

Exhibit C-Materials and Specifications

General and specific descriptions and specifications for adherence in procurement and installation of materials and equipment in this RFP.

A. Fiber Cables, Terminations and Panels

- i. Provide optical fiber cabling, connecting hardware, and related hardware as manufactured by Corning Cable Systems®. Provide ancillary components as complying with this specification and incorporate Corning FastAccess Technology.
- ii. The number of fibers required in the cables for each project shall be dependent on the application but in no case shall be less than 12 strands. The number of strands in installed cable does not necessarily constitute the number of strands terminated or spliced. Coordinate the actual fiber count required for each application with City staff.
- iii. Only dry block tape allowed, no gel or other wet blocking materials.
- iv. All fiber terminations to be spliced pigtails or splice on connectors of SC/UPC style connected to Corning CCH panels.
- v. Fiber panels to be Corning PCH style rack mount. Wall mount installations, if necessary, will be determined per installation.
- vi. All Respondents responsible to familiarize themselves with termination points to avoid unknowns.
- vii. Post installation testing results for each segment as completed.

B. Pull Boxes and Vaults

- i. For the purposes of this specification, a pull box shall be defined as an enclosure in which no more than two underground conduits enter, a vault shall be defined as an enclosure in which more than two underground conduits enter or a splice is located.
- ii. Pull boxes and Vaults are not to be cut to accommodate conduit or box installation. All conduit entries must be from below the box entering in the bottom vertically or at slight angles.
- iii. Pull boxes shall be installed at 500 feet apart along the length of a new conduit installation, or as required for ease of fiber optic cable pulling. On runs where installation of conduit is at a steady level plane without the need to have more than a few percent change in grade pull boxes/vaults can be spaced up to 1000' apart.
- iv. Cable slack in pull boxes shall be 50' min. if space allows and 100' min at all intersection crossings on both sides.
- v. In the case of existing conduit and pull box runs undersized boxes shall be replaced per the guidelines set forth in these specifications at a minimum.
- vi. Pull boxes are to be straight wall polymer concrete with 20k split lids (Highline PHG series or similar), box size 24x36x36 where feasible, but minimum size not less than 17x30x30 if larger not possible due to space restrictions. Any box subject to routine traffic or "occasional" heavy vehicle traffic to be solid concrete with steel lids such as Oldcastle "Christy B2436" or comparable sized appropriate for location. All must comply with ANSI/SCTE 77 2017.
- vii. All boxes to have poured fiber reinforced concrete collar 6" (min) x 10-12" wide and are location specific upon determination of City staff.
- viii. Vaults shall be manufactured of fiber-reinforced polymer concrete or if applicable circumstances warrant, precast concrete. Minimum dimensions shall be 36" wide x 36" long x 36" deep. Provide two (2) cable racks on each side of the vault (8 total).
- ix. Vaults shall be installed at all splice points and /or 2,000 feet apart along the length of a new conduit installation, or as required for ease of cable installation.
- x. Vaults shall contain a minimum of 100' of slack on either side of a splice point.
- xi. All boxes/vaults are to be installed on top of a compacted gravel base with min 10" gravel base inside the box.

C. Conduit

- i. All new conduit to be HDPE and continuous runs without couplers. If couplers must be used, usage must be approved by City staff and must be E-Loc or non-corroding

band clamp. No new conduit runs to be greater than 500' between boxes unless cleared through City staff.

- ii. Transition elbows are to be large sweep design manufactured from HDPE, no PVC, (see Table I).
- iii. Meeting building code requirements for cable installation is the respondent's responsibility. This includes innerduct or rigid piping installation in ceilings, plenums, etc. if necessary. This note "will not" constitute a change order and is Respondent's responsibility to ensure installation quotes accurately reflect all materials needed on any given segment.
- iv. 1250# Mule tape to be installed after installation of fiber to allow for future access.

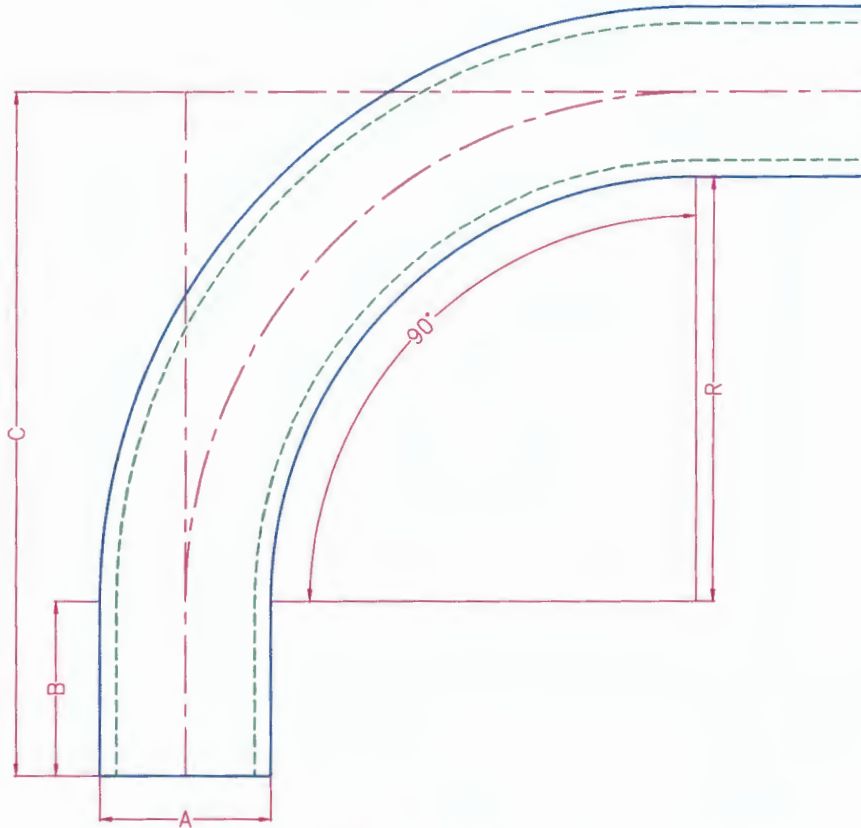
TABLE I – Conduit, Couplers & Transitions

See Table I on next page:

NOMINAL SIZE	SDR	APPROXIMATE				
		DIMENSIONS (in.) / WEIGHT				
		WPR	A	B	C	R
2	7	335	2 3/8	6	13.3	7.13
	9	252				
	11	200				
	17	125				
3	7	335	3 1/2	6	16.5	10.5
	9	252				
	11	200				
	17	125				
4	7	335	4 1/2	6	19.5	13.5
	9	252				
	11	200				
	17	125				
6	7	335	6 5/8	7	26.9	19.9
	9	252				
	11	200				
	17	125				
8	7	335	8 5/8	10	34.5	24.5
	9	252				
	11	200				
	17	125				
10	7	335	10 3/4	11	43.2	32.25
	9	252				
	11	200				
	17	125				
12	7	335	12	13	51.3	38.3
	9	252				
	11	200				
	17	125				
14	7	335	14	13	51.9	38.9
	9	252				
	11	200				
	17	125				
16	7	335	16	16	64	48
	9	252				
	11	200				
	17	125				
18	7	335	18	18	72	54
	9	252				
	11	200				
	17	125				
20	7	335	20	20	80	60
	9	252				
	11	200				
	17	125				

REVISION HISTORY			
REV	DESCRIPTION	DATE	NAME

- NOTES**
1. TOLERANCES +/- 2".
 2. ANGLE TOLERANCES +/- 2.0°.
 3. MADE FROM HDPE SIZE SPECIFIC PIPE.
 4. FOLLOW INDUSTRY STANDARD FUSION PROCEDURES.
 5. FOLLOW INDUSTRY STANDARD QUALITY PROCEDURES.
 6. CUSTOM DESIGN AVAILABLE.
 7. IF SPECIFIC DIMENSIONS NEEDED, PLEASE CALL.
 8. LARGER SIZES AVAILABLE UPON REQUEST.
 9. WPR BASED ON PE 4710 FOR WATER AT 73° F.
 10. MOLDED FITTINGS MFG BY AGRU, PERFORMANCE PIPE, CENTRAL PLASTICS.
- CONFIDENTIAL NOTICE / CONTROLLED DOCUMENT**
 Dissemination of this information contained herein is prohibited



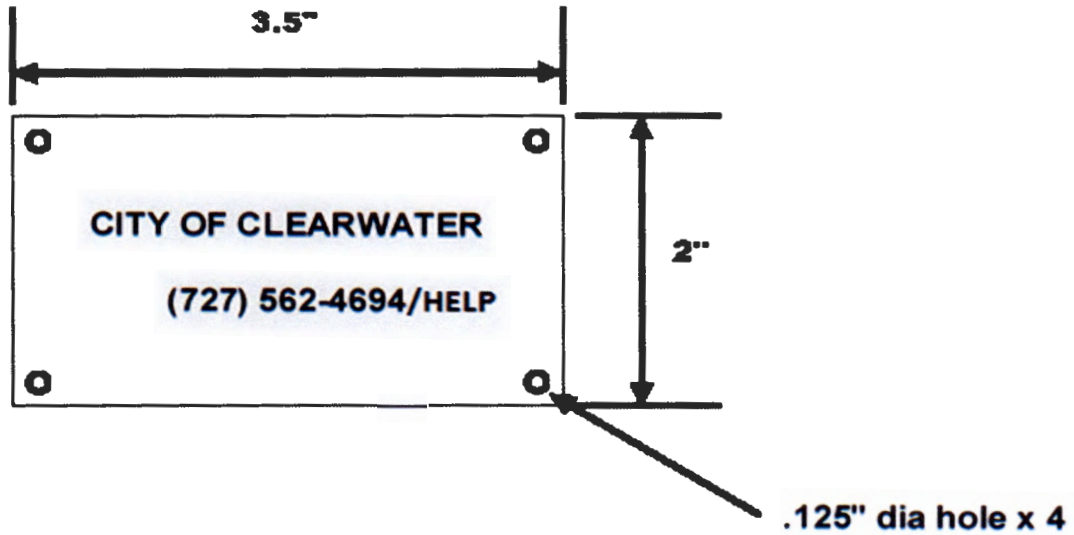
<h1 style="color: red; margin: 0;">SECOR</h1>		TITLE: SWEEP 90° ELL MANUFACTURED BY PIPESTAR INTERNATIONAL			
		DATE:	DRAWN BY:	CHECKED BY:	DWG. NO.
17321 GROESCHKE ROAD HOUSTON, TX. 77084 PH. # 281-556-1661 FAX# 281-556-1683		06/29/15	PATRICK O'GRADY	JUSTIN KEYS	A

TABLE II – PULL BOX/VULT IDENTIFICATION LABEL PLATE

Label plates material 316 stainless with 15ga min/.125" max thickness, lettering must be stamped or engraved with the below information and affixed to vault cover with four 316 grade pan head security torx drive screws minimum .750" long.

- a. City of CLEARWATER
- b. Fiber Optic Cable
- c. 727-562-4694/HELP

DIAGRAM FOLLOWS BELOW:



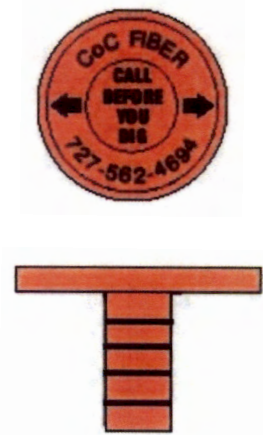
D. CABLE ROUTE MARKERS

- i. Delineator posts are to be "RhinoMarker Tri-View" orange with orange caps installed on RhinoMarker U-channel posts.
- ii. Curb and pavement markers are to be RhinoMarker A-Tag.
- iii. Substitutions are not authorized without express approval by City staff and must meet or exceed full specs of RhinoMarker brand.

TABLE III – Delineator Post Caps

Delineators/Markers Color: Standard orange/black lettering fade resistant and UV stable
 (DOMES)
 "Warning Fiber Optic Cable"
 CITY of CLEARWATER
 727-562-4694
 (RhinoMarker TriView)

(Curb/Pavement)
 "CoC FIBER"
 "CALL BEFORE YOU DIG" with Arrows
 727-562-4694



- a. Permanent, UV stable polypropylene, 10yr fade warranty
- b. Located at all locations where fiber crosses under roadways and sidewalks
- c. 1.5" dia.
- d. Rhino A-TAG or equal

WARNING TAPE

- i. Fiber optic warning tape shall be bright orange color, minimum 3" wide, and 6 mil thick. Warning tape shall be installed for the full length of the cable or conduit run.
- ii. Warning tape shall be marked "WARNING FIBER OPTIC CABLE."
- iii. Warning tape shall be buried 12" below existing grade.
- iv. The buried cable warning tape shall be a flexible, elastic material intended for burial and use as an underground utility warning notice. Ensure that the surface of the warning tape is coated and sealed to prevent deterioration caused by harsh soil elements. Ensure that the tape material and ink colors do not change when exposed to acids, alkalis, and other destructive chemical variances commonly found in Florida soils. Ensure that the warning tape color is orange as required by the American Public Works Association (APWA) Uniform Color Code and has "CAUTION: FIBER OPTIC CABLE BURIED BELOW," or other wording approved by the City Information Technology Department, permanently printed on its surface. Include buried cable warning tape with all underground conduit where feasible and conduit depth is $\leq 48"$.

F. LOCATE WIRE

- i. Trace wire size per below specs to be installed where not preexisting.
- ii. Tracer wire to be pulled in with pipe on new bores. Tracer wire installed during drilling to be Copperhead SoloShot 1045-EHS only.
- iii. Tracer wire installed in existing conduit with fiber to be Copperhead Superflex 1230-SF.
- iv. Locate wire shall be installed in same horizontal location as the conduit and shall be installed outside of the conduit for new conduit installations, otherwise inside conduit with fiber cable for preexisting conduit not already containing locate wire.
- v. All boxes to contain magnesium (preferred) or copper clad grounding rod installed for grounding trace wire.

G. LOCATE WIRE SURGE PROTECTION

- i. Furnish and install a locate wire surge protection system. Ensure that locate wires are attached to a surge protection system dedicated to safely dissipating high transient voltages or other foreign electrical surges induced into the designating system. Provide this grounding through a stand-alone system that does not include electric power or ITS device grounding.
- ii. The surge protection system shall allow signals generated by locate system transmitters to pass through the protection system without going to ground.
- iii. The protection system shall automatically reset, and pass locate system transmitter signals after the unit has grounded to dissipate over-voltages.
- iv. The locate wire surge protection is intended for below or above-grade applications.
- v. The locate wire surge protection system shall be grounded to a driven rod within 10 feet of the system using an AWG #6 single conductor wire with orange insulation.
- vi. The locate wire surge protection device shall be enclosed for protection from environmental hazards and accessible for connection of portable locate system transmitters.

H. DIAGNOSTICS/TROUBLESHOOTING

Provide City with complete Diagnostic OTDR test kit, EXFO AXS-110 or comparable, minimum specs as follows.

- Quad wavelength
- SC connectors
- Li-ion batteries; 8 hours of continuous operation as per Bellcore TR-NWT-001138
- Wavelengths (nm) 850/1300/1310/1550
- Dynamic range b (dB) 24/25/32/30
- Pulse width (ns) Multimode: 5, 10, 30, 100, 275, 1000

- Singlemode: 5, 10, 30, 100, 275, 1000, 2500, 10 000
- Event dead zone c (m) 0.8
- Attenuation dead zone c (m) 3.5/4.5/4/4.5
- Linearity (dB/dB) ± 0.03
- Loss threshold (dB) 0.01
- Loss resolution (dB) 0.01
- Sampling resolution (m) Multimode: 0.08 to 2.5; singlemode: 0.08 to
- Sampling points Up to 64 000
- Distance uncertainty d (m) $\pm (0.75 + 0.0025 \% \times \text{distance} + \text{sampling resolution})$
- Distance range (km) Multimode: 0.1 to 40; singlemode: 0.65 to 260
- Typical real-time refresh (Hz) 4
- Memory capacity 500 traces
- Measurement time User-defined
- Stable source output power e (dBm) Multimode: -3 ; singlemode: -2.5
- Visual fault locator: Laser, 650 nm ± 10 nm, CW typical $P_{out} = 1.4$ mW open beam
- Integrated Power Meter
- Calibrated wavelengths (nm): 850, 1270, 1290, 1310, 1330, 1350, 1370, 1390, 1410, 1430, 1450, 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610, 1625
- Power range (dBm) 26 to -64 (GeX 2 mm)
- Uncertainty $\pm 5 \% \pm 0.4$ nW (up to 5 dBm)
- Display resolution (dB)
- 0.01 (-54 dBm to P_{max})
- 0.1 (-54 dBm to -64 dBm)
- 1 (-64 dBm to min)
- Automatic offset nulling range g Maximum power to -38 dBm
- Tone detection (Hz) 270/1000/2000
- Appropriate SM launch cable.
- SC/ST termination, adapters for LC, SC, and bare fiber testing
- Termination Kit, Corning LanScape TKT-UNICAM-PFC



FOSC® 450 D6 Fiber Optic Splice Closure, Gel Cable sealing, no pre-installed tray, 6 cable attach., six ground feedthrough lugs, with test valve

- Single-ended, O-ring sealed dome closure for splicing feeder and distribution cables
- Gel cable sealing technology allows easy adding or removing of a wide size range of cables
- Compatible with most common cable types: e.g. loose tube, central core, ribbon fiber
- FOSC splice trays hinged for access to any splice without disturbing other trays
- Closure can be used in aerial, pedestal and underground (up to 5 meters) environments
- Compatible with CommScope's CWDM modules and optical splitter trays

Product Classification

Regional Availability	Latin America North America
Product Type	Single-ended, round fiber closure
Product Brand	FOSC®
Product Series	FOSC 450

General Specifications

Cable Entry Drop Port Style	Round
Cable Entry Main Port Style	Round
Cable Ports Quantity, total	6 round ports
Cable Sealing Type	Compressed gel
Closure Sealing Type	Dome-to-base clamp with O-ring
Closure Style	Single-ended
Color	Black
Fiber Storage Basket Type	D6 standard size
Ground Feed-through Lugs, quantity	6
Mounting	Pole Strand Wall
Network Area Type	Feeder
Splice Tray Included, quantity	0
Splicing Capacity, Mass Fusion, maximum	1152
Splicing Capacity, Single Fusion, maximum	576
Splicing Capacity, Single Splice, 12 fibers, maximum	576
Splicing Capacity, Single Splice, 6 fibers, maximum	288

931866-000 | FOSC450-D6-6-NT-0-D6V

Splicing Type, Supported

Mass fusion | Single fusion

Dimensions

Length

753 mm | 29.646 in

Diameter

254 mm | 10 in

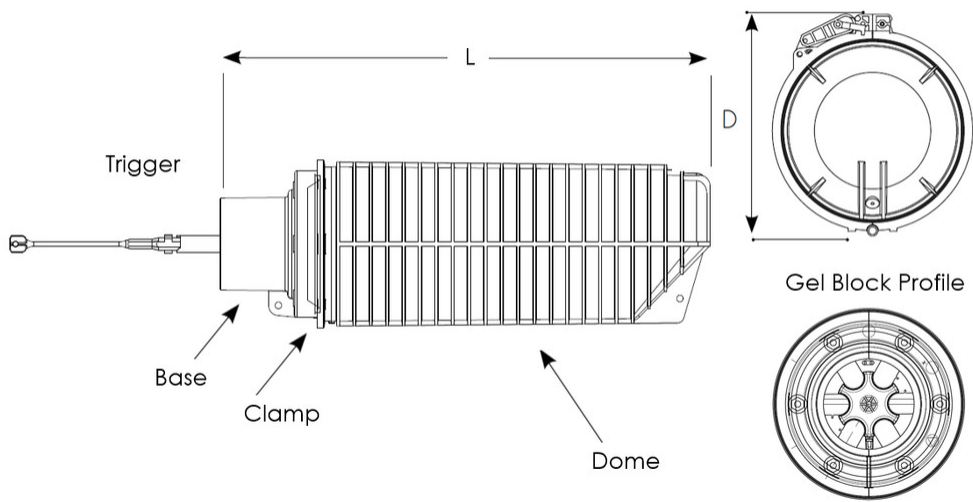
Diameter, with clamp

292 mm | 11.496 in

Main Cable Diameter, maximum

25 mm | 0.984 in

Dimension Drawing



Ordering Tree

931866-000 | FOSC450-D6-6-NT-0-D6V

FOSC 450 - XX - X - XX - X - X X X

Closure Size (inches)

A4	4 cable entry ports; 8 dia. x 19 long
BS	6 cable entry ports; 9 dia. x 19.5 long
B6	6 cable entry ports; 10 dia. x 24 long
C6	6 cable entry ports; 11.5 dia. x 23 long
D6	6 cable entry ports; 11.5 dia. x 30 long

Termination Hardware Quantity for the Kit

2	2 cable attachments included
4	4 cable attachments included
6	6 cable attachments included (N/A for A size)

Capacity and Type of Splice Tray

NT	No tray installed in factory
12	A, B, or C tray with two SM6 splice modules
24*	A, B, or C tray with two SM12 splice modules
36	D tray with six SM6 splice modules
72*	D tray with six SM12 splice modules
R1	A, B size ribbon tray (accommodates 12 ribbons/144 fibers)
R2	D size ribbon tray (24 ribbons/288 fibers)
R3	C size ribbon tray (18 ribbons/216 fibers)
SF	Stackable single fusion trays (12 splices)

*Note: SMOUV (1120-01) splice protection sleeves are highly recommended for use with SM12 splice modules.

Quantity of Splice Trays Factory Installed

0 or 1 is standard	Choose either "0" trays (no trays installed) or "1" tray installed. Additional trays sold separately.
--------------------	---

Valve for Flash Testing

V	Valve (standard)
N	No Valve

Note: We recommend flash test valves for FOSC closures. However, non-valved closures are available upon request.

Number of Ground Feed-through Lugs

0	No grounding
1	1 ground feed-through lug (A4 only, N/A for BS)
3	3 ground feed-through lugs (B6, C6, and D6 closures only, N/A for BS)
6	6 ground feed-through lugs (C6 and D6 closure only, N/A for BS)

Note: FEG and MEG kits provide optional ground isolation for FOSC 450 closures.

Slack Basket Type

N	No Basket
A	A4 Standard Size
B	B6, BS Standard Size
C	C6 Standard Size
D	D6 Standard Size
E	Special Bulkhead Basket arrangement for B, BS closures only
T	Tall Size
S	Stackable Trays in D Closure

Note: D-size closures with "N" option include backbone used to route ribbons to ribbon trays. A and B-size closures include storage "socks".

Material Specifications

Material Type

Impact-resistant polymer

Environmental Specifications

Environmental Space

Below ground | Buried

Qualification Standards

IEC 61300, 5 m waterhead

Water Resistance

Flash test valve at 5 psi (40 kPa)

Packaging and Weights

Included

Cable termination attachments (6)

Packaging quantity

1

Packaging Type

Box | Carton

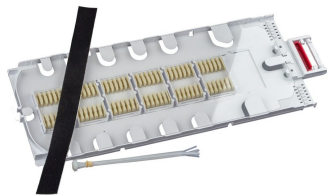
Weight, net

9.07 kg | 19.996 lb

Regulatory Compliance/Certifications

Agency	Classification
CHINA-ROHS	Below maximum concentration value
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system
REACH-SVHC	Compliant as per SVHC revision on www.commscope.com/ProductCompliance
ROHS	Compliant





FOSC® Splice Tray Kit, clear cover with 6 SM-6 splice modules, tie-wraps

Product Classification

Regional Availability	North America
Product Type	Fiber splice tray
Product Brand	FOSC®
Product Series	FOSC 450

General Specifications

Application	For use with FOSC-450 Fiber closures
--------------------	--------------------------------------

Packaging and Weights

Packaging quantity	1
---------------------------	---

Regulatory Compliance/Certifications

Agency	Classification
CHINA-ROHS	Below maximum concentration value
REACH-SVHC	Compliant as per SVHC revision on www.commscope.com/ProductCompliance
ROHS	Compliant



GATORPATCH



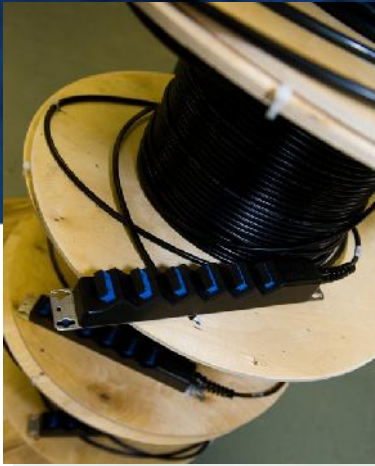
The ultimate fiber
distribution terminal



**Fiber
Connections Inc.**
Innovate | Design | Deliver

GATORPATCH

Rugged, Fast, Reliable!



Trust the original
GatorPatch for all your
fiber distribution needs

The GatorPatch is a unique, rugged, factory terminated fiber distribution solution. Easy to install in the field, this patented product has been used extensively all across the globe in a wide range of applications such as ITS (transportation), industrial, power utility, etc. With such a wide array of fiber and connector options, the GatorPatch is THE product to use for pre-terminated “plug & play” applications. The GatorPatch is manufactured and tested to the highest industry standards right here in North America in our state of the art manufacturing facility.

KEY FEATURES

- installs quickly in outdoor enclosures, pedestals, and equipment racks at zero RU
- factory terminated and 100% tested
- available in many cable and connector configurations
- available as a pigtail for splicing or pre-terminated for plug & play applications
- slim body design is potted for additional ruggedness
- custom designs available upon request
- -40°C to +70°C operating temperature
- manufactured in North America for quick turn around
- up to 24 fibers in a single GatorPatch

GATORPATCH



The GatorPatch found it's niche in the ITS (transportation) industry when contractors were looking for a solution that would give them a rugged, pre-terminated patch panel that would easily fit inside an awkward traffic control cabinet. They needed this patch panel to come with a blunt (pigtail) custom length tail at the other end that could be run to the underground trunk cable for splicing. Since that time, the list of potential applications for the GatorPatch has grown significantly. Below are some examples but, the list continues to grow.

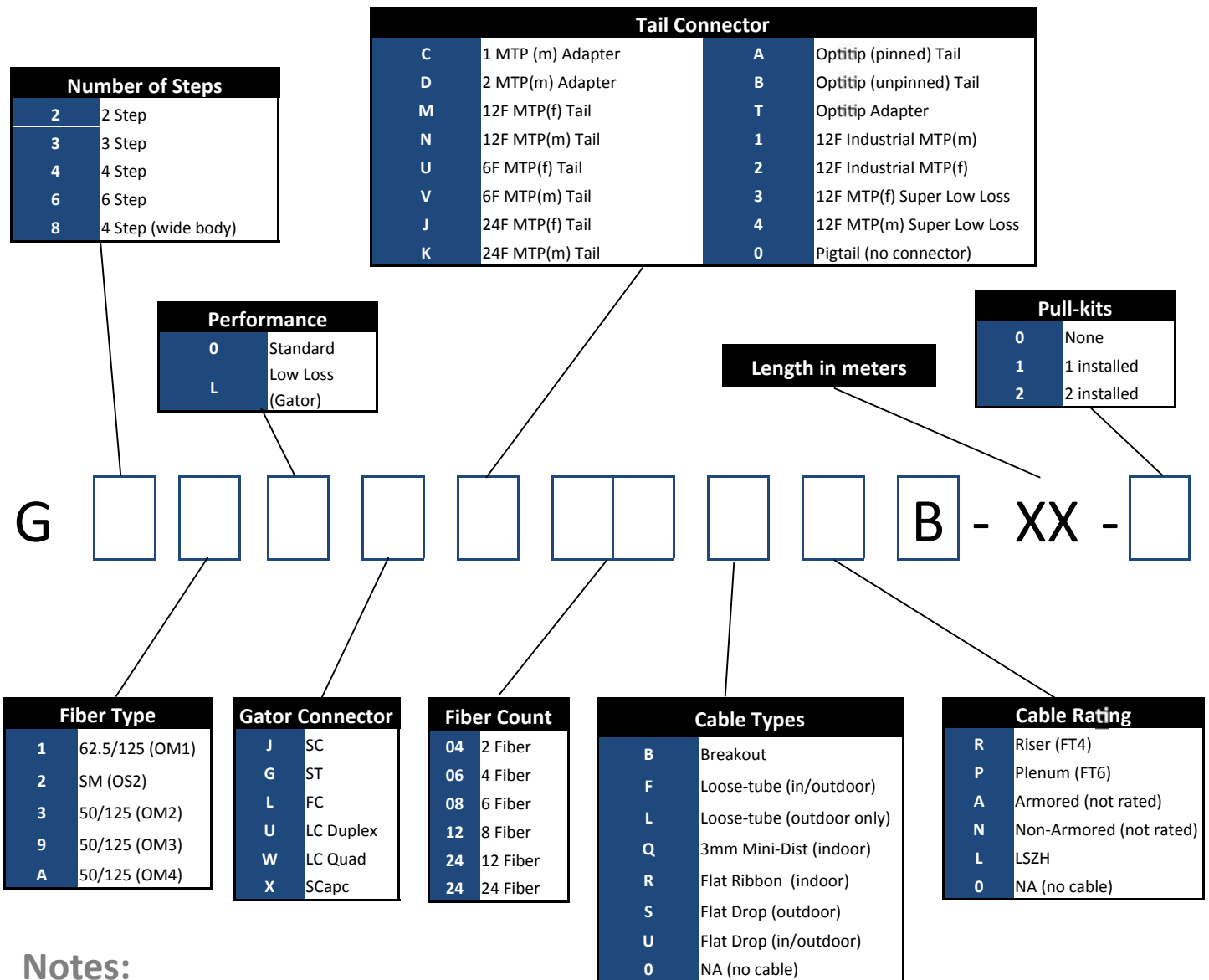
Above photo shows a GatorPatch installed in a typical traffic control cabinet. The blunt (pigtail) end of the cable is spliced to the main underground trunk cable

Applications

- ITS (transportation)
- alternative energy (wind/solar)
- mining
- oil and gas
- industrial
- cellular
- quick deployment
- disaster recovery



ORDERING INFORMATION AND TECHNICAL SPECIFICATIONS



Notes:

1. Low loss Gator connectors available on OS2, OM3, OM4 fiber only.
2. Super low loss MTP connectors available on OM4 fiber only.
3. Minimum length of cable tails is 2 meters.

Please contact customer service for additional information.
 Custom configurations available upon request.
 All specifications are subject to change

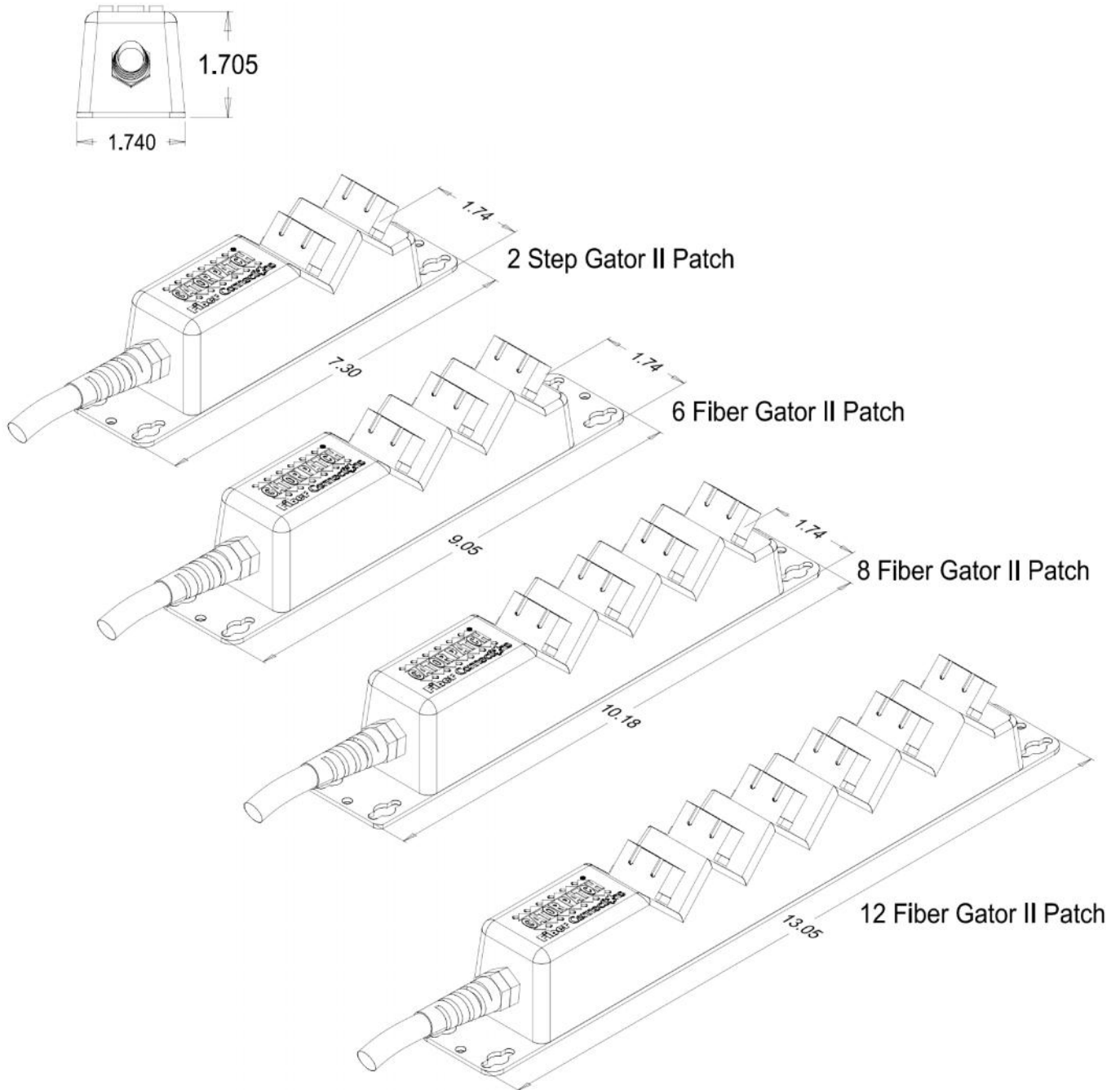
ORDERING INFORMATION AND TECHNICAL SPECIFICATIONS

Technical Specifications - GatorPatch body connectors					
Connector Performance	Multimode (OM1, OM2, OM3, OM4)			Single mode (OS2)	
Test wavelength	850 and 1300nm			1550nm	
Insertion loss (per connector)	0.2dB, 0.15dB(low loss) typ.			0.2dB, 0.15dB(low loss) typical	
	0.4dB, 0.3dB(low loss) max.			0.4dB, 0.3dB(low loss) max.	
Reflectance	< -20dB			< -55dB	
Durability	500 matings, <0.2dB change			500 matings, <0.2dB change	
Tensile strength - straight pull (cable tail)	50lbs (220N), <0.2dB change			50lbs (220N), <0.2dB change	
Temperature range	-40 to +70C			-40 to +70C	
Ferrule polish	PC			upc, apc	
Connector options	ST, SC, LC, FC			ST, SC, LC, SCapc, Lcapc, FC	
Technical Specifications - MTP adapter or tail (when applicable)					
Insertion loss (MTP Multi fiber Connector)	0.2dB typ.			0.25dB, 0.2dB(low loss) typ.	
	0.5dB max, 0.35dB elite max. 0.2dB super low loss elite OM4			0.5dB, 0.35dB elite max.	
Insertion Loss (Optitip multifiber Connector & Industrial MPO)	0.3dB typical			0.3dB typical	
	0.75dB max			0.75dB	
Durability	500 matings, <0.2dB change			500 matings, <0.2dB change	
Temperature range	-40 to +70C			-40 to +70C	
Cable Performance	Multimode				Single-mode
Fiber Type	62.5/125µm	50/125µm			Single-mode
		(850/1300nm)			(1310/1550nm)
ISO/IEC name	OM1	OM2	OM3	OM4	OS2
Max. Atten. (dB/km)	3.4/1.0	3.0/1.0	3.0/1.0	3.0/1.0	0.4/0.3
Min. OFL - Bandwidth (MHz•km)	200/500	700/500	1500/500	1500/500	- / -



SCHEMATICS

2,3,4,6 Step (slim) Gator Patch



SCHEMATICS

4 Step (wide) Gator Patch

