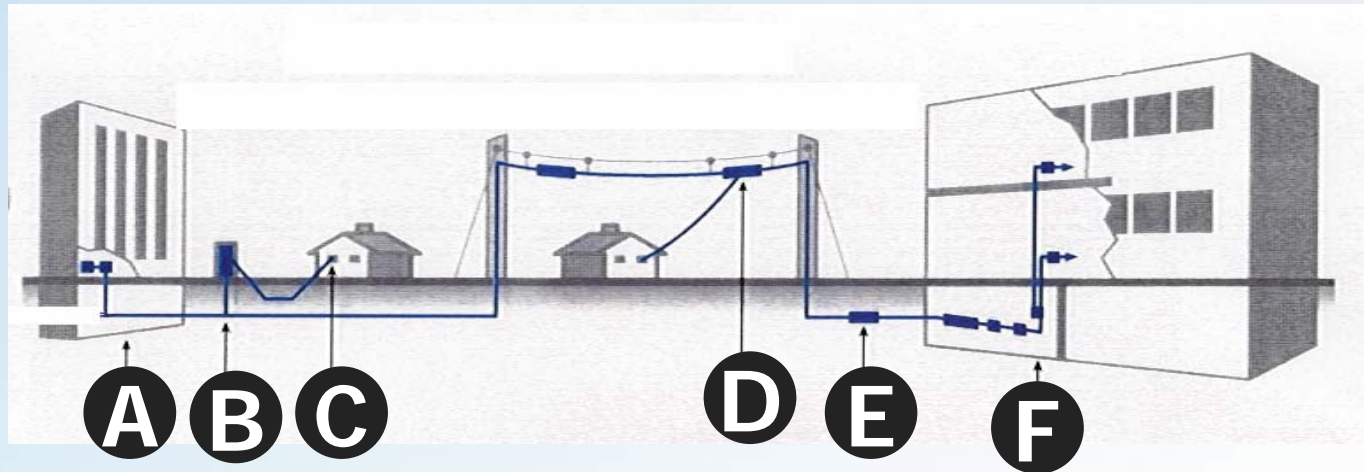
- A. Central Office/CATV Head End
- SM & MM pigtail and patch cord (SC, FC, MPO, LC, MT-RJ, MU)
 - Cable Management System (ODF, DDF, Panels)
 - SM & MM Passive Devices incl. Attenuators, Couplers, WDM, Isolators,
 - Indoor Fiber Optical Cable
 - PCM Cable
 - Grounding wire connector

OSP & Interconnection Product Portfolio



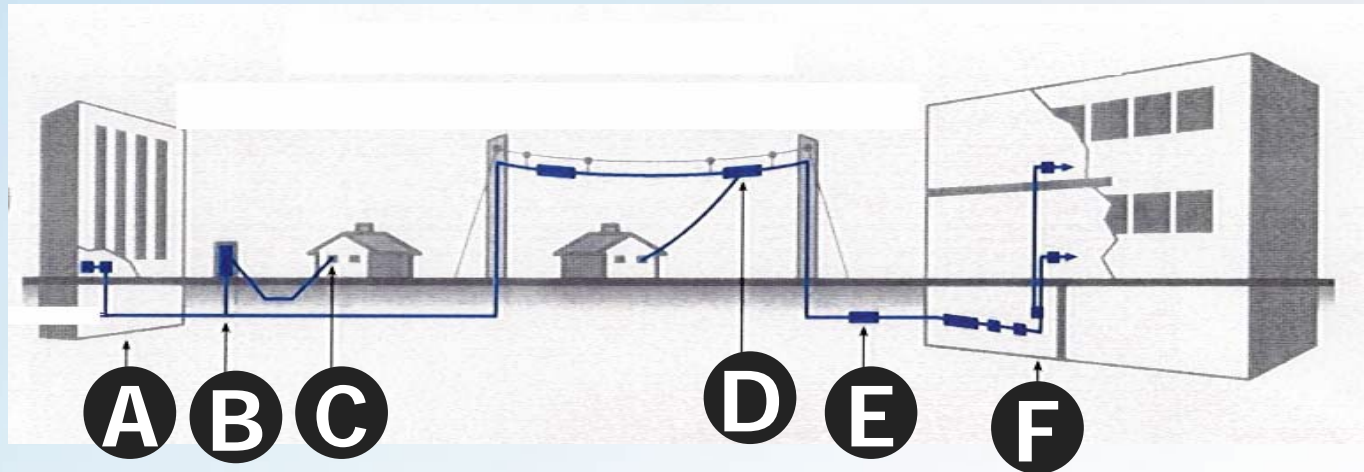
- B. Pedestal Equipment
- Fiber Joint Enclosures
 - SM Patch cord /Pigtails (SC,FC,LC,ST)
 - Cross Connection Cabinet
 - SM Passive Devices: Couplers, Splitters

OSP & Interconnection Fiber Optic Product Portfolio



- C. Residential Building
- SM Patch cord / Pigtails (SC, FC, LC, MT-RJ)
 - Distribution Cabinet or Panel (Outdoor/Indoor)
 - Outdoor or Indoor Plant Fiber Optic Cable

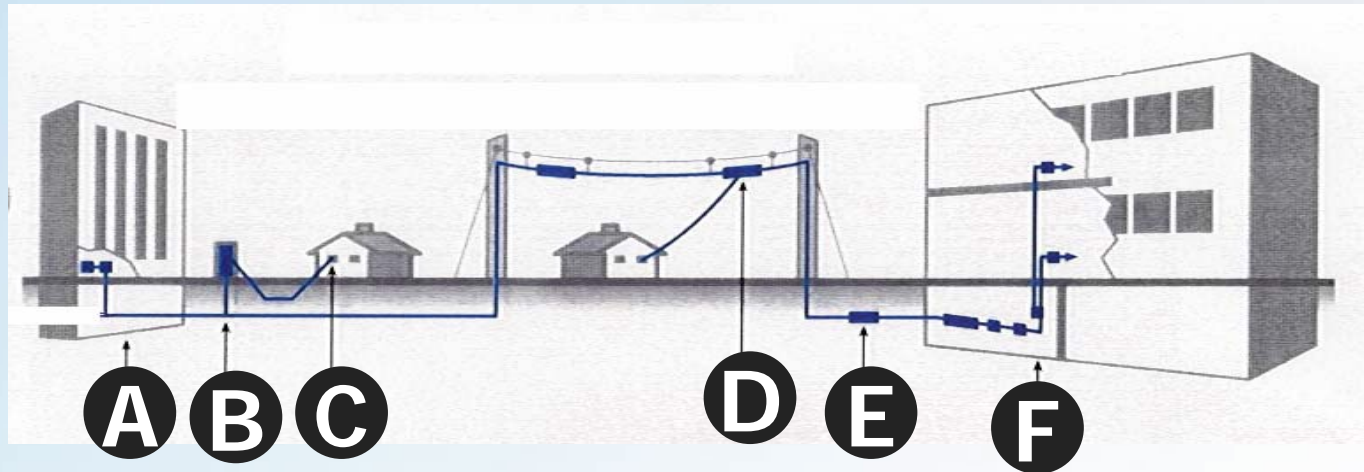
OSP & Interconnection Product Portfolio



D. Aerial / Pole Equipments

- Aerial Joint Enclosures
- Fiber Patch cord / Pigtailed (FC, SC, LC, MT-RJ)
- Aerial Fiber Optic Cable

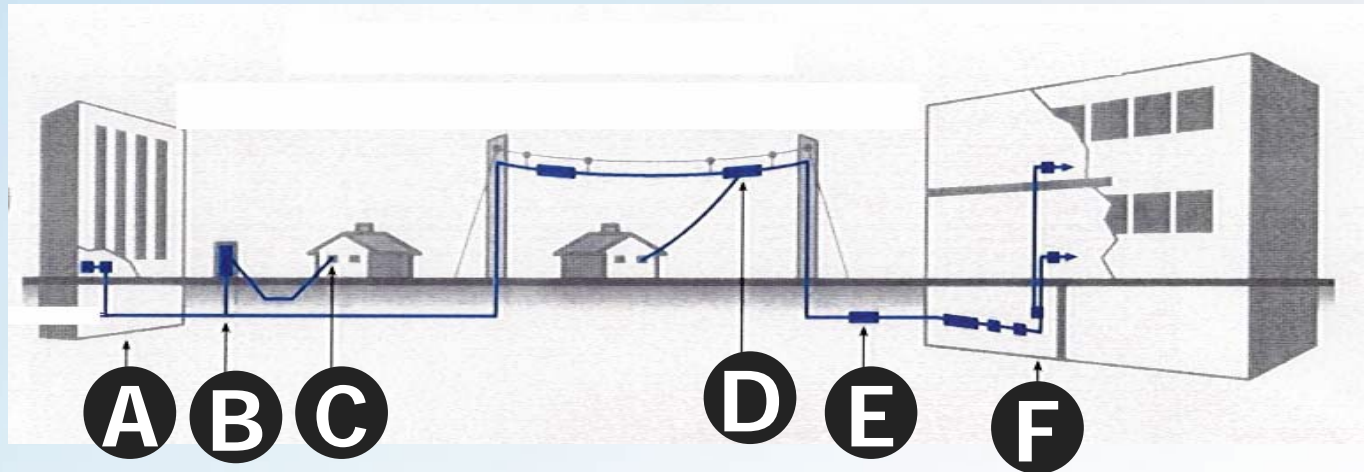
OSP & Interconnection Product Portfolio



E . Buried Environment

- Buried Joint Enclosures
- Patch cord / Pigtails (FC, SC, LC, MT-RJ)
- Splitters
- Outdoor Plant Fiber Optic Cable

OSP & Interconnection Product Portfolio



F. Commercial Building

- Fiber Patch cord/ Pigtail (SC, FC, MPO, MT-RJ, MU)
- Patching Systems (ODF, DDF, Panels...)
- SM & MM Passive Devices incl. Attenuators, Couplers, WDM, Isolators.
- Indoor Fiber Optical Cable
- PCM Cable
- Grounding wire connector

Outside-Plant & Interconnection Products From RAP



Enclosure



Passives Components



Patch cord



Adapter/ Attenuator



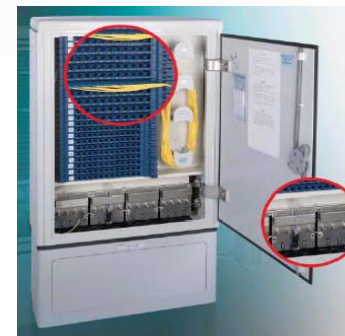
Optical Cable



ODF



FlexField ODF/DDF



Cross Connection Cabinet

International Telecommunication Union – ITU

Telecommunication Standardization Sector – ITU-T



ITU-T Optical Fiber and Cable Category

ITU-T Telecommunication
Standardization Sector of ITU

SERIES G: Transmission systems and
Media. Digital Systems and Networks

G 651

G 652

G 653

G 654

G 655

G 656

G 657



International Telecommunication Union – ITU

Basic Knowledge for Fiber Categories

G651: Multimode fiber;

G652: None dispersion shift single mode fiber;

G653: Dispersion shift single mode fiber;

G654: Cutoff wavelength shift single mode fiber;

G655: None zero dispersion shift single mode fiber;

G656: Optimized G652 fiber for DWDM system;

G657: Optimized fiber for FTTH system.



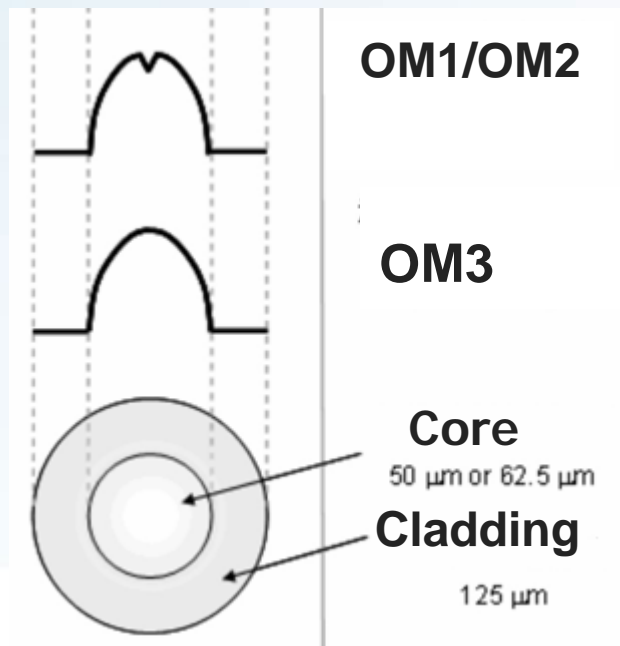
International
Organization for
Standardization

What is OM1,OM2,OM3?

OM1: 50/125um or 62.5/125um,200MHz.KM Bandwidth

OM2: 50/125um or 62.5/125um,500MHz.KM Bandwidth

OM3: 50/125um ,2000MHz.KM Bandwidth

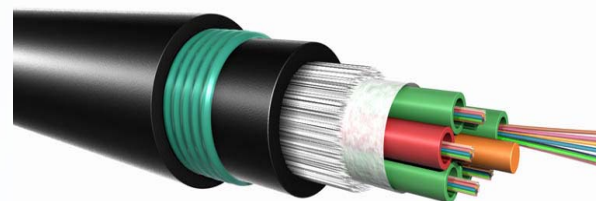


Index profile for MM fiber

Rosenberger Outside-Plant Fiber Optical Cable

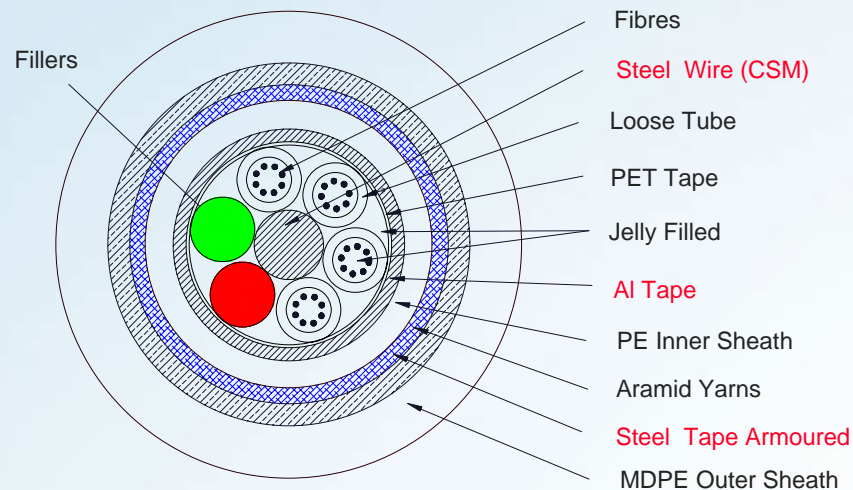
The Wide-range of Optical Fiber Cables

1. **Outdoor aerial, duct & direct-burial fiber optical cable for long-haul optical transmission**
2. **Central / stranded loose tubes**
3. **Non-metallic or armored**
4. **Special application cable for harsh environment**
5. **Up to 144 fibers or more**
6. **Single mode G652,G653,G654 and G655fiber available**



Rosenberger Outside-Plant Fiber Optical Cable

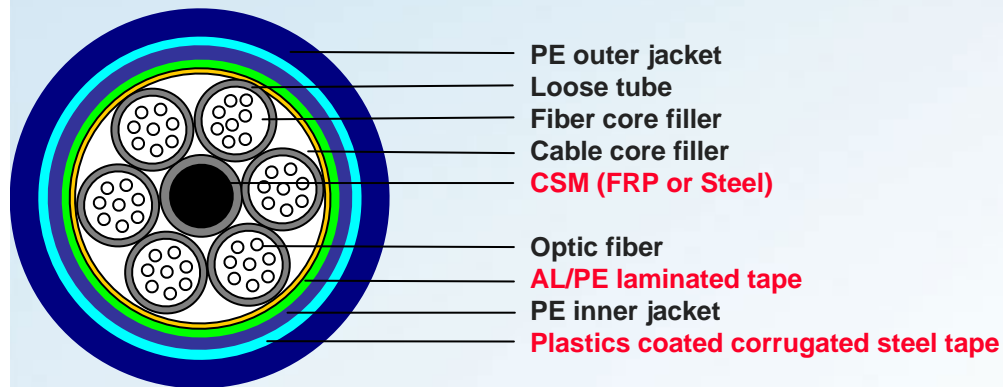
Armored & Kevlar Heavy Duty Fiber Optical Cable



- ✓ Fiber count: 2 ~ 144
- ✓ Fiber color: per TIA/EIA-598B
- ✓ Armor: Steel Tape & Al. Tape
- ✓ Tension strength (long-term):
>= 3500 N (Kevlar)
- ✓ Tension strength (short-term):
>= 8000 N (Kevlar)
- ✓ Crush resistance: >= 5000 N / 10cm
- ✓ Operating temp.: -40°C~+70°C
- ✓ Installation temp.: -20°C~+70°C
- ✓ Rosenberger PN: 98A036-xxx (G652D)

Rosenberger Outside-Plant Fiber Optical Cable

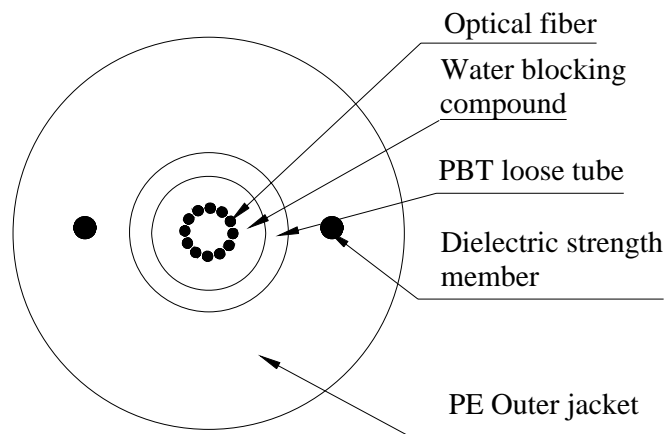
Armored Direct-burial Fiber Optical Cable (GYTA53)



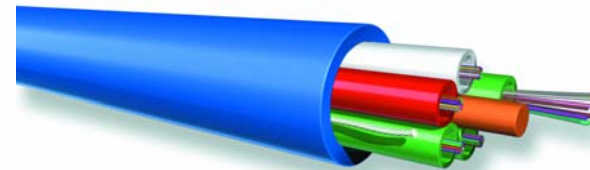
- ✓ Fiber count: 2 ~ 144
- ✓ Fiber color: per TIA/EIA-598B
- ✓ Armor: Corrugated steel tape & AL.tape
- ✓ Tension strength (long term):
>= 1000 N
- ✓ Tension strength (short-term):
>= 3000 N
- ✓ Crush resistance: >= 3000 N / 10cm
- ✓ Operating temp.: -40°C ~ +70°C
- ✓ Installation temp.: -20°C ~ +70°C
- ✓ Rosenberger PN: 98A133-xxx (G652D)
98A134-xxx (G655)

Rosenberger Outside-Plant Fiber Optical Cable

Non-metallic Aerial, Duct Fiber Optical Cable (HD)

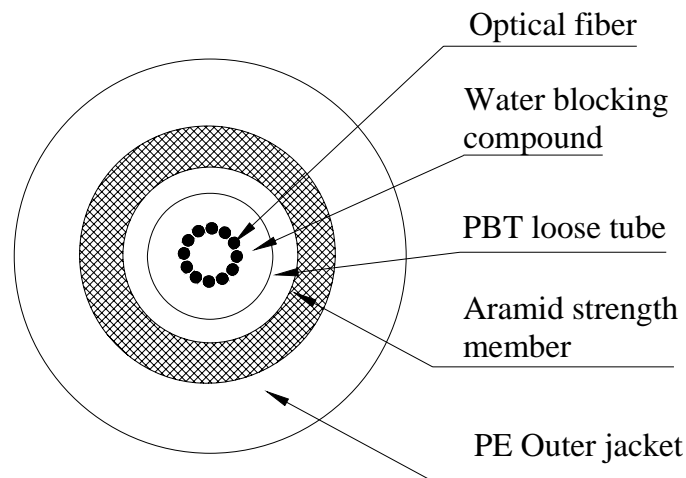


- ✓ Fiber count: 2 ~ 144
- ✓ Fiber color: per TIA/EIA-598B
- ✓ Tension strength (long-term):
≥ 1300 N
- ✓ Tension strength (short-term):
≥ 2700 N
- ✓ Crush resistance: ≥ 1000 N / 10cm
- ✓ Operating temp.: -40°C ~ +70°C
- ✓ Installation temp.: -20°C ~ +70°C
- ✓ Rosenberger PN: 98A071-xxx(G652D)

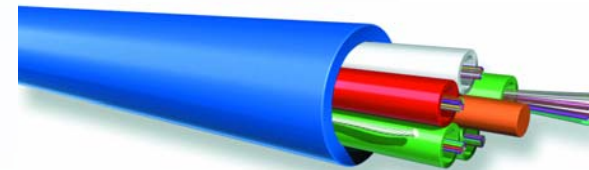


Rosenberger Outside-Plant Fiber Optical Cable

Non-metallic Aerial, Duct Fiber Optical Cable (LD)

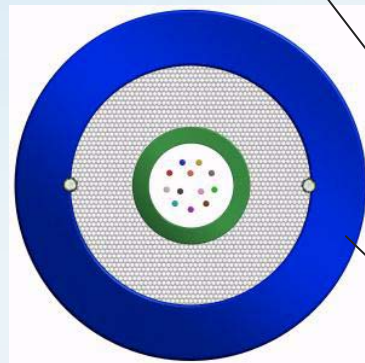
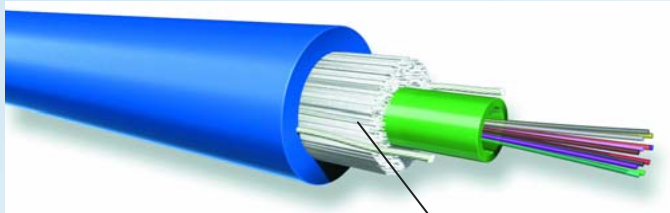


- ✓ Fiber count: 2 ~ 144
- ✓ Fiber color: per TIA/EIA-598B
- ✓ Tension strength (long-term):
≥ 300 N
- ✓ Tension strength (short-term):
≥ 700 N
- ✓ Crush resistance: ≥ 250 N / 10cm
- ✓ Operating temp.: -40°C ~ +70°C
- ✓ Installation temp.: -20°C ~ +70°C
- ✓ Rosenberger PN: 98A074-xxx (G652D)



Rosenberger Outside-Plant Fiber Optical Cable

U-DBH/U-D(ZN)H Rodent-protection Universal Cable



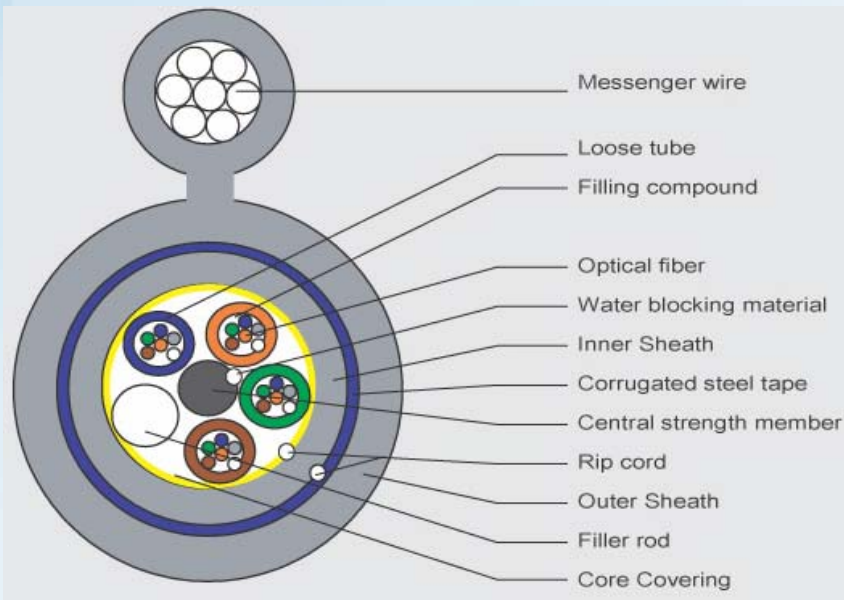
Glassroving for strain relief and rodent proof

LSZH outer jacket

- ✓ Comply with DIN VDE 0888
- ✓ Fiber count: 2 ~ 144
- ✓ Fiber color: per DIN VDE 0888
- ✓ Tension strength (long-term):
≥ 1200 N
- ✓ Tension strength (short-term):
≥ 2700 N
- ✓ Crush resistance: ≥ 1000 N / 10cm
- ✓ Operating temp.: -40°C~+70°C
- ✓ Installation temp.: -20°C~+70°C
- ✓ Comply with IEC 60332-3C, IEC 610754-2, IEC 61034-2
- ✓ Rosenberger PN: 21121x (G652D)

Rosenberger Outside-Plant Fiber Optical Cable

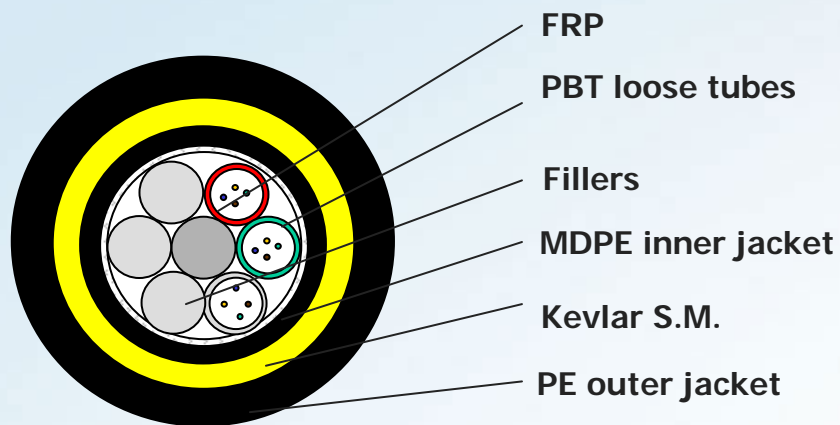
Figure-8 Type Aerial Fiber Optical Cable



- ✓ Comply with IEC794-1
- ✓ Fiber count: 2 ~ 144
- ✓ Fiber color: per TIA/EIA-598B
- ✓ Tension strength (short-term):
≥ 8000 N per IEC794-1-E1
- ✓ Compressive strength:
≥ 2200N per IEC794-1-E3
- ✓ **Max. pole span length: 50m**
- ✓ **Max. wind velocity: 126km/hr**
- ✓ Operating temp.: -10°C ~ +70°C
- ✓ Installation temp.: -20°C ~ +70°C
- ✓ Rosenberger PN: 98A110 (12F-G652D)
98A123 (24F-G652D)

Rosenberger Outside-Plant Fiber Optical Cable

ADSS Fiber Optical Cable



- ✓ Max. pole span: 200~600m/1000m
- ✓ Fiber count: 2 ~ 144
- ✓ Fiber color: per TIA/EIA-598B
- ✓ Operating temp.: -40°C~+70°C
- ✓ Installation temp.: -10°C~+60°C

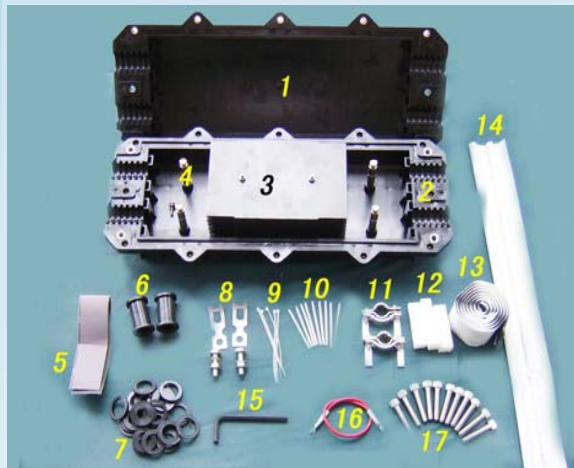
Main Parameters to be advised for ordering:

- ✓ MOTS (max operating tension strength)
- ✓ RTS (rated tensile strength)
- ✓ ETS (ultimate tensile strength)
- ✓ EDS (everyday stress)
- ✓ UES (ultimate exceptional stress)
- ✓ Pole Span

Necessary information for choosing or ordering optical cable

1. Application environment: indoor, outdoor;
2. Installation condition: aerial, buried, duct ;
3. Fiber type : single mode(G652 or G655), multimode;
4. Fiber count: such as 48 fibers;
5. Construction: metallic armored or non-metallic ;
6. Material of sheath: PE,PVC, LSZH;
7. Mechanical performance: tensile or crush strength;
8. Pole span, wind velocity for aerial type cable;
9. Diagram of cable.

Rosenberger Fiber Optical Cable Joint Enclosures In-line and Dome type are Available



Technical Specification

Fiber additional attenuation:	$\leq 0.01\text{dB}$
Fiber bending radius:	$\geq 40\text{mm}$
Retaining fiber length:	$\geq 1.6\text{m}$
Tensile and crush resistance:	$\geq 2000\text{N}/10\text{cm}$
Operating temperature:	$-40^{\circ}\text{C} \sim +60^{\circ}\text{C}$
Application environment:	Aerial, Duct, Direct buried

Rosenberger P/Ns:

98K100-47:	24-fiber
98K100-78:	36-fiber
98K100-79:	48-fiber
98K100-69:	144-fiber

Rosenberger Fiber Optical Distribution Frames (ODF)

Operation Conditions

- Operation temperature: $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$
- Relative humidity: $\leq 85\% (+30^{\circ}\text{C})$
- Atmosphere pressure: 70 kPa ~106 kPa



GPX339A



GPX339B

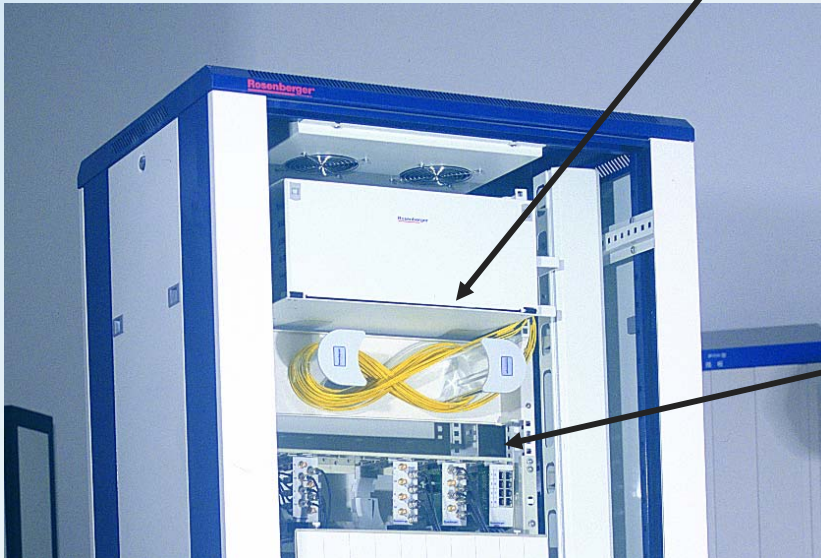


GPX339C



GPX339CII

Rosenberger Fiber Optical Distribution Frames (ODF)



Optical Distribution Unit (ODU)

- 24/36/48/72-fiber FC
- 24/36/48/72-fiber SC
- 19" Rack Mountable
- Splice tray with holders
- Pigtails, Adapters & Accessories

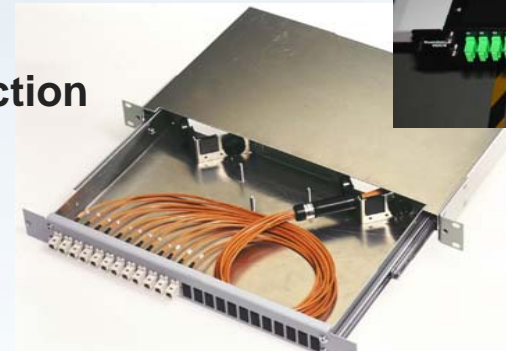
Optical Cable Storage Spool

- 3HU height
- 19" Rack Mountable
- Rosenberger PN: 993044026

Rosenberger HDCS® Fiber Optic Patch Panel

Fiber Patch Panel

- ✓ Aluminum or steel material
- ✓ Fixed-type and pull-out type construction
- ✓ Cable gland for universal cable
- ✓ 1HU for up to 24(48*) Fibers
- ✓ 2HU for up to 48(96*) Fibers
- ✓ SC-duplex, ST, E2000, MT-RJ*, LC-Duplex*, MU-Duplex*, FC front interface available
- ✓ Accessories for splice application



Rosenberger Fiber Optic Cross Connection Cabinet (CCC)

Applications

- Long-distance optical transmission network
- The office or far off optical access networks
- Video transmission network
- Data communication network
- FTTZ(zone), FTTH, FTTB, FTTO

Item	Type	Size (mm)	Capacity (fibers)
1	GXF5-189A	1450×750×300	288
2	GXF5-189A II	1450×750×300	288
3	GXF5-189B	1350×750×300	288
4	GXF5-189B II	1350×750×300	288
5	GXF5-189C	1460×750×320	288
6	GXF5-189C II	1460×750×320	288
7	GXF5-189D	700×480×300	144
8	GXF5-189D II	700×480×300	144



Rosenberger FlexField® Modular System

FlexField® Modular Panel

- ✓ FlexField® is a trademark & patent of Rosenberger
- ✓ ODF/DDF/Ethernet system
- ✓ Modules handle a variety of cables & connectors:
 - G.703 Pair Cable & Coax + Baluns
 - Trunk Fiber Network + FTTX
 - Ethernet Cabling System



FlexField®

Rosenberger Fiber Optic Distribution Box

Applications

- The office or far off extremity of optic access networks
- The intelligent building
- FTTZ(zone), FTTH, FTTB, FTTO



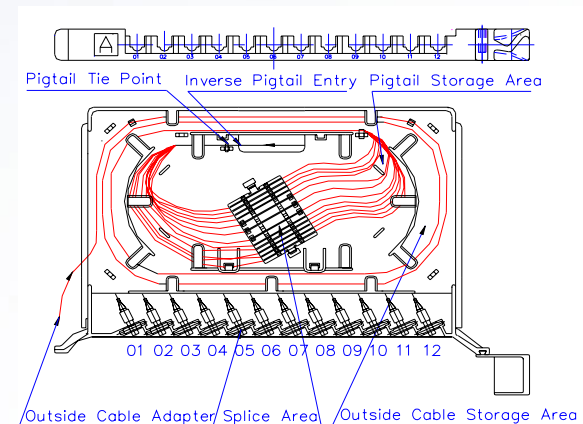
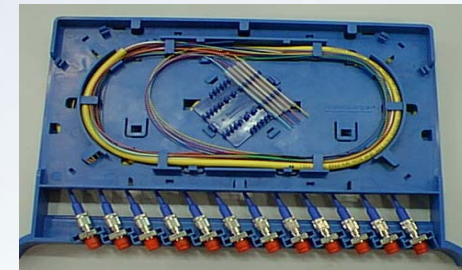
Item	Type	Size (mm)	Capacity (fibers)	Remarks
1	GXF5-189E	506×435×180	48	Indoor Junction Box
2	GXF5-189F	440×310×180	24	Outdoor Junction Box



Rosenberger Fiber Optic Splice Tray

Features

- Use in optical distribution frames (ODF)
- Use in Cross connection cabinets (CCC)
- Function of fiber distribution & splicing
- Adapter options: SC, FC, LC
- With splice protection tubes
- With 12-fiber splice holder
- Tray cover plate (upper & lower)
- Fiber routing instructions

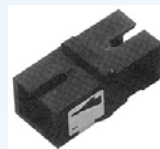
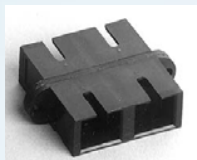
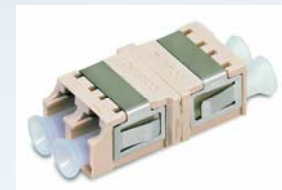


Rosenberger Fiber Optic Adapters

Fiber Optic Adapters

The Advantages - Variety

- ✓ **Single mode or Multi mode or Both**
- ✓ **Metal or Plastic Housing**
- ✓ **Simplex or Duplex**
- ✓ **Flange-less or with flange**
- ✓ **Hybrids type**



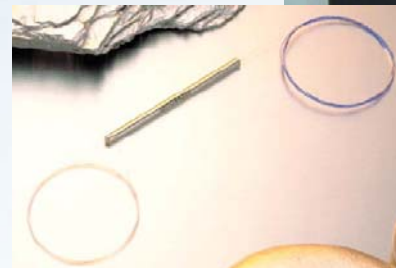
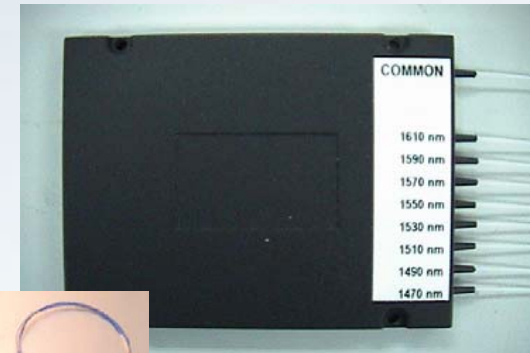
Rosenberger Fiber Optic Splitter

Application

1. CATV Network;
2. FTTx Network;
3. Telecom Network;
4. Measurement instrument;

Features

1. Fused type or PLC type;
2. Different Coupling Ratio available, 1%-50%;
3. Different Port Configuration: 1:2, 1:16, 1:32;
4. Wide bandwidth: 1300 to 1590 nm.



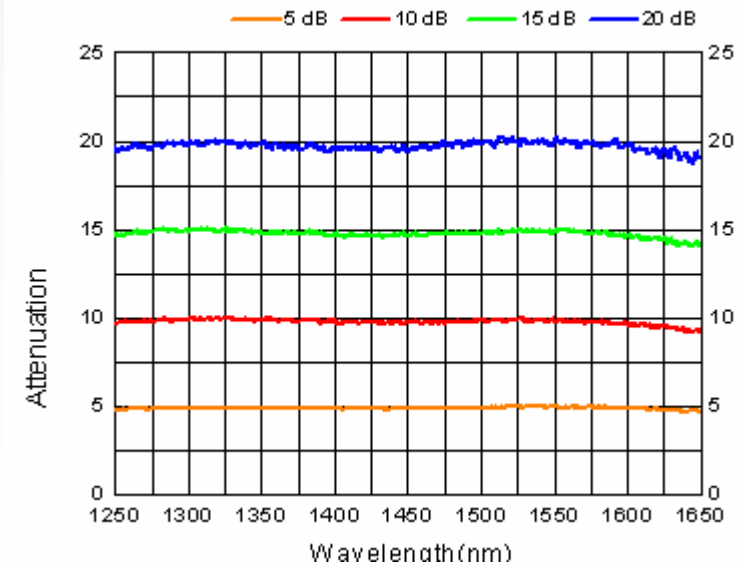
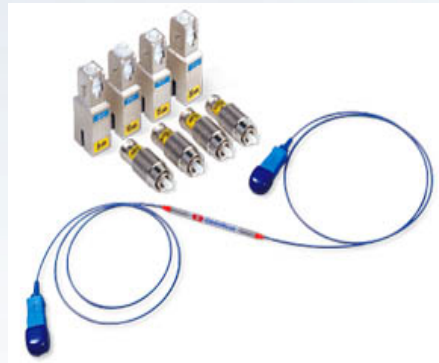
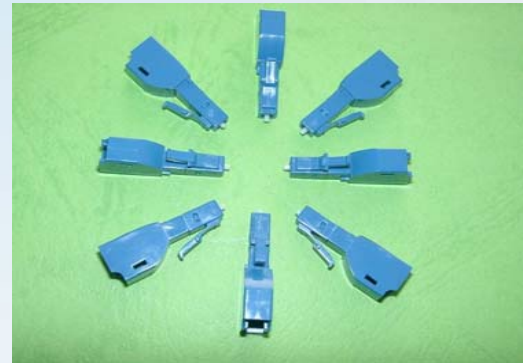
Rosenberger Fiber Optic Attenuator

Application

1. CATV Network;
2. Telecom Network;
3. LAN Cabling system
4. Fiber Optic Lab or Plant;

Features

1. Inline and Plug type;
2. Different type connector available
3. Large Attenuation range, 5dB-30dB;
4. All fiber process, high reliability;
5. Wide wavelength band,
from 1300nm to 1590nm;



Rosenberger Fiber Optic Cable Assemblies

All industry-standard fiber optic connectors / patch cords / pigtails are available from Rosenberger A/P



SC/PC



SC/APC



ST/PC



FSMA



DIN



MT-RJ



ESCON



FDDI



FC/APC



FC/PC



MTP®



E-2000™



MU



MU/APC



LC/PC



LC/APC

Rosenberger Fiber Optic Cable Assemblies Harsh Environment Patch Cord (HEC)

Application

- 2G,3G, Wimax Wireless system,
- Link between RBS and Antenna

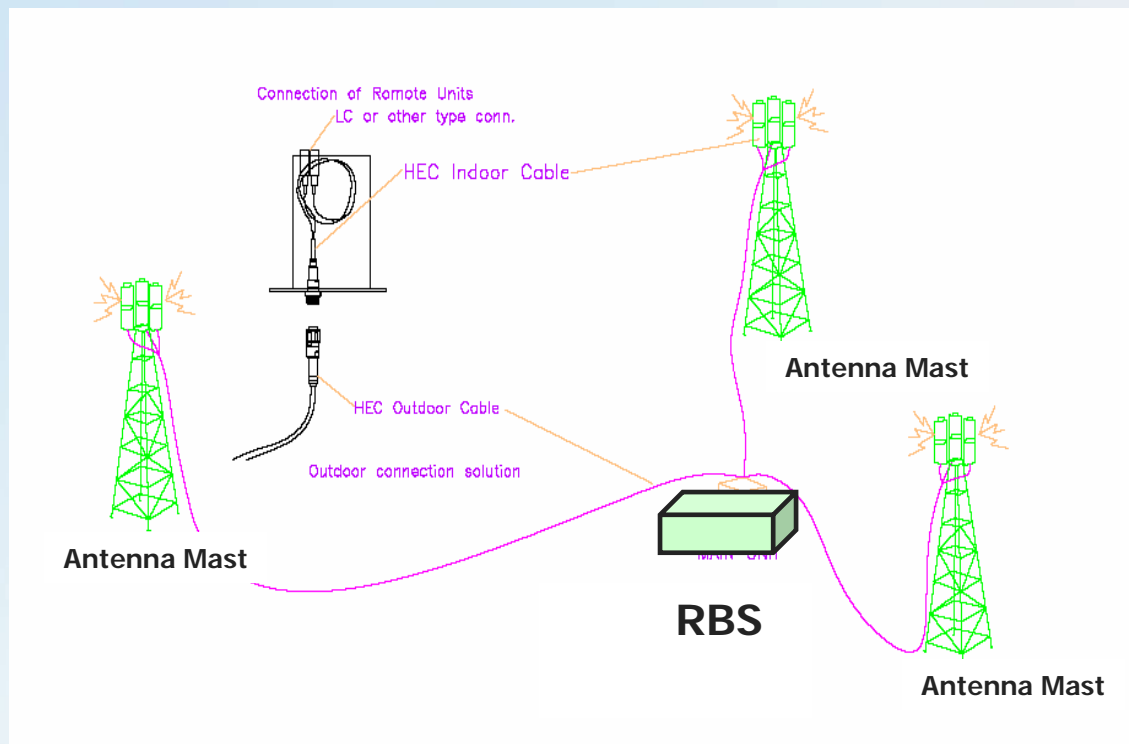


Features

- Plug and Play installation
- 2 or 4 fibers;
- Multi mode and single mode available ;
- IP67 for harsh environment;
- Low insertion loss: Max 0.5dB/Connector.

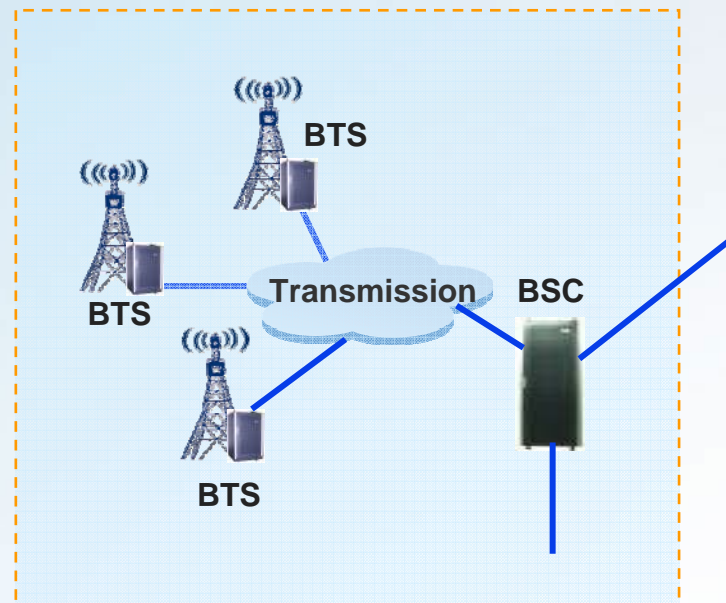


Rosenberger Fiber Optic Cable Assemblies Harsh Environment Connector (HEC)



Several antenna can share one Bases station!

Rosenberger Fiber Optic Cable Assemblies Harsh Environment Connector (HEC)



Coaxial Connectivity Solution

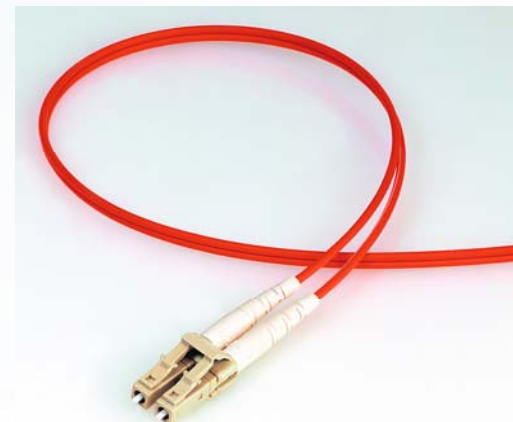
Rosenberger Fiber Optic Cable Assemblies Harsh Environment Connector (HEC)

Key Advantage

1. **Distance:** offer tailor-made length;
2. **Safety:** dielectric optic fiber cable is immune to lightning strikes and electrical discharge;
3. **Size:** 7mm OD of cable Compare to 30mm of copper cable;
4. **Installation time:** 2 person in a few minute of fiber cable compare a team with lifting devices in one day;
5. **Future proof:** the fiber is independent of any protocol and bit rates.
6. **Economics:** easy handling, easy transport, easy installation, share base station;
Saving Cost!

Necessary information for choosing Fiber Cable Assembly

1. Application environment: indoor, outdoor;
2. Fiber type : single mode(G652 or G655), multimode(50/125,62.5/125);
3. Fiber count: simplex, duplex, or multi fibers;
4. Material of Jacket :PVC, LSZH, Riser, Plenum;
5. Connector type: SC, FC, LC, MTRJ, ST;
6. Cable length.





Summary

- 1. Offer tailored design**
- 2. Total solution provider**
- 3. Wide range products**
- 4. Quick and Flexible delivery**

A photograph of a rock climber in a red shirt and dark pants scaling a steep, golden-brown rock face. The climber is positioned in the upper right quadrant, with a red rope visible. The background features a clear blue sky and dark, jagged mountain peaks at the bottom. The text 'Thank you!' is overlaid in white on the left side of the image.

Thank you!

Hang_lee@rosenbergerAP.com