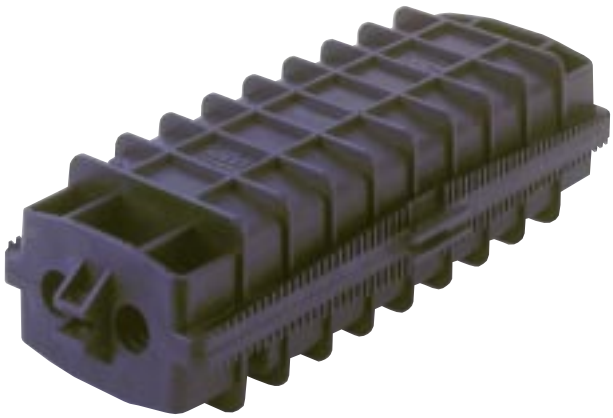
Fibre Optic Closure 2179-CS



Fibre Optic Closure 2179-CS

The Fibre Optic Closure 2179-CS is designed and developed based on the proven 3M sealing technology. It is made of plastic molded parts and mastic sealing materials. Closing of the closure is simply done by the sliding latching mechanism. 2179-CS latching system provides short installation time and easy re-entry. There is no need for special tooling for closing and opening the closure..

Applications

Closure is suitable for the applications up to 48 single fibers, which can cover most of the applications in the fiber distribution networks like Fiber To The Home / Fiber To The Curb (FTTH/FTTC) Underground, aerial, pedestal or direct buried applications are possible with the closure. 2179-CS has chemical and mechanical resistance for all the application areas in the fiber networks. Can be used in BUTT or In-Line configuration.

Capacity

The closure can accept cable sizes from 1,01 cm (0,4") to 2,54 cm (1"). Maximum number of cable entries is 4 in In-Line configuration. 2179-CS can be used with 3M FOT001 trays, suitable for single fiber fusion splices, as standard. 2179-CS closure also has the version that can accommodate DIN splice trays where Fibrlok™ or crimp protectors are used. For both tray systems it is possible to place maximum 4 trays and maximum 12 fiber slices per tray in 2179-CS.

Kit contents

2179-CS closure kit includes all necessary parts to complete closure installation. Tray type and the number of the trays needs to be selected according to the application needs. FOT001 trays can be supplied with the closure as standard. If DIN trays are required “2179-CS Closure Kit w/DIN tray bracket w/o tray” version should be selected and the DIN tray(s) & tray accessories should be ordered separately.

Features

- Compact in size (44,7cm x 17,52cm x 10,67cm)
- Fiber capacity up to 48 single fibres
- Accepts variety of splice/protector versions;
  heath shrink single fusion spliceprotector, crimp ptotector, FibrlokÙ
- Proven sealing technology
- Available in complete kit (with trays + accessories)
- Sliding latch mechanism

Benefits

- Suitable for limited space applications, too. (hadholes)
- Applicable for all networks. FTTH /FTTC solutions.
- Covers different splice methods for low fiber count applications
- Wide area of usage; underground, aerial, direct buried, pedestal
- Reduced inventory
- No requirement for special tooling. Saves time and cost
- Easy application

Specifications

Technical characteristics

Cable strength:	40kPa, 1000N for 1min, No apparent splice case degradation happened. No leakage.
Cable compress:	100N, 1min, No apparent splice case degradation happened. No leakage.
Vibration:	40kPa A=±1.5mm, f=25Hz, 15min, No apparent splice case degradation happened. No leakage.
Cable bend:	40kPa, 150mm, ±45degree, 10Cy., No apparent splice case degradation happened. No leakage.
Cable torsion:	500mm, ±90 degree, 10Cy. No apparent splice case degradation happened. No leakage.
Rust resistance:	Metal part: salt spray for 30days, without rust
Temperature cycling.:	-40c-20C-60C, 2h ,10Cy. Then fill 60kPa air-pressure, without leakage.
Impact:	1kg,1m @-20C. No apparent splice case degradation happened. No leakage.
Immersion:	Water depth 2.5m, 30 days, without water intrusion.
Air tightness:	100kPa@Room temperature, 5 min. No apparent splice case degradation happened. No leakage.
Insulation:	Water depth 1.5m, 24hours, 15kVDC for 1min, R>20000Mohm@500VDC
Compression:	40kPa, 2000N/10cm, 1min, No apparent splice case degradation happened. No leakage.
Chemical Resistance:	40kPa, 5%HCL, 5%NaOH, 5%NaCl for 24hours. Without corrosion and leakage.

Physical characteristics

Material:	Molded plastic
Outside dimension (LxWxH):	15.7” x 6.9”x 4.2”
Splice chamber space (LxWxH):	12”x4.7”x 3.3”
Weight (without kit):	1715g
Cable diameter:	0.4 – 1 inch
Cable port:	4 (2 each side)
Quantity of cables installed:	2 - 4
Maximum number of trays:	3M FOT001 Slice Trays 4 DIN trays 4
Capacity of 3M FOT001 Tray:	12 single Fusion splices / tray
Capacity of DIN tray:	Max 12 single Fusion splices / tray Max 12 single Fibrlok™ / tray Max 12 single Crimp splices / tray
Looping length of bare fibres:	>2 X 0.8m
Looping length of fibre with loose-tube:	>2 X 0.8m

Ordering Information

Ref.-No.

Fibre optic closure 2179-CS (w/o tray)	MOQ: 15 each	2179-CS/0
Fibre optic closure 2179-CS (12C w/1 tray)	MOQ: 15 each	2179-CS/1
Fibre optic closure 2179-CS (24C w/2 trays)	MOQ: 15 each	2179-CS/2
Fibre optic closure 2179-CS (36C w/3 trays)	MOQ: 15 each	2179-CS/3
Fibre optic closure 2179-CS (48C w/4 trays)	MOQ: 15 each	2179-CS/4
Closure Kit 2179-CS w/DIN tray bracket w/o tray	MOQ: 15 each	2179-CS/DIN

Additional parts

Aerial Hanger Kit	MOQ: 15 each	2179-CS/AHK
Re-entry Accessory Kit 2180-CS	MOQ: 15 each	2180-CS/RAK
Port Accessory Kit 2179-CS	MOQ: 15 each	2179-CS/PAK
Pole Mount Accessory Kit 2179-CS	MOQ: 15 each	2179-CS/PK

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2179-CS Fiber Optic Closure

2179-CS closure is designed and developed based on the proven 3M sealing technology. It is made of plastic molded parts and mastic sealing materials. Closing of the closure is simply done by the sliding latching mechanism. **2179-CS** latching system provides short installation time and easy re-entry possibility. There is no need for special tooling for closing and opening the closure.

Applications
Closure is suitable for the applications up to 48 single fibers, which mostly can cover the Fiber To The Home / Fiber To The Curb (FTTH/FTTC) applications and distribution networks.
Underground, aerial, pedestal or direct buried applications are possible with the closure. **2179-CS** has chemical and mechanical resistance for all the application areas in the fiber networks. Can be used in BUTT or In-Line configuration.

Capacity
Closure can accept cable sizes from 1,01 cm (0,4") to 2,5 cm (1"). Maximum number of cable entries is 4 in In-Line configuration
2179-CS can be used with 3M FOT001 trays, suitable for single fiber fusion splices, as standard. **2179-CS** closure also has a version that can accommodate DIN splice trays where Fibrlok™ or crimp splices are used. For both tray systems it is possible to place maximum 4 trays and maximum 12 fiber splices per tray in **2179-CS**.

Kit contents
2179-CS closure kit includes all the necessary parts to complete closure installation. Tray type and the number of the trays needs to be selected according to the application needs. FOT001 trays can be supplied with the closure as standard. If DIN trays are required "**2179-CS** Closure Kit w/DIN tray Bracket w/o tray" version should be selected and the DIN trays & tray accessories should be ordered separately.

Features	Benefits
• Compact in size (44,7cm x 17,52cm x 10,67cm)	• Suitable for limited space applications, too. (had holes).
• Fiber capacity up to 48 single fibers	• Applicable for all networks. FTTH /FTTC solutions.
• Accepts variety of splice versions; single fusion splice, crimp splice, Fibrlok splice.	• Covers different splice methods for low fiber count applications.
• Proven sealing technology.	• Wide area of usage; underground, aerial, direct buried, pedestal.
• Available in complete kit (with trays + accessories)	• Reduced inventory.
• Sliding latch mechanism.	• No requirement for special tooling. Saves time and cost.
	• Easy application.

Specifications

Technical characteristics	Physical characteristics
Cable strength: 40kPa, 1000N for 1min, No apparent splice case degradation. No leakage. **Cable compress**: 100N, 1min, No apparent splice case degradation. No leakage. **Vibration:** 40kPa ; A=+/-1.5mm , f=25Hz , 15min, No apparent splice case degradation. No leakage. **Cable bend:**40kPa, 150mm, +/-45degree, 10Cy., No apparent splice case degradation. No leakage. **Cable torsion:** 500mm, +/-90 degree, 10Cy. No apparent splice case degradation. No leakage. **Rust resistance:** Metal part: salt spray for 30days, without rust. **Temperature cycling.** -40c-20C-60C , 2h , 10Cy. , Then fill 60kPa air-pressure, without leakage. **Impact:** 1kg,1m @-20C,No apparent splice case degradation. No leakage. **Immersion:** Water depth 2.5m, 30 days, without water intrusion. **Air tightness:** 100kPa@Room temperature, 5 min. No apparent splice case degradation No leakage. **Insulation:** Water depth 1.5m, 24hours, 15kVDC for 1min, R>20000Mohm@500VDC. **Compression:** 40kPa, 2000N/10cm, 1min, No apparent splice case degradation. No leakage. **Chemical Resistance:** 40kPa, 5%HCL , 5%NaOH,5%NaCl for 24hours. Without corrosion and leakage.	**Material :** Molded plastic **Outside dimension (LXWXH):** 15.7" x 6.9"x 4.2" **Splice chamber space (LXWXH):** 12"x4.7"x 3.3" **Weight (without kit):** 1715g **Cable diameter:** 0.4 – 1 inch **Cable port :** 4 (2 each side) **Quantity of cables installed:** 2 - 4 **Maximum number of trays:** 3M FOT001 Slice Trays 4 DIN trays 4 **Capacity of 3M FOT001 Tray :** 12 single Fusion splices / tray **Capacity of DIN tray :** Max 12 single Fusion splices / tray Max 12 single Fibrlock ™'s / tray Max 12 single Crimp splices / tray **Looping length of bare fibers:** >2 X 0.8m **Looping length of fiber with loose-tube :** >2 X 0.8m

Ordering Information Ref.-No.

Stock number	Description	MOQ	
XS003822433	2179-CS fiber optic closure (w/o tray)	15 each	2179-CS/0
XS003822441	2179-CS fiber optic closure (12C w/1 tray)	15 each	2179-CS/1
XS003822458	2179-CS fiber optic closure (24C w/2 trays)	15 each	2179-CS/2
XS003822466	2179-CS fiber optic closure (36C w/3 trays)	15 each	2179-CS/3
XS003822474	2179-CS fiber optic closure (48C w/4 trays)	15 each	2179-CS/4
XS003826905	2179-CS Closure Kit w/DIN tray Bracket w/o tray	15 each	2179-CS/DIN
Additional parts			
XS003820312	Aerial Hanger Kit	15 each	2179-CS/AHK
XS003821765	2180-CS Re-entry Accessory Kit	15 each	2180-CS/RAK
XS003822417	2179-CS Port Accessory Kit	15 each	2179-CS/PAK
XS003822425	2179-CS Pole Mount Accessory Kit	15 each	2179-CS/PK

***For DIN tray & DIN tray accessories refer to " *3M Solutions For Access Networks Catalog 2003/2004*" page 448-449.**

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3M

2179-CS Fiber Optic Splice Case

Instruction

2179-CS Fiber Optic Splice Case Description

1.0 General

1.1 The 3M 2179-CS Fiber Optic Splice Cases are closures that can be used in buried, underground, aerial, and pedestal applications. These closures are suitable for short-term pressurization during flash testing. **Please refer to your company's approved applications.** Each splice case has two cable entry ports on each end. Port plugs allow the cases to be used for butt or inline splices. The rigid non-encapsulated case provides moisture protection.

1.2 The 3M 2180-CS reentry kit is used to provide easy reentry.

2.0 Specifications

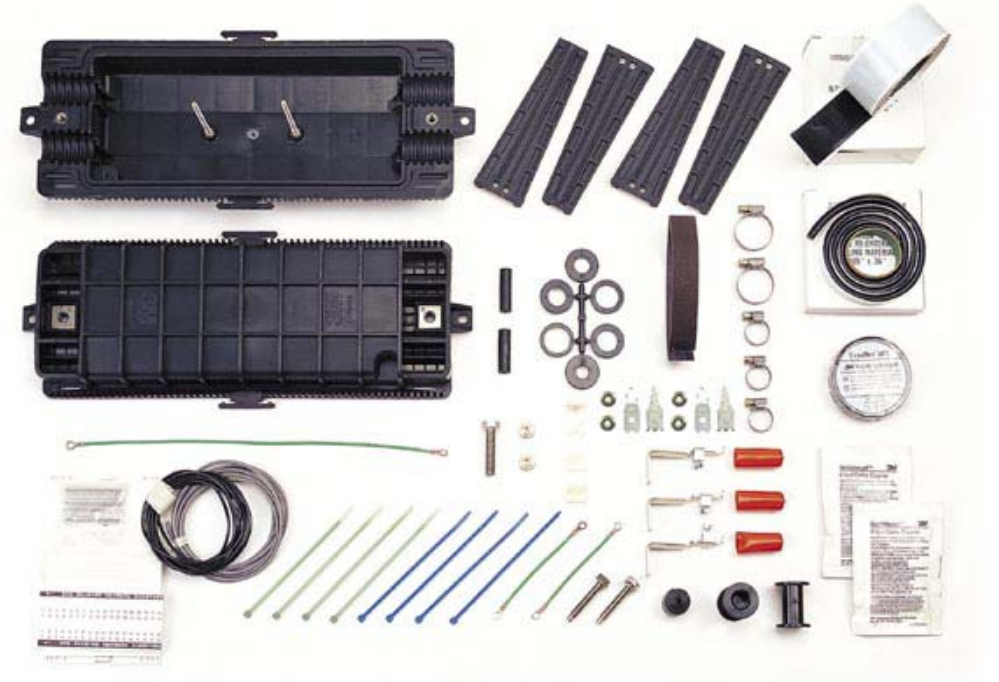
Maximum cable diameter:	1.0″ (25mm)
Minimum cable diameter:	0.4″ (10mm)
Closure length:	15.7”(399mm)
Closure width:	6.9” (175mm)
Closure height:	4.2” (106mm)
Available splice chamber space:	
Length:	12” (295mm)
Width:	4.7” (120mm)
Height:	3.3” (84mm)

2.1 Splice Tray Capacity:

Max Capacity of Splice Tray	4	3M FOT001 Splice Tray
Max Capacity of Fibre Splice	12 x 4	Loose Fiber

3.0 Kit Contents

3.1 3M 2179-CS Splice Case Kit Contents:



3.2 3M 2180-CS Re-entry Kit Contents: (For use in the 2179-CS)

3.3 Tools Required:

- 1/2″ (12.7mm) Hex Driver
- Wire Cutter for Steel Strength Members
- Screwdriver
- Torque wrench
- Tape Measure
- Electrician's Scissors
- Hammer

2179-CS Closure Installation Procedure

Note: Proper sealing of the 3M™ 2179-CS Series Fiber Optic Splice Case depends on strict adherence to these instructions and the use of specified materials. Deviations can cause leakage or cause damage. Maintain sealing surfaces clean to ensure proper sealing. DO NOT USE any un-release agents or other unspecified materials. These types of materials may lead to loss of sealing effectiveness.

4.0 Case and Cable Preparation

Securely screw both tray mounting posts into the closure bottom half and fit the tray support spacer over each post.

Attach twisted ties on the appropriated place on the base of the case.

4.1 Sealing Washers and Cable Tie

Slide two sealing washers down each cable. Use sealing washers with smallest inside diameter, which will slide on cable. Install one green cable tie on the "Feeder Cable" and trim. Install one blue cable tie on each "Distribution Cable" and trim.

Note: If necessary, sealing washers can be split and placed on the cable.

Note: When removing cable sheath, do not cut, kink, or damage inner layers. If damage occurs, cut back sheath to adequately inspect and repair.

4.2 Sheath Removal

Remove 70" (180 cm) of outer cable sheath (and shield or armor, if present). Remove successive sheath layers and wrapping to expose primary tubes protecting fibers. Stagger layers as recommended by cable manufacturer or per standard practice.

4.3 Remove all cable grease. Clean all primary tubes and dielectric strands with approved cleaner. Cover all sharp edges with vinyl tape.

Note: Carefully follow health, safety and environmental instructions as given on Material Safety Data Sheet or container label for cable cleaner solvent being used.

4.4 Trim any solid filler tubes and discard.

Note: Do not trim strength members at this time.

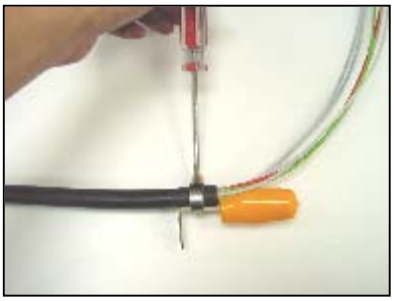
4.4 Scuffing

Scuff 5" (127 mm) of each cable end using supplied sheath scuff. Use 80T tape to remove the scraps.

Note: Do not use a carding brush to scuff sheaths.

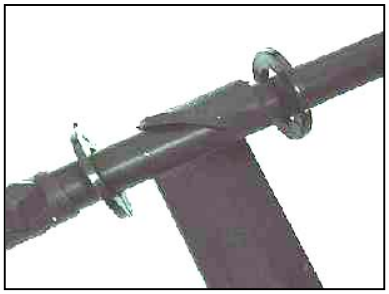
5.0 Sheath Retention and Strain Relief

Wrap the supplied 23# tape 1.2″ (3cm) from cable sheath end. Cut the central strength member 1.5″ (3.8cm) to fit along the strength member clamp. Secure the strength member to the cable retention /strength member clamp.



Secure the cable to the cable retention/strength member clamp. The cable and strength member should fit the clamp contours. Install rubber boot onto clamp.

5.1 Cable Build-up

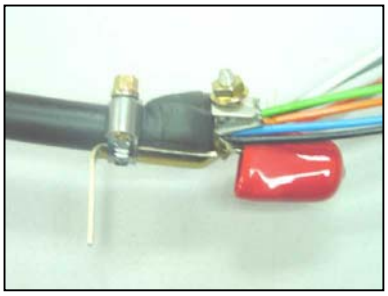


Use the 1.5" (38 mm) rubber tape included with the gasket to build the cable seals. Check the placement of the tape by positioning the strength member clamp where it will be anchored to the cable tie down bracket. Wrap the supplied rubber tape between sealing washers 2" (51 mm) from cable sheath end.

Always cut the tape in 2-dimensional bevels. To seal unused cable openings, build-up the tape on the plug. The tape should be wrapped to 1" (25mm) outside diameter.

5.2 Bonding and Grounding (Optional)

Note: Take care when installing shield bond connectors so underlying layers of cable are not damaged.



Install 4460-D Shield Bond Connector following instructions provided with connector. The lower jaw is positioned under the metallic shield under the cable sheath 90° from the strength member clamp. The two jaws are drawn tightly together with the nut and bolt trapping both the metallic shield and cable sheath between both jaws.

6.0 Fiber Preparation

With a loose buffer tube cutter, remove the loose buffer tubes in easy stages of approximately 400-450mm(16-18″) to the manufacturer's instructions. Leave 50mm(2.0″) of the loose buffer tube from the cable butt. Gauge the depth of the cutter blade on a scrap piece. The buffer tube cutter should score the buffer tube deep enough to enable separation to be completed with a gentle flexing movement between the fingers. Carefully remove the excess gel from the group of fibers with 3M cable cleaner.

Cut a length of flexible buffer tube 838mm(33″) long. Thread a fibre group into the piece of measured flexible buffer tube and out of the opposite end. Approx. 1m(29″) of fibers will be outside of the flexible buffer tubing for organization inside the tray. Allow the flexible tubing to expand and push onto the loose tube approximately 25mm(1″).

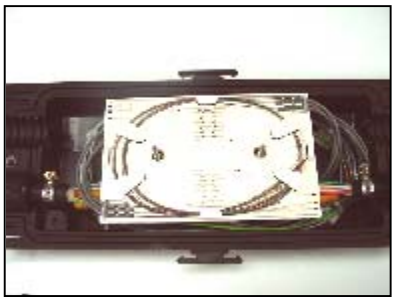
7.0 Splicing and Organization

Once the length of the flexible buffer tube has been determined, the splicing process can be completed outside of the closure.

7.1 Select the fibre groups to be spliced from both cables. Organize the flexible tubing from cable butt to splice tray entrance. Snap the flexible tube into the plastic splice tray clamps avoiding any sharp bends.

7.2 Cut the overlapping fibres to size using the tray insert as a guide. Arrange all the fibres in number sequence. Organize the fibres inside the splice tray avoiding tight bends, bringing the two corresponding fibres, from each cable, to an overlap position from opposite directions.

7.3 After splicing, re-organize the spliced fiber back into the splice tray. With finger pressure locate the spliced fiber and protector into the splice tray retention channels. The splice tray holds a maximum of 12 spliced fibers.



7.4 Snap the splice tray cover in position on top of the base. Secure the flexible loose tube to the tray with the small plastic tie through the slots provided. **Do Not Over Tighten. Note:** Ensure the ties do not interfere with the stacking of additional splice trays.

7.5 Additional tie wraps and twisted ties are provided to help organize the flexible loose tubes inside the closure. Carefully organize the flexible buffer tubes when placing the trays onto the splice tray supports. Allow the flexible tubes to naturally cross at each end on the inside of the closure.

7.6 To continue with additional fiber splicing, repeat above steps, on completion, secure all splice trays to the splice tray supports with brass nuts.

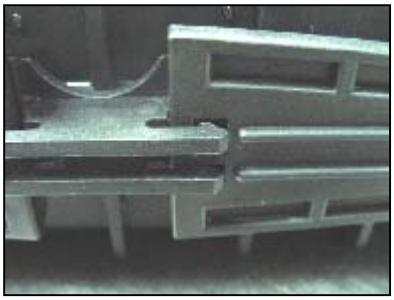
7.7 Completed Splice

Shown above are 2 completed splice trays secured to the splice tray supports with flexible loose tubes organized ready for cover closing.

8.0 Splice Case Assembly

With the plastic backing tape in position, lay the sealing tape into the grooves on both sides of the bottom cover half along the flanges. Cut the tape to rest against the cable sealing tape. **Do Not Stretch The Tape.** Carefully remove the plastic backing tape from both tapes.

Fit the cover onto the base. Hand start bolts at the both closure ends. Tighten hand tight. Using a torque wrench, tighten bolts evenly. Torque all bolts to 200-250 in-lbs. (2.9Kgm-29Nm).
Note: After Approx. 10 min. Re-torque the bolts to 200-250 in-lbs. (2.9Kgm-29Nm).
Only re-torque once.



Slide the four wedges onto the sealing ledge and evenly push the wedges towards the closure center using hand force only. Complete the cover sealing by tapping the wedges evenly securing the closure halves together to provide a watertight seal.

9.0 Sealing Test

To check for leaks, flash test splice case by applying air to 10 psi (0.67 bar) MAXIMUM, THEN RELEASE PRESSURE.

10. Splice Case Re-entry

Tap the wedges to remove.

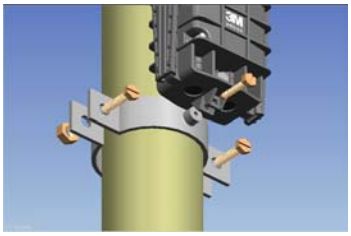
Using a torque wrench, loosen bolts. Then tighten reentry bolts（M10x1）evenly to open the case.

Note: It is mandatory to replace all sealing tape after re-entry.

11. To Install the Aerial-hanger, pole-mount and wall-mount kits, please refer to the figures below:

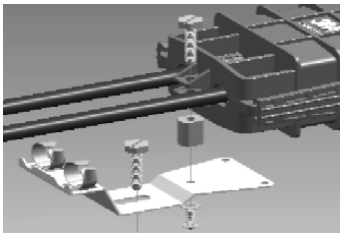
Aerial Hang

Install case on the steel strand with two hose clamps.



Pole Mount

Install the clamps on the case and then fix them on the pole.



Wall Mount

Install 2198A kits on the case and fix them on the wall with two bulge-bolts (optional).

Note: the aerial hanger, pole-mount and wall-mount kits are optional.

Important Notice

All statements, technical information and recommendations related to the Seller's products are based on information believed to be reliable, but the accuracy or completeness thereof is not guaranteed. Before utilizing the product, the user should determine the suitability of the product for its intended use. The user assumes all risks and liability whatsoever in connection with such use.

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3M

2179-CS Fiber Optic Splice Case

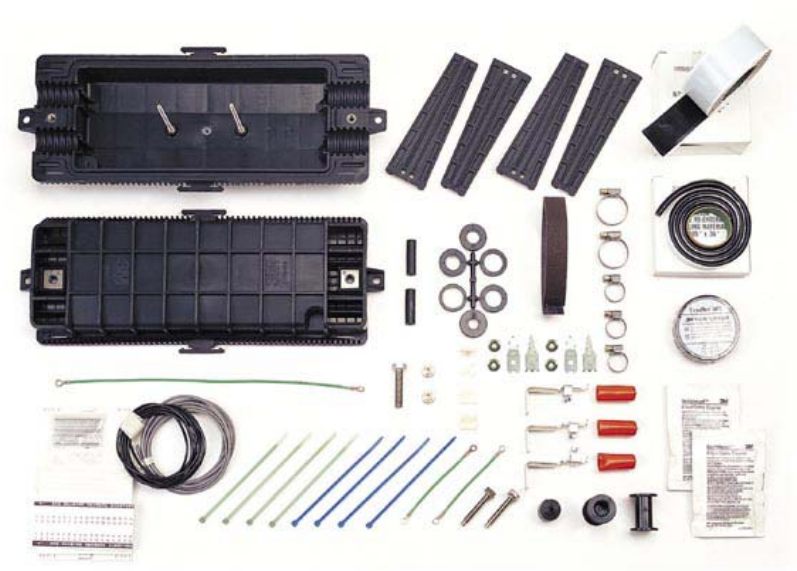
Technical Report

July 2002

1.0 Product Description

The 3M™ 2179-CS Fiber Optic Splice Case is a molded plastic enclosure used for protecting splices in fiber optic cables. It's suitable for buried, underground, aerial, and pedestal applications. Splice case has two cable entrance ports on each end. Port plugs allow the case to be used for butt or in-line splices. The rigid non-encapsulated cases provide physical and environmental protection. The splice cases are suitable for short-term pressurization during flash testing.

1.1 2179-CS Splice Case Kit Contents



1.2 2180-CS Re-entry Accessory Kit Contents: (For use in the 2179-CS)

1.3 Main Material Composition

Injection molded base	Polypropylene
Case Fasteners	Stainless steel
Inserts for plastic	Stainless steel
Air Valve	Stainless steel
Sealing Cord/tape	Acrylic rubber
Sealing washer tree/Plugs	PBT engineering thermoplastic

1.4 Closure Dimensions：

Outside dimension (LXWXH)	15.7” x 6.9”x 4.2” (399x175x106mm)
Splice chamber space (LXWXH)	12”x4.7”x 3.3” (295x120x 84mm)
Weight (without kit)	1715g
Cable diameter	0.4 – 1 inch (10--25 mm)
Cable port	4 (2 each side)

1.5 Closure Capacity:

Quantity of cables installed	2 - 4
Maximum number of 3M FOT001 Slice Trays	4
Capacity of 3M FOT001 Splice Tray	12 Fusion Splices
Looping length of bare fibers	>2 X 0.8m
Looping length of fiber with loose-tube	>2 X 0.8m

1.6 Temperature Range：

Operation	-40 - +60℃

2.0 Test Program Overview

To ensure the long-term performance reliability of the 3M™ 2179-CS Fiber Optic Splice Case, the cases have been subjected to a number of tests, which expose them to conditions more severe than anticipated in actual field use. The tests are based upon telephone industry performance specifications and are believed to represent the most severe requirements of that industry.

2.1 Test Items

The following list outlines the major areas, which were examined in this test program:

- Environmental
- Mechanical Strength
- Material Integrity
- Electrical Performance Tests

2.2 All the tests are conducted in accordance with:

- China MII Standard YD/T 814-1996
- Technical Specification of related MPT Bidding Document for Optic Fiber Cable Jointing Closure

3.0 Environmental Tests and Results

The 2179-CS Fiber Optic Splice Case was subjected to a series of environmental tests in order to determine the ability of the splice case to withstand worst-case environmental conditions that may be experienced in outside plant. See the table below for configurations tested and results.

3.1 Temperature Cycling test

The temperature cycling test determines if rapid thermal expansion and contraction has any effect on the mechanical integrity of the 2179-CS Closure. The closures were exposed to 10 9.6-hour cycles from 60°C to -40°C and 20°C. the 9.6-hour cycle includes 1.6-hour transition periods and two hour dwell times at the three temperature extremes.
After the test, 60kPa air-pressure is conducted into the closures to check whether there is any degradation happened in 5 minutes.

Temperature Cycling Test Result

Sample ID	Pressure in the Closure		Damage
	Pre-test (MPa)	Post-test (MPa)	
10	0.061	0.060	None
11	0.060	0.059	None
12	0.060	0.059	None

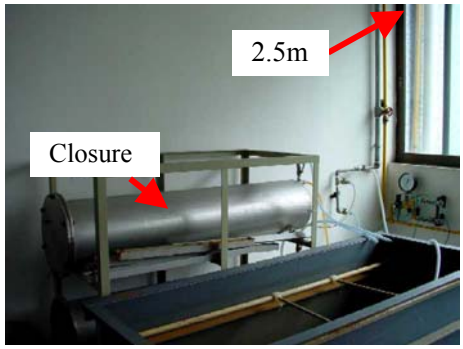
Results: No apparent splice case degradation happened.

3.2 Water Resistance

The water resistance test determines if the 2179-CS splice case can withstand the rigors of the previous environmental test series without degradation on its seal. Two splice cases were subjected to 2.5m water immersion for thirty days.

Water Resistance Test Result

Sample ID	Water Intrusion
15	None
16	None



Results: There was no water intrusion or mechanical damage to the closure.

4.0 Mechanical Tests and Results

The 2179-CS splice case was subjected to a series of mechanical tests in order to determine the ability of the closure to protect splices from external mechanical forces and stresses. This series of tests are intended to simulate the actual stresses that the splice case may be exposed to under normal installation and operating conditions.

4.1 Tensile Strength

The cable is installed with one cable at each end. The axial force 1000N is applied on the cable using the INSTRON tensile machine. The tensile machine moves with the speed of 1CM/min. along the cable axial direction. While the tensile strength reaches 1000N, hold the force for 1 minute.
Before the test, all the closures are pressurized up to 40 kPa and after the test, check the closure for the pressure, and observe the appearance of the closures.

Tensile Test Results

Sample ID	Pressure in the Closure		Damage
	Pre-test (MPa)	Post-test (MPa)	
1	0.040	0.040	None
2	0.040	0.040	None

Results: The splice case experienced no external mechanical damage, no air leakage and the cables at the entrance didn't loosen.

4.2 Compression

The compression test determines if the 2179-CS splice case can withstand heavy loads that may be applied during installation or maintenance. The 200kg of compressive force is applied on a 40x10cm of aluminum plate and then put onto the closure. The force will hold for 1 minute. (As shown in the figure).
The above procedure was conducted at room temperature. Before the test, all the closures are pressurized up to 40 KPa and after the test, check the closure for the pressure, and observe the appearance of the closures.

Compression Test Result

Sample ID	Pressure in the closure		Damage
	Pre-test (MPa)	Post-test (MPa)	
3	0.040	0.040	None
4	0.040	0.040	None
5	0.040	0.040	None

Results: The cases experienced no visible physical damage and no air leakage.

4.3 Impact

The impact test determines if the 2179-CS splice case can withstand a sudden impact from a foreign object. Two splice cases were conditioned at -20°C for one hour. Each splice case was subjected to a 1kgm vertical impact, over the center of the splice case, using a 5.1cm spherical radius impact head.(Refer to the Figure.)
Before the test, all the closures are pressurized up to 40 KPa and after the test, check the closure for the pressure, and observe the appearance of the closures.

Impact Test Result

Sample ID	Pressure in the closure		Damage
	Pre-test (MPa)	Post-test (MPa)	
3	0.040	0.040	None
4	0.040	0.040	None
5	0.040	0.040	None

Results: The splice cases experienced no external mechanical damage (no cracks in the splice case housing) and no air leakage.

4.4 Airtight Test

Three 2179-CS closures are pressurized up to 100kPa at room temperature for 5 minutes.

Airtight Test Result

Sample ID	Pressure in the closure		Damage
	Pre-test (MPa)	Post-test (MPa)	
1	0.100	0.100	None
2	0.100	0.100	None
3	0.100	0.100	None

Results: No splice case degradation was apparent.

4. 5 Cable Flexing

The cable-flexing test determines the ability of the 2179-CS splice case to isolate fibers and splices from cable bending which may occur during installation. At a distance of 150mm from the closure/cable interface, the assembly was given 10 cycles +/-45° bending. The cable jacket and shield bond connector inside the closure showed no signs of mechanical damage.

Cable Flexing Test Result

Sample ID	Pressure in the closure		Damage
	Pre-test (MPa)	Post-test (MPa)	
6	0.041	0.041	None
7	0.042	0.042	None

Results: The splice case experienced no external mechanical damage, no air leakage and the cables at the entrance didn't loosen.

4.6 Cable Torsion

The cable torsion test determines the ability of the 2179-CS splice case to isolate fibers and splices from torsion that may occur during installation. The samples were used in the previous test. At a distance of 1 m from the closure/cable interface, the cable was twisted for ten cycles. A cycle involves a 90° clockwise twist followed by a 180° counter-clockwise twist followed by a 90° clockwise twist back to the original position. Final readings were taken. This procedure was repeated at room temperature. The cable jacket and shield bond connector inside the closure showed no signs of mechanical damage.

Cable Torsion Test Result

Sample ID	Pressure in the closure		Damage
	Pre-test (MPa)	Post-test (MPa)	
6	0.044	0.044	None
7	0.041	0.041	None

Results: The splice case experienced no external mechanical damage, no air leakage and the cables at the entrance didn't loose.

4.7 Vibration

Before the test, the closure is pressurized to 40KPa. Two closures are fixed onto the vibration table. The frequency is 25Hz, the amplitude is +/-1.5mm and the duration is 15

minutes with X-axis and Z-axis direction individually. (See Figure.)

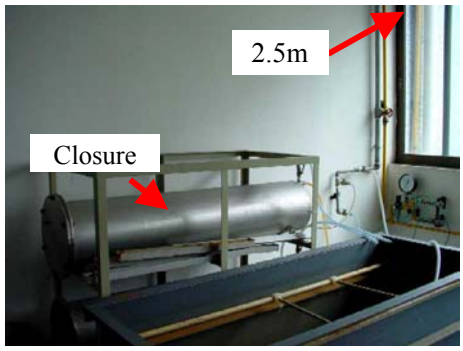
Vibration Test Result

Sample ID	Pressure in the closure		Damage
	Pre-test (MPa)	Post-test (MPa)	
8	0.040	0.040	None
9	0.040	0.040	None

Results: After subjected to the above test, there is no air leakage, no mechanical damage and crack in the appearance and breakage in the closure.

4.8 Water Resistance

The water resistance test determines if the 2179-CS splice case can withstand the rigors of the previous environmental test series without degradation on its seal. Two splice cases were subjected to 2.5m water immersion for thirty days.



Water Resistance Test Result

Sample ID	Water Intrusion
15	None
16	None

Results: There was no water intrusion or mechanical damage to the closure.

5.0 Material Integrity Tests

The materials used in the 2179-CS splice case were tested to determine their ability to withstand the severe conditions that could exist in the outside plant environment.

Three 2179-CS closures were immerged in the following chemicals for a period of 24 hours at room temperature.

5% HCl 5% NaCl 5% NaOH

Before the test, all the closures are pressurized up to 40 KPa and after the test, check the closure for the pressure, and observe the appearance of the closures.

Chemical Resistance Test Result

Sample ID	Pre-test		Post-test	
	Pressure (MPa)	Weight （g）	Pressure (MPa)	Weight （g）
17	0.041	1880	0.040	1880
18	0.040	1770	0.040	1770
19	0.042	1822	0.042	1822

Results: No evidence of corrosion of the material was observed. And there is no air leakage.

6.0 Electrical Performance Tests:

6.1 Insulation resistance

Putting the closures in the water for 24 hours and then connects all the metallic element together. Test the insulation resistance between the metallic element and the earth. The test voltage is 500 VDC.

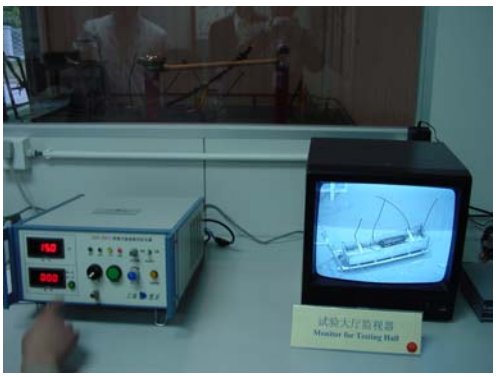
Insulation Resistance Test Result

Sample ID	Insulation Resistance (Ω)
13	$1.8x10^{15}$
14	$1.6x10^{15}$

Results: The insulation resistance is greater than 20,000Mohm. So the closure has good insulation resistance.

6.2 Dielectric strength

Putting the closures in the water for 24 hours, and then connect all the metallic element together. Test the dielectric strength between the metallic element and the earth. The test voltage is 15,000 VDC, the voltage is applied for 2 minutes.



Dielectric strength Test Result

Sample ID	Result
13	Pass
14	Pass

Results: the closure has good dielectric strength.

7.0 Conclusions

The 3M™ 2179-CS splice cases were examined through a variety of tests, which cover the product ability to protect the fiber cable splice. Throughout the tests, the 3M™ 2179-CS splice case met the severe requirements and performed with good results.