



# **Verizon NEBS™ Compliance: Generic Requirements for Fiber Optic Splice Closures and Terminals**

Verizon Technical Purchasing Requirements

VZ.TPR.9412

**Issue 5, December 2009**





**CHANGE CONTROL RECORD:**

<b>Version</b>	<b>Date</b>	<b>Action*</b>	<b>Reason for Revision</b>
1	12/14/2007	New	New Document
2	3/18/2008	Change	Added Terminology for Thin Wall Terminal
3	4/3/2008	Change	Additional Notes were added to document to clarify concatenation test methods Section 5.3.1 Cable Clamping – was modified to required optical measurements before and after testing only. Modified Crafts person interaction testing to include RL measurements during with a maximum allowable change of 2dB. Removed the notations allowing bend radius limiters.
4	4/16/2008	Change	Added procedure for front panel/rear panel disconnect test. (Fiber Optic Splice Closures) Changed Task names for Fiber Accessibility and Mold Stress Relief. (Fiber Optic Splice Closures)
5	12/4/2009	Add	5.4.9- Added allowance for UVA-340 Cycle 1 per ASTM G154 or Xenon Cycle 1 per ASTM G155
* New, Add, Delete, Change, Reissue			



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**1.0 PURPOSE**

The purpose of this Verizon Technical Purchasing Requirement (VZ.TPR) document is to provide the FOC testing requirements for Fiber Optic Splice Closures and Terminals. This requirement is based on GR-771 Generic Requirements for Fiber Optic Splice Closures.

**2.0 SCOPE**

FOC Products

**3.0 REFERENCES**

<b>ASTM G21</b>	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
<b>Verizon PFOC Memo #1</b>	
<b>Verizon PFOC Memo #3</b>	
<b>Verizon PFOC Memo #3, rev 1</b>	
<b>Verizon PFOC Memo #3, rev 2</b>	
<b>Verizon PFOC Memo #5</b>	
<b>Verizon PFOC Memo #5, rev 3</b>	
<b>Verizon PFOC Memo #7</b>	
<b>Verizon PFOC Memo #7, rev 1</b>	
<b>Verizon PFOC Memo #7, rev 2</b>	
<b>Verizon PFOC Memo #7, rev 3</b>	
<b>Verizon PFOC Memo #9, rev 2</b>	
<b>Verizon PFOC Memo #9, rev 3</b>	
<b>Verizon PFOC Memo</b>	Standard Practice for Operating Fluorescent Lighting Apparatus for



#12	UV Exposure of Non-Metallic Materials
Verizon PFOC Memo #12a	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
Verizon PFOC Memo #14	
Verizon PFOC Memo #24	
Verizon PFOC Memo #24, rev 1	
Verizon PFOC Memo #24, rev 2	
Verizon PFOC Memo #26	
GR-63-CORE, Issue 3, March 2006	NEBS™ Requirements: Physical Protection
GR-454-CORE, Issue 1, December 1997	Generic Requirements for Supplier Provided Documentation
GR-769-CORE, Issue 1, October 1994	Generic Requirements for Organizer Assemblies
GR-771-CORE, Issue 1, 1994	Generic Requirements for Fiber Optic Splice Closures
GR-3120-CORE, Issue 1, March 2005	Generic Requirements for Hardened Fiber Optic Connectors
GR-3125-Core, Issue 1, March 2006	Generic Requirements for Outdoor Fiber Distribution Hubs (FDH's)

#### 4.0 ACRONYMS

<b>A</b>	After
<b>B</b>	Before
<b>D</b>	During
<b>FOC</b>	Fiber Optic Components
<b>IL</b>	Insertion Loss
<b>ITL</b>	Independent Testing Laboratory



## **5.0 TEST REQUIREMENTS FOR FIBER OPTIC SPLICE CLOSURES AND TERMINALS**

Verizon purchases Fiber Optic Splice Closures and Terminals for various applications. Fiber Optic Splice Closures and Terminals shall meet the requirements specified in the following tables, which are based on to the requirements specified in Telcordia document GR-771: Generic Requirements for Fiber Optic Splice Closures. All the testing must be completed by a Verizon approved ITL.



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
<b>3 General Requirements and Objectives</b>				
3.1 Documentation				
3.1.1 Practices		R3-1		Complete set of documentation in agreement with GR-454, Generic Requirements for Supplier-Provided Documentation
3.1.2 Workcenter Information Package		R3-2		Supplier shall prepare a Workcenter Information Package
3.2 Marking, Packaging and Shipping				
3.2.1 Identification		R3-3		An assembled splice closure shall be Identified by Manufacturers name and model number
		R3-4		Month, Year and Serial Number, on closure and shipping container
		R3-5		NRTL - (fire resistant only)
		O3-6		Identifiable without entering closure
3.2.2 Shipping Container and Packaging Arrangement		R3-7		Shipped in single container, packaged in order needed.
		R3-8		Packaging shall be adequate to ensure no damage during shipping, see GR-63 (shipping, handling and storage)
		O3-9		Shipping container and packaging should be reusable, recyclable or biodegradable.
3.2.3 Package Label		R3-10		Clearly labeled with part numbers and names consistent with instructions
		R3-11		Consumable materials with shelf life: clearly marked with expiration date on three sides of the closure packaging. SR-NWT-2759



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
3.2.4 Package Quality		R3-12		Packaging shall be adequate to ensure no damage during shipping, see GR-63 (shipping, handling and storage)
3.2.5 Consumable Materials		R3-13		Consumable materials shall have a minimum shelf life of one year from the date of shipment.
		R3-14		Expiration data shall be clearly shown
		R3-15		Maximum and minimum allowable storage temperatures shall be clearly printed on the packaging.
		R3-16		If consumable material is packaged in another container, the outer container must also be marked with shelf life and storage temps.
3.3 Initial Product Qualification and Periodic Requalification		R3-17		Each splice closure family must be qualified prior to initial product offer and periodically thereafter. Testing performed per Table 6-1 in GR-771
		R3-18		Change in form, fit or function require requalification of the product.
<b>4 Splice Closure Features and Functions</b>				
4.1 Materials				
4.1.1 Metallic		R4-1		Metals shall be resistant and/or protected against general corrosion (stress corrosion, cracking, pitting, etc.)
		R4-2		No Galvanic corrosion
		R4-3		No external wraps or coating shall be necessary to protect from corrosion
4.1.2 Non-Metallic		R4-4		Resistant to solvents, stress cracking and creep (based on testing in section 5.4.8)
		R4-5		Materials shall be compatible with chemicals and other materials they might be exposed to.



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
4.2 Common Closure Requirements				
4.2.1 Cable Compatibility		R4-6		Compliant with VZ.TPR.9418 and VZ.TPR.9437
4.2.2 Cable Entrance Capacity		R4-7		Per GR-771
4.2.3 Cable Termination Hardware		R4-8 thru R4-10		Per GR-771
4.2.4 Bonding and Grounding Hardware		R4-11		Provide hardware to accommodate a #6 AWG or larger conductor
		R4-12		1000 Amps for 20 seconds
		R4-13		Provide hardware and installation instructions for extending electrical continuity of all metallic elements via min #6 copper grounding conductor.
		R4-14		Continuity shall not be affected by re-entry in to the closure
		R4-15		Internal and external ground - easily separable
4.2.5 Closure Mounting Hardware		R4-16		Aerial Closures must include all mounting hardware
		O4-17		Mounting hardware should allow closure to be temporarily supported on the strand during installation
4.2.6 Fiber and Splice Organization		R4-18		GR-769
		R4-19		Accommodate mechanical and fusion splices
		R4-20		Capable of storing fiber from fiber ribbon cables, loose tube cables and core tube cables with fiber bundles
		R4-21		
		O4-22		Should accommodate the storage of passive optical components
		R4-23		



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
		R4-24		
4.2.7 Fiber and Splice Storage Capacity		R4-25		
4.2.8 Fiber and Splice Protection		R4-26 thru R4-28		
4.2.9 Maintenance		O4-30 thru O4-31		
4.2.10 Components		R4-32		Fasteners must be captivated
4.2.11 Installation Size and Weight		R4-33		Installation, repair and re-entry with one trained craftsperson
		R4-34		Assembled Closure w/o cables, splices and organizers < 22 lbs.
		O4-35		Assembled Closure w/o cables, splices and organizers < 33 lbs.
4.2.12 Safety		R4-36		No sharp edges, comers, burrs or other hazardous features
		R4-37		Nontoxic and dermatological safe
4.2.13 Security		CR-38		Equipped with locking device
4.2.14 Tools		R4-39		No special tools required
4.3 Taunt Sheath Closures (TSC's)				
4.3.1 Closure configuration		R4-40		Capable of being installed on previous installed fiber optic cable
4.3.2 Cable Termination		R4-41		Capable of be installed on figure 8 cable
		R4-42		Capable of expressing rigid and non-rigid cable.
4.3.3 Cable Capacity		R4-43		Capable of expressing a single distribution cable
		O4-44		Capable of expressing two distribution cables
		R4-45		Branch and drop cable capacity (GR-771, section 4.2.2)
4.3.4 Cable Sheath Opening		R4-46		Minimum sheath opening: 50cm



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
		CR4-47		Maximum sheath opening: 91cm
4.3.5 Fiber Splicing		R4-48		Must accommodate splicing of fibers in both the upstream and downstream directions
		R4-49		Store splices from added cable(s) without disturbing existing splices
4.3.6 Fiber and Splice Storage		R4-50		Capable of storing splices with as little as 25cm of fiber from the express cable without inducing a significant tensile or torsion stress on the fibers or splices
		R4-51		Capable of storing fiber slack from the branch or drop cable(s) without inducing significant torsion stress on the splice(s)
4.4 Free Breathing Closures (FBC's)				
4.4.1 Drainage of Condensate		R4-52		FBC must provide means of drainage for condensate
4.4.2 Insect Resistance		R4-53		Shall not permit insect intrusion
4.5 Hermetically Sealed Closures				
4.5.1 Air Valves		R4-54		HSC shall be equipped with Air valve
4.6 Pre-Terminated Closure				
4.6.1 Closure Dimensions		R4-55		A PTC and all attached cables: capable of being pulled into 3" dia. Conduit
		R4-56		A PTC and all attached cables: capable of being pulled through a 90 bend in a 3" dia. Conduit having a 3' radius
4.7 Hybrid Fiber Closures (HFCs)				
<b>Mechanical Performance</b>				



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.3.1: Cable Clamping	AA	R5-3	IL B/A	Set up 4 samples using at least one of each cable (or if applicable drop cable as specified in FOC Memo 12 Rev 1) in at least one cable port of the 4 samples. First set up with hardware loose - take readings at -5C, after stabilized for at least 2 hrs. . Then per product installation instructions secure cables and take readings -5C after at least 2 hour dwell for 1 hr. Repeat at +40C and at +23C for all 4 samples. Perform tests (this means install hardware) after a minimum of two hours stabilization at each temperature and take readings during installation and for at least 1 hour after hardware is installed. Use new cables for each temperature, must replace cables. Any damaged cable is to be noted as a failure, any IL reading above criteria is a failure. Must test once each of the different type cables used at each temperature. If a cable is used twice only required to test once. Minimum sampling rate is once every one half hour. Samples tested at +23C move forward to next test - Sheath Retention. - See Notes: 1, 3, 4, 5, 6, 7, 10, 14



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.3.2: Sheath Retention	AA	R5-4	IL B/D/A	100 lb pull, test @ -40C, +40C. Test for 24 Hr. Distribution cable 100 lbs, drop cable 10 lbs. Thin Wall stubbed plastic terminals use 25 lbs on the stub. During readings taken once every 1/2-hour minimum. Details: Use the (4) samples from the previous test with at least one of each cable (or if applicable drop cable as specified in FOC Memo 12 Rev 1) in at least one cable port of the 4 samples. Install each of the 4 samples in the fixture with no weight, stabilize for min of 2 hrs at -40C, take readings, and then apply appropriate weight for 24 hours. During readings taken once every 1/2-hour minimum. Remove weight take readings at -40C and repeat procedure at +40C for all 4 samples. A damaged cable is noted as a failure; above criteria IL is a failure. Must test once each of the different type cables used. If a cable is used twice only required testing once. For factory stubbed terminals, first test at +40C then at -40C. See Notes: 1, 3, 4, 5, 6, 7,10, 14
5.3.3: Cable Flexing	AA	R5-5	IL B/D*/A	22lbs, Test @ -30C, +40C. Direct monitoring or concatenated circuit used with the same criteria. Use the set of 4 samples from the previous test. Test each of the different cables per FOC Memo 12 at least once. Take baseline reading at +23C, for both test temperatures, during readings taken the whole 5 min (200 ms sweep rate needed). The wt (22 lbs) is hanging. After readings taken at 23C, for both test temperatures. Raise the weight take readings. Rotate as specified in GR-771 and repeat procedure. Test at -30C and +40C. In this test no replacement of cables is permitted. The edge of the closure is defined as end of hard plastic & not any heat shrink tubes installed. Stabilize the set-up for at least 2 hrs at each temperature. See Notes: 1, 3, 4, 5, 6, 7, 10, 13, 14



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.3.4: Cable Torsion	AA	R5-6	IL B/D*/A	OM - IL, use only 1625 nm for during, use all wavelengths for Before and After at 23C, for both test temperatures. Test @ -30C, +40C. Direct monitoring or concatenated circuit used with the same criteria. Use the set of 4 samples from the previous test. Test each of the different cables per FOC Memo 12 at least once. OM at 1625 with a fast sampling (200 ms sweep rate needed) while the 10 cycles are occurring. Cycles defined as 1 per approx 5 sec. to complete. Sample damage, delta loss beyond criteria, and cable damage are noted as failures. See Notes: 1, 3, 4, 5, 6, 7, 10, 13, 14
5.3.5: Vertical Drop	AB	R5-7	N/A	Test @-40C, 40C. Stabilize for 2 hrs at the test temperatures. Follow GR requirements and criteria; drop each sample on a different side. So, each of the four samples is dropped once but the side is different for each. If removed from chamber, test each sample within 2 minutes. See Note: 1, 7, 14
5.3.6: Compression	AB	R5-8	N/A	Use short stubs in each port that are sealed at the ends, use FOC Memo 12 for cables to be used. Test 300 lbs Buried and Underground, all others are 100 Lbs - 15 min @-40C, 40C; Stabilize for 2 hrs. Follow GR requirements and criteria. See Note 1, 5, 7, 10, 11, 14



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.3.7: Impact (Drop Tube)	AB	R5-9	N/A	Applies to Buried and Underground closures. Test @ -40C, 40C using 100 ft-lbs for drop tube (or if applicable 10ft-lbs). Stabilize for 2 hrs. Impact 4 locations top, bottom and two sides, centered hits on each side - must hit between hardened connectors, connector damage that can be replaced in field is not a failure. Only field non-replaceable damage is a failure. If necessary due to failure include max. levels that the product can pass, see FOC (Memo 5 Rev 3) impact matrix. For thin-wall closures (i.e.: usually stubbed and not used for splicing) use 10 ft-lbs. If removed from chamber, test each sample within 2 minutes. See Note 1, 5, 7, 10, 11, 14
5.3.7: Impact (Pendulum and Drop Tube)				Applies to Aerial on Pole and in/outdoor Wall. Test @ -40C (if indoor use only test to -5C), and +40C, using 50 ft-lbs for drop tube and 50 lbs for pendulum. For thin-wall closures (i.e.: usually stubbed and not used for splicing) use 10 ft-lbs for both drop tube and pendulum tests. Stabilize for 2 hrs at test temperatures. Drop tube - impact topside only. Pendulum hit (50 ft-lbs) three exposed vertical surfaces - front and sides. Note: must hit between hardened connectors on front impact, connector damage that can be replaced in field is not a failure. Only non-replaceable damage is a failure. If necessary due to failure include max. levels that the product can pass, see FOC (Memo 5 Rev 3) impact matrix. If removed from chamber, test each sample within 2 minutes. See Note 1, 5, 7, 10, 11, 14
5.3.7: Impact (Pendulum)				Applies to Aerial Strand. Test @ -40C and +40C, using 50 ft-lbs. Stabilize for 2 hrs at test temperatures. Impact 2 locations front, and back (center). Note: must hit between hardened connectors if applicable on front impact, connector damage that can be replaced in field is not a failure. If removed from chamber, test each sample within 2 minutes. See Note 1, 5, 7, 10, 11, 14



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.4.6: Water Resistance	AA/AB	R5-16	N/A	Based on use: in hand hole and buried 10 foot water head - 7 days; WDR for Aerial, see note 8 below for amount of water for free breather, no water on connectors. If sealed no water allowed. If for manhole 20-foot water head for 7 days. Immersion test covers WDR. Follow applicable FOC memos. See Note 1, 5, 7, 10, 11, 8
Immersion				
Wind Driven Rain				
Water Spray				
5.3.8: Central Member Protrusion	AA	R5-10	N/A	Follow procedure in GR-771. Use one of the samples from group AA and perform test one time. See Note 1
<b>Environmental Performance</b>				Note 5.4.1 to 5.4.6 conducted in series
5.4.1: Thermal Aging	B	R5-11	N/A	Aging at 90C for 30 days for the gaskets. Consideration may be given with a lower temperature and longer test duration may be needed for some gasket materials if their glass transition temperature is exceeded. See Note 1, 9
5.4.2: Assembly	B	R5-12	N/A	Follow procedure in GR-771, assemble at -5C, +40C. Follow supplier instructions. Assemble 2 at -5C and 2 at +40C. See Note 1, 5, 7, 9, 10, 14



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.4.3: Temp/Humidity Cycling	B	R5-13	IL B/D/A	OM - IL 4 wavelength before, during and after. Test with 4 samples @ (-40C, 65C) 30 days, Mark where cables enter the closure to check movement. Samples must be installed to simulate field installation with a minimum of 6 feet of cable on each side of the product in the chamber - this pertains to all applications. Product under test must be positioned in the chamber in the orientation that it will be in when field installed. Cables installed into the unit under test must not be in a configuration that causes any additional stress or forces that would not normally be present in a correct installation of the product in the field. The test set up will as much as possible be representative of an actual deployment in the Outside Plant. If cable movement is found the amount should be noted and reviewed. Use FOC Memo 1 and minimum of 12 fibers are directly monitored (including ports) - must have ports and through fibers monitored. Monitored fibers are to be equally spread across all cables entering and exiting the sample - use GR-771 - 6.3 guidelines for monitoring fibers. See Notes: 1, 3, 4, 5, 6, 7, 10
5.4.4: Freeze/Thaw	B	R5-14	IL B*/D*/A*	Applies to UG and Buried. OM - IL ONLY 1625 wavelength / before, during and after/ 4samples.Ten Cycles. See Verizon Memo # 7 for details. Half ports with cable & half with dust caps, as product application applies. Use smallest hand hole size that the sample will correctly fit in. See Notes: 1, 3, 4, 5, 6, 7, 10
5.4.6: Water Resistance (Immersion/Wind Driven Rain)	B	R5-16	N/A	Based on use: in hand hole and buried 10 foot water head - 7 days; WDR for Aerial, see note 8 below for amount of water for free breather, no water on connectors. If sealed no water allowed. If for manhole 20-foot water head for 7 days. Immersion test covers WDR. See Note 1, 5, 7, 10, 8



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.4.5 Weather tightness	B	R5-15	N/A	Review for dust entrance. Applies to free breathing closures only, minimal dust entrance is permitted with no dusts allowed near or on optical components. Follow GR-771 procedure. See Note 1, 5, 7, 10
5.4.8.1: Chemical Resistance - Material Degradation	CA	R5-18	N/A	Test bars - 30 test bars per each material type. Follow test procedure in GR-771.
5.4.8.2: Chemical Resistance - Chemical Immersion	CB and CC	R5-19 thru R5-21	N/A	Applies to UG and Buried. Closure Samples = 8 total, 2 samples in each of 4 chemicals. Follow GR-771 procedure. 25 "dog bones" of each material type in 4 chemicals, follow GR-771 procedures. Can be immersed with the closures. See Note 1, 7
5.3.6 Compression	CB	R5-8	N/A	Use short stubs in each port that are sealed at the ends, use FOC Memo 12 for cables to be used. Test 300 lbs Buried and Underground, all others are 100 Lbs - 15 min @-40C, 40C; Stabilize for 2 hrs. Follow GR requirements and criteria. See Note 1, 5, 7, 10, 11
5.3.7 Impact	CB	R5-9	N/A	Applies to Buried and Underground closures. Test @ -40C, 40C using 100 ft-lbs for drop tube (or if applicable 10ft-lbs). Stabilize for 2 hrs. Impact 4 locations top, bottom and two sides, centered hits on each side - must hit between hardened connectors, connector damage that can be replaced in field is not a failure. Only field non-replaceable damage is a failure. If necessary due to failure include max. levels that the product can pass, see FOC (Memo 5 Rev 3) impact matrix.. For thin-wall closures (i.e.: usually stubbed and not used for splicing) use 10 ft-lbs. If removed from chamber, test each sample within 2 minutes. See Note 1, 7, 10, 11, 14
5.4.6: Water Resistance (Immersion)	CB	R5-16	N/A	Based on use: in hand hole and buried 10-foot water head - 7 days; no water allowed. If for manhole 20-foot water head for 7 days. Immersion test covers WDR. See Note 1, 5, 7, 10, 11, 8



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.4.9: UV Resistance	D	R5-22	N/A	See GR3120, 3115 R3-21 - Per ASTM G154 2,000 hours, or ASTM 155 1,000 hours on test bars. Shall not craze or crack and must retain 80% of original strength. Use Instron before and after exposure. Follow procedure in GR-771 Allowance is permitted for UVA-340 Cycle 1 per ASTM G154 or Xenon Cycle 1 per ASTM G155
5.4.10: Fungus Resistance	E	R5-23		ASTM G21 - Zero rating
Environmental Vibration - OM	F		IL B/D/A	OM - IL 4 wavelength / before, during and after/ Only 2 samples. Mount units as intended to a mounting fixture that mounts directly to vibration table. Simulates environmental vibration. See GR 3125 section 5.5.1.4 for ETSI Vibration curve. See Note: 3, 4, 6, 7
<b>Electrical Requirements</b>				
5.2.1: Bond Clamp Retention	F	R5-1	N/A	20 Lb for 1 min - per GR-771 - See Note 1, 7
5.4.7 Corrosion Resistance	F	R5-17	N/A	Acidified Saltwater for UG and buried, Salt Fog for Aerial - follow procedures in GR-771, except length of test changed to 30 days for both tests. If acidified salt water is conducted, salt fog can be waived - See Note 1, 7
Acidified Saltwater				
Salt-Fog Spray				
5.2.2: AC Fault Test	F	R5-2	N/A	1000 Amp AC 20 seconds - performed after Salt Fog or Acidified Saltwater - at room temp. See Note 1, 7
<b>Conditional Requirements</b>				
5.5.1 Bullet Resistance	H	CR5-23	N/A	12 gauge # 6 lead/steel shot for field load one sample. Mount to fixed position. Shoot connector side of terminal. 50 ft distance. 28 inch modified choke. See GR 3125 section 5.4.13
5.5.2 Core Blocking Ability	I	CR5-25	N/A	Follow GR-771



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.5.3: Rodent Resistance	J	CR5-26	N/A	One inch radius, and Rockwell Hardness R87, and smooth surface with no protrusion
5.5.4 Steam Resistance	K	CR5-27	N/A	
5.5.5 Fire Resistance	L	CR5-28 Thru CR5-31	N/A	Required if product is used indoors or on buildings. Follow GR-771 Fire test requirements. Materials must a minimum be UL 94V-0 flammability rated and an Oxygen Index of less than 28 required. Both the Horizontal and Vertical tests are required.
GR-449 5.4.3 Front Plane Connector Disconnect and Re-connect (Craft Interaction Test) - OM	M		IL - B/D*/A RL - D*	OM - IL at 1625 wavelength B/D/A, Test at -18C, +40C. Use GR449 5.4.3. 10 cycles See Note: 3, 4
GR449 Fiber Accessibility Handling Test - OM			IL - B/D*/A RL - D*	This test looks at the result of accessing fiber on products with multiple splice trays. For example if there is a product that has three splice trays, are the customers on splice tray one effected if the craft has to access splice tray three. 50 cycles of handling with OM - IL 1625 wavelength before, during and after 1 sample at -5C and +40C. RL is to be monitored during only with a max change of 2dB. Applies only to closures with splice trays. 200 ms sweep rate needed. Concatenation using one fiber. See Note: 3, 4
GR449 5.1 High Temperature Storage / Mold Stress				80C (176F) for 14 days. Look for deformation that would affect products form fit and function. This test is suggested for reviewing alternate materials, plastic mold changes with out having to redo section 5.4.3.



FOC Test Plan for Fiber Optic Splice Closures Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
NRTL Registration			N/A	CPE applications or mounted at Customer Premise or in areas where the general public has access to the installed product.



Notes: General GR 771 testing, use with modified Table 6-1 dated April 4, 2007 "Performance Test Sequence"

1. Tests with same letter are done in sequence from top to bottom, Example Samples A, B and F are each one set of samples with the tests to be conducted in series with the same samples done in sequence. .
2. Assumes GR326 Connector, Assumes GR20 Cable
3. Direct Optical Monitoring, Dust caps on remaining ports if applicable for additional info see Verizon Memo # 1 & 3. Concatenation is used for Craft Interaction test and fiber tray handling test. Concatenation is allowed with no increase in IL criteria for torsion and flexing tests
4. IL criteria for all four wavelengths (1310, 1490, 1550, 1625 nm) = +/- [(# of fusion splices x criteria) + (# of connector interfaces x criteria)]. Test each wavelengths unless otherwise noted (see FOC Memo 3 Rev 3 for all details) - All Optical Monitoring is direct except for Handling Splice Tray Test (allowed for Torsion and Flexing with no increase in IL criteria) and Craft Interaction Test - i.e. GR-449 tests Refer to FOC Memo 3
  - a. When connectors are monitored use .3 db/fiber of change during test for 90 % of circuits monitored and use .45 db/fiber for 10% of circuits monitored. Refer to FOC Memo 3
  - b. When circuit is just a through fiber or one with a splice the use .05 db/fiber change for 90 % of circuits monitored and .15 /fiber for 10 % monitored - Refer to FOC Memo 3
  - c. RL to be monitored at 1625nm during craftsperson interaction testing. (not to exceed 2dB change)
5. Use Verizon cable matrix for cable selection see Verizon Memo #12. If a specific cable is not available discuss with Verizon for possible substitution.
6. Temperature and Humidity Testing and Mechanical Testing - no. of fibers monitored
7. For Closure/Terminals or Terminals:  
Minimum Number of Fibers Monitored:

12 F avail in Ports	12 F
24 F avail in Ports	12F
48 F avail in Ports	18 F
72 F avail in Ports	24 F
144 F avail in Ports	36 F



Note: Minimum of 50% (not more than 60%) of fibers monitored will be through the terminal ports (not the cable entry ports). The balance of fibers will be monitored through the closure using the cable entry ports. The fibers must be spliced and routed through splice trays to fully exercise the product.

Can interrupt/extrapolate, these guidelines for sizes not listed, using direct proportions and a linear relationship to the number of fibers available in ports

- Mechanicals for all type closures follow GR-771 for number of fibers to be monitored.
  - If the product under test is a closure only, then follow mechanical guidelines on number of fibers for Temp/Hum test.
8. The maximum total accumulation of water in the closure shall not exceed 1 cm<sup>3</sup> (1 gram of water) per 0.028 m<sup>3</sup> (1 ft<sup>3</sup>) of closure volume. There shall be no evidence of water on any optical components that might be damaged from water exposure. For additional info see Verizon Memo # 17
  9. For gasket samples that require factory assembly after thermal aging the gaskets shall be witnessed at the factory during assembly. Samples must be clearly & permanently marked for tracking.
  10. Since different cable types are used this must be accounted for in the samples under test. All cable ports must have a cable installed. At least 2 of each of the 9 cables (FOC Memo #12) must be installed in each of the four samples to allow for required testing of mechanical tests across all samples. This will also spread the evaluation of different cables in each of the 4 samples across the environmental tests. See Cable list below.
  11. When cut, make sure ends are sealed against water intrusion sample AB and CB
  12. The quantity of samples shown for each sample group assumes no product variations, i.e., one size with one type and size of cable. If different cable types or sizes can be used or if there is more than one size or capacity of the product, this and other product variations must be accounted for in the samples under test, possibly requiring an increase in the sample size.
  13. "Deleted"
  14. When testing for thermal tests, the samples shall be conditioned for 2 hours to obtain thermal equilibrium
  15. For hermetically sealed units seal verification is performed with 5 psi for 15 min.
  16. Thermal Cycle configuration of closures and terminals is to simulate field installations with at least 6 feet of cable on both ends of the unit in the thermal chamber.
  17. Fungus readings guide: #0 - ok pass; #1 SIT to review pictures; and #2 and above - replace the plastic.



## **Additional Notes:**

### **Optional Test Method**

Concatenated circuits up to 24 fibers may be monitored but the optical criterion is not increased above that allowed for single fiber circuits. Circuits with 20 to 24 fibers can have no more than 0.15dB total change in insertion loss and circuits with 10 to 19 fibers can have no more than 0.10dB total change in insertion loss. Circuits with less than 10 fibers can have no more than 0.05dB change in insertion loss. RL changes of no more than 2dB are allowed. More than one concatenated circuit will be used to monitor the required number of fibers when that number is greater than 24.

### **Method of Concatenation**

Fusion splices will be used at the end of the cable outside the cabinet to join fibers on that end, including the launch and detect pigtails. For field-installed cables, fusion splices will be used inside the cabinet to complete the concatenated circuit. In order for standard, factory stubbed products to be tested; jumpers will be used on the front plane to complete the circuit.



GR-771 Table 6-1 Performance Test Sequence												
Performance Requirement				Sample Group	Sample Qty	Sample # (example)	Deployment Family					
Description	Test Temp		Buried				Underground	Pedestal	Outdoor Wall	Aerial Pole	Aerial Strand	Indoor Wall
<b>5.2 Electrical Requirements</b>												
5.2.1 Bond Clamp Retention	23C	G	2	G1, G2	X	X	X	X	X	X		
5.4.7 Corrosion Resistance*	Acidified Saltwater				23C	X	X					
	Salt-Fog Spray				23C			X	X	X	X	
5.2.2 AC Fault Test	23C				X	X	X	X	X	X	X	X
<b>5.3 Mechanical Performance</b>												
Prepare closure & Materials	--	AA	4	AA1-AA4								
Prepare Cables	--											
Splice Fiber	--											
5.3.1 Cable Clamping	40C, -5C, 23C				X	X	X	X	X	X	X	X
5.3.2 Sheath Retention*	40C, -40C											
5.3.3 Cable Flexing	40C, -30C											
5.3.4 Cable Torsion	40C, -30C											
5.3.5 Vertical Drop	40C, -40C	AB	4, 8, 12 or 16	AB1-AB16	X	X	X	X	X	X		
5.3.6 Compression*	40C, -40C				X	X						
5.3.7 Impact*	Drop Tube				4	AB1-AB4	X	X				
	Pendulum				4	AB5-AB8					X	
	Drop Tube & Pendulum				40C, -40C	4	AB9-AB12			X	X	
		40C, -5C	4	AB13-AB16						X		



GR-771 Table 6-1 Performance Test Sequence

Performance Requirement		Test Temp	Sample Group	Sample Qty	Sample # (example)	Deployment Family						
						Buried	Underground	Pedestal	Outdoor Wall	Aerial Pole	Aerial Strand	Indoor Wall
Description												
5.4.6 Water Resistance*	Immersion	23C	AA	4	AA1-AA4	X	X					
			AB	4	AB1-AB4							
	Wind Driven Rain	23C	AA	4	AA1-AA4			X	X	X	X	
			AB	4-8	AB5-AB12							
	Water Spray	23C	AA	4	AA1-AA4							X
			AB	4	AB13-AB16							
5.3.8 Central Member Protrusion		23C	AA	1	any AA	X	X	X	X	X	X	X
<b>5.4 Environmental Performance</b>												
Prepare closure & Materials		--	B	4	B1-B4	X	X	X	X	X	X	X
Prepare Cables		--										
Splice Fiber		--										
5.4.1 Thermal Aging		90C										
5.4.2 Assembly		-5C, 40C										
5.4.3 Temp/Humidity Cycling		-40C to 65C										
5.4.4 Freeze/Thaw												
5.4.5 Weather tightness		23C										
5.4.6 Water Resistance*	Water Immersion	23C										
	Wind Driven Rain	23C										
	Water Spray	23C										
5.4.8 Chemical Resistance*												



GR-771 Table 6-1 Performance Test Sequence										
Performance Requirement		Sample Group	Sample Qty	Sample # (example)	Deployment Family					
Description	Test Temp				Buried	Underground	Pedestal	Outdoor Wall	Aerial Pole	Aerial Strand
5.4.8.1 Material Degradation (stress cracking)	23C	CA	30	CA1-CA30	X	X	X	X	X	X
5.4.8.2 Chemical Immersion										
5.4.8.2 (A) Closure	23C	CB	8	CB1-CB8	X	X				
5.3.6 Compression*	-40C, 40C									
5.3.7 Impact* (Drop Tube)	-40C, 40C									
5.4.6 Water Immersion	23C									
5.4.8.2 (B) Tensile Bars	23C	CC	25	CC1-CC25	X	X				
5.4.9 UV Resistance	23C	D	10	D1-D10			X	X	X	X
5.4.10 Fungus Resistance		E	4	E1-E4	X	X	X	X	X	X
Environmental Vibration	23C	F	2	F1, F2	X	X	X	X	X	X
<b>5.5 Conditional Requirements</b>										
5.5.1 Bullet Resistance	23C	H	1	H1				X	X	X
5.5.2 Cable Core Blocking Ability	23C	I	1	I1	X	X	X	X	X	X
5.5.3 Rodent Resistance	23C	J	5	J1-J5	X	X	X	X	X	X
5.5.4 Steam Resistance	130.5C	K	1	K1		X				X
5.5.5 Fire Resistance		L	1	L1						X
GR449 Front Plane Connector Disconnect / Re-connect	-18C +40C	M	1	M1	X	X	X	X	X	X
GR449 Fiber Accessibility	-5C, 40C	N	1	N1	X	X	X	X	X	X
GR49 5.1 High Temperature Storage / Mold Stress	80C	O	2	O1, O2	X	X	X	X	X	X
NRTL Registration	--	P	1	P1	X	X	X	X		X



\* Requirement contains performance levels specific to each deployment family.

**Sample Groups:**

- AA = 4 closures
- AB = 4 to 16 closures (depending on deployment, impact test requirements)
- B = 4 closures
- CA = 30 rectangular samples per material
- CB = 8 closures, 2 per chemical (Immersion ONLY)
- CC = 25 tensile bars per material (Immersion ONLY)
- D = 10 Test Bars
- E = Polymeric Material (4 samples per material)
- F = 2 closures
- G = 2 closures
- H = 1 closure
- I = 1 closure
- J = 5 Test Plaques
- K = 1 closure
- L = 1 closure
- M = 1 closure
- N = 1 closure
- O = 2 closures
- P = 1 closure





**The following matrix must be performed if a splice closure or optical terminal fails the Impact test in GR 771:**

- Test the product at: Step 1. 0 degrees F at 20 ft-lb and 40 ft-lb. then at:
- Step 2. 20 degrees F at 20 ft-lb, 40 ft-lb, 60 ft-lb, and 80 ft-lb  
then at:
- Step 3. 40 degrees F at 20 ft-lb, 40 ft-lb, 60 ft-lb, and 80 ft-lb

The intent is to determine the highest force that the product can pass at the different temperatures specified. This provides additional information to assess the product.

A test pass at a higher force eliminates the need to test at a lower force, i.e.: if the product passes at 40 F at 60 ft-lb and this was performed first then 20 and 40 ft-lb are not required tests. The highest force at each temperature is to be determined.

This matrix test sequence is required for both Impact tests listed in the GR. One test is "without" chemical immersion and the other is after chemical immersion.

It is only required if the product cannot pass the Impact tests as specified in GR-771 (except the temperature at the low end is -40 C, this was changed from -18 C by Verizon on PFOC Memo # 3).



**Verizon Select Cables for GR-771 Closure/Terminal Testing**

<b>Manufacturer</b>	<b>Cable Type</b>	<b>Cable P/N</b>	<b>Sheath</b>	<b>Cable Size</b>	<b>Fibers</b>
<b>Sumitomo</b>					
	Distribution	SE-5BW2LT-012	Armored	0.46	12
	Distribution	SE-5B92MR-288	Dielectric	0.82	288
	Drop	SE-5B81PT-006	Flat	0.18	6
	Drop	SE-5B8MPT-006	Figure 8	0.2	6
<b>Pirelli</b>					
	Distribution	0006-HBS1LAFEAJA	Armored	0.45	6
	Distribution	0444-HCSTRAFESJC	Dielectric	1.05	444
	Drop	0006-HDHNLEDJNZK	Figure 8	0.17	6
	Drop	0006-HDHNLADJNVK	Flat	0.2	6
<b>Corning Cable Systems</b>					
	Distribution	012EC5-14101-20	Armored	0.51	12
	Distribution	576EQ4-14101-20	Dielectric	0.98	576
	Drop	002EB4-14101A-20	Flat	0.18	2
	Drop	006EBA-14101A-20	Figure 8	0.16	6
<b>OFS</b>					
	Distribution	AGSX-012-BXC	Armored	0.61	12
	Distribution	AG3X-156-BXC	Dielectric	0.71	156
<b>Draka/Compteq</b>					
	Distribution	A-ES-CR2-1JKT-108	Dielectric	0.68	108
	Drop	F-DFTNATJ-06-BB-xxx	Flat		

Note: Verizon has not designated a difference between Distribution and Feeder cable as a result the test setup should use these cables interchangeably.



<b>Verizon Select Cables for Drop Splice Closure Testing</b>					
<b>Manufacturer</b>	<b>Cable Type</b>	<b>Cable P/N</b>	<b>Sheath</b>	<b>Cable Size</b>	<b>Fibers</b>
<b>Sumitomo</b>					
	Drop	SE-5B81PT-006	Flat	0.18	6
	Drop	SE-5B8MPT-006	Figure 8	0.2	6
<b>Pirelli</b>					
	Drop	0006-HDHNLEDJNZK	Figure 8	0.17	6
	Drop	0006-HDHNLADJNVK	Flat	0.2	6
<b>Corning Cable Systems</b>					
	Drop	002EB4-14101A-20	Flat	0.18	2
	Drop	006EBA-14101A-20	Figure 8	0.16	6
<b>Draka/Compteq</b>					
	Drop	F-DFTNATJ-06-BB-xxx	Flat		



## Cable Coding for Verizon TP-771 Tests

I've used letters to designate the cables. Letters **a - d** are armored cables, **j - n** are armored cables, and **q - v** are drop cables. Only Corning Cable Systems cable, cable "s", is used for a hardened cable on the F Terminal.

Procedure: The following cables must be installed in one cable entry port at least once for GR-771 Mechanical and Environmental Tests:

<b>a</b> - Sumitomo, PN SE-5BW2LT-012, Diameter=. 46 in	Loose Tube
<b>b</b> - Pirelli, PN 0006HBx1LAFEAJA, Diameter= .45 in	Loose Tube
<b>c</b> - Corning PN 012EC5-14101-20, Diameter=.51 in	CT Ribbon
<b>d</b> - OFS PN AGSX-012-BXC, Diameter=.61 in	CT Ribbon

### Dielectric: (Maximum Diameters)

<b>j</b> - Draka, PN A-ES-CR2-1JKT-108, Diameter= .68 in	CT Ribbon
<b>k</b> - OFS, PN AG3X-156-BXC, Diameter= .71 in	CT Ribbon
<b>l</b> - Sumitomo, PN SE-5B92MR-288, Diameter= .82 in	Ribbon
<b>m</b> - Pirelli, PN 0444HCSTRAFESJC, Diameter=1.05 in	LT Ribbon
<b>n</b> - Corning, PN 576EQ4-14101-20, Diameter 0.98 in	CT Ribbon

Closures or Terminals that Accept Drops through designed drop ports must test the following drop cables:

### Drop Cables: (Minimum Diameters)

<b>r</b> - Sumitomo, PN SE-5B81PT-006, Diameter=. 18 in	Flat
<b>s</b> - Pirelli, PN 0006HDHNLEDJNZK, Diameter=. 17 in	Figure 8
<b>t</b> - Corning, PN 002EB4-14101A20, Diameter=. 18 in	Flat
<b>u</b> - Sumitomo, PN SE-5B8MPT-006, Diameter= .20 in	Figure 8
<b>v</b> - Pirelli, PN 0006HDHNLADJNVK, Diameter=. 20 in	Flat
<b>w</b> - Corning, PN 006EBA-14101A20, Diameter= .16 in	Figure 8



FOC Test Plan for Outdoor Fiber Optic Terminals Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
<b>3 General Requirements and Objectives</b>				
3.1 Documentation				
3.1.1 Practices		R3-1		Complete set of documentation in agreement with GR-454, Generic Requirements for Supplier-Provided Documentation
3.1.2 Workcenter Information Package		R3-2		Supplier shall prepare a Workcenter Information Package
3.2 Marking, Packaging and Shipping				
3.2.1 Identification		R3-3		An assembled splice closure shall be Identified by Manufacturers name and model number
		R3-4		Month, Year and Serial Number, on closure and shipping container
		R3-5		NRTL - (fire resistant only)
		O3-6		identifiable without entering closure
3.2.2 Shipping Container and Packaging Arrangement		R3-7		Shipped in single container, packaged in order needed.
		R3-8		Packaging shall be adequate to ensure no damage during shipping, see GR-63 (shipping, handling and storage)
		O3-9		Shipping container and packaging should be reusable, recyclable or biodegradable.
3.2.3 Package Label		R3-10		Clearly labeled with part numbers and names consistent with instructions
		R3-11		Consumable materials with shelf life: clearly marked with expiration date on three sides of the closure packaging. SR-NWT-2759



FOC Test Plan for Outdoor Fiber Optic Terminals Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
3.2.4 Package Quality		R3-12		Packaging shall be adequate to ensure no damage during shipping, see GR-63 (shipping, handling and storage)
3.2.5 Consumable Materials		R3-13		Consumable materials shall have a minimum shelf life of one year from the date of shipment.
		R3-14		Expiration data shall be clearly shown
		R3-15		Maximum and minimum allowable storage temperatures shall be clearly printed on the packaging.
		R3-16		If consumable material is packaged in another container, the outer container must also be marked with shelf life and storage temps.
3.3 Initial Product Qualification and Periodic Requalification		R3-17		Each splice closure family must be qualified prior to initial product offer and periodically thereafter. Testing performed per Table 6-1 in GR-771
		R3-18		Change in form, fit or function require requalification of the product.
<b>4 Splice Closure Features and Functions</b>				
4.1 Materials				
4.1.1 Metallic		R4-1		Metals shall be resistant and/or protected against general corrosion (stress corrosion, cracking, pitting, etc.)
		R4-2		No Galvanic corrosion
		R4-3		No external wraps or coating shall be necessary to protect from corrosion
4.1.2 Non-Metallic		R4-4		Resistant to solvents, stress cracking and creep (based on testing in section 5.4.8)
		R4-5		Materials shall be compatible with chemicals and other materials they might be exposed to.



FOC Test Plan for Outdoor Fiber Optic Terminals Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
4.2 Common Closure Requirements				
4.2.1 Cable Compatibility		R4-6		Compliant with VZ.TPR.9418 and VZ.TPR.9437
4.2.2 Cable Entrance Capacity		R4-7		Per GR-771
4.2.3 Cable Termination Hardware		R4-8 thru R4-10		Per GR-771
4.2.4 Bonding and Grounding Hardware		R4-11		Provide hardware to accommodate a #6 AWG or larger conductor
		R4-12		1000 Amps for 20 seconds
		R4-13		Provide hardware and installation instructions for extending electrical continuity of all metallic elements via min #6 copper grounding conductor.
		R4-14		Continuity shall not be affected by re-entry in to the closure
		R4-15		Internal and external ground - easily separable
4.2.5 Closure Mounting Hardware		R4-16		Aerial Closures must include all mounting hardware
		O4-17		Mounting hardware should allow closure to be temporarily supported on the strand during installation
4.2.6 Fiber and Splice Organization		R4-18		GR-769
		R4-19		accommodate mechanical and fusion splices
		R4-20		capable of storing fiber from fiber ribbon cables, loose tube cables and core tube cables with fiber bundles
		R4-21		
		O4-22		should accommodate the storage of passive optical components
		R4-23		



FOC Test Plan for Outdoor Fiber Optic Terminals Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
		R4-24		
4.2.7 Fiber and Splice Storage Capacity		R4-25		
4.2.8 Fiber and Splice Protection		R4-26 thru R4-28		
4.2.9 Maintenance		O4-30 thru O4-31		
4.2.10 Components		R4-32		fasteners must be captivated
4.2.11 Installation Size and Weight		R4-33		Installation, repair and re-entry with one trained craftsman
		R4-34		Assembled Closure w/o cables, splices and organizers < 22 lbs.
		O4-35		Assembled Closure w/o cables, splices and organizers < 33 lbs.
4.2.12 Safety		R4-36		No sharp edges, comers, burrs or other hazardous features
		R4-37		nontoxic and dermatological safe
4.2.13 Security		CR-38		Equipped with locking device
4.2.14 Tools		R4-39		No special tools required
4.3 Taunt Sheath Closures (TSC's)				
4.3.1 Closure configuration		R4-40		Capable of being installed on previous installed fiber optic cable
4.3.2 Cable Termination		R4-41		Capable of be installed on figure 8 cable
		R4-42		Capable of expressing rigid and non-rigid cable.
4.3.3 Cable Capacity		R4-43		Capable of expressing a single distribution cable
		O4-44		Capable of expressing two distribution cables
		R4-45		Branch and drop cable capacity (GR-771, section 4.2.2)
4.3.4 Cable Sheath Opening		R4-46		minimum sheath opening: 50cm



FOC Test Plan for Outdoor Fiber Optic Terminals Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
		CR4-47		maximum sheath opening: 91cm
4.3.5 Fiber Splicing		R4-48		must accommodate splicing of fibers in both the upstream and downstream directions
		R4-49		Store splices from added cable(s) without disturbing existing splices
4.3.6 Fiber and Splice Storage		R4-50		capable of storing splices with as little as 25cm of fiber from the express cable without inducing a significant tensile or torsion stress on the fibers or splices
		R4-51		capable of storing fiber slack from the branch or drop cable(s) without inducing significant torsion stress on the splice(s)
4.4 Free Breathing Closures (FBC's)				
4.4.1 Drainage of Condensate		R4-52		FBC must provide means of drainage for condensate
4.4.2 Insect Resistance		R4-53		Shall not permit insect intrusion
4.5 Hermetically Sealed Closures				
4.5.1 Air Valves		R4-54		HSC shall be equipped with Air valve
4.6 Pre-Terminated Closure				
4.6.1 Closure Dimensions		R4-55		A PTC and all attached cables: capable of being pulled into 3" dia. Conduit
		R4-56		A PTC and all attached cables: capable of being pulled through a 90 bend in a 3" dia. Conduit having a 3' radius
4.7 Hybrid Fiber Closures (HFCs)				
<b>Electrical Criteria</b>				
5.2.1: Bond Clamp Retention		R5-3	IL B/D/A	1000 Amp AC 20 seconds. (optional) As received before salt fog
<b>Mechanical Criteria</b>				



FOC Test Plan for Outdoor Fiber Optic Terminals Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.3.1: Cable Clamping	A	R5-3	IL B/D*/A	OM - IL 4 wavelength / before, during and after/ 2 samples-, 100lbs@ -30C (at installation), 23C, 40C
5.3.2: Sheath Retention	A	R5-4	IL B/D*/A	OM - IL 4 wavelength / before, during and after/ 2 samples-, 100lbs for 24 hours @ -40C, 23C, 40C. See note 10
5.3.3: Cable Flexing	A	R5-5	IL B/D*/A	OM - IL 4 wavelength / before, during and after/ 2 samples, 22lbs@ -30C, 40C
5.3.4: Cable Torsion	A	R5-6	IL B/D*/A	OM - IL 4 wavelength / before, during and after/ 2 samples, 22lbs@ -30C, 40C
5.3.5: Vertical Drop	A	R5-7	N/A	Test @-40C, 40C, 30 inches height
5.3.6: Compression	A	R5-8	N/A	Test (300lbs- 15 min) @-40C, 40C,
5.3.7: Impact	A	R5-9	N/A	Test@-40C, 40C, test at 10ftlbs. Impact 4 locations, front, back, side and between connector groups. Include pendulum (50ft-lbs) on aerial strand for pole and aerial. Include max. levels that the product can pass. This applies to products with a factory stub that is for distribution only, no express cable. All others 100 ft/lbs.
5.4.6: Water Resistance (Water Immersion/Wind Driven Rain)	A	R5-16	N/A	10 foot head 7 days. Based on use in hand hole and buried 10 foot based on product use in a hand hole WDR for Aerial, see GR487 for amount of water for free breather, no water on connectors. If sealed no water allowed. If for manhole 20 foot water head
5.3.8: Central Member Protrusion	A	R5-10	N/A	100 lb force
<b>Environmental Performance</b>				
5.4.1: Thermal Aging	B	R5-11	N/A	Telcordia requires aging at 90C for 30 days for the gaskets.
5.4.2: Assembly	B	R5-12	N/A	Must be done with factory tools at the factory. Should witness installation Or if in field then install at 0C, 40C



FOC Test Plan for Outdoor Fiber Optic Terminals Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.4.3: Temp/Humidity Cycling / OM	B	R5-13	IL B/D/A	OM - IL 4 wavelength before, during and after 2 samples @(-40C, 65C) 30 days
5.4.4: Freeze/Thaw OM	B	R5-14	IL B/D/A (1625nm only)	OM - IL 1625 wavelength / before, during and after/ 2 samples. See new freeze thaw procedure. Half with cable/half with dust caps if applied. Use smallest hand hole size. See note 5
5.4.6: Water Immersion	B	R5-16	N/A	10 foot head 7 days. Based on use in hand hole 10 foot based on product use in a hand hole WDR for Aerial, see GR487 for amount of water for free breather, no water on connectors. If sealed no water allowed
5.4.8.A: Chemical Resistance -Stress Cracking	test bars	R5-18	N/A	Test bars - 30 test bars per each material type. For purchased products see GR3120. Put the test bars under stress for 24 hours
5.4.8.B: Chemical Resistance - Chemical Immersion	B	R5-19 thru R5-21	N/A	Immerse the complete product in the chemicals for 7 days
5.3.6: Compression	B	R5-8	N/A	Test (300lbs- 15 min) @-40C, 40C,
5.3.7: Impact	B	R5-9	N/A	Test@-40C, 40C, test at 10ftlbs. Impact 4 locations, front, back, side and between connector groups. Include pendulum (50ft-lbs) on aerial strand for pole and aerial. Include max. levels that the product can pass. This applies to products with a factory stub that is for distribution only, no express cable. All others 100 ft/lbs. Also see PFOC impact matrix.
5.4.5 Weather tightness	B	R5-15	N/A	Review for dust entrance
5.4.6: Water Immersion	B	R5-16	N/A	Buried 10 foot head 7 days. 10 foot based on product use in a hand hole. WDR for aerial



FOC Test Plan for Outdoor Fiber Optic Terminals Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
5.4.9: UV Resistance	test bars	R5-22	N/A	See GR3120, 3115 R3-21 - Per ASTM G154 2,000 hours, or ASTM 155 1,000 hours on test bars. Shall not craze or crack and must retain 80% of original strength. Use Instron before and after exposure.
5.5.1 Bulletproof Resistance	C	CR5-23	N/A	12 gauge #6 lead shot for field load one sample. Mount to fixed position. Shoot connector side of terminal. 50 ft distance. 28 inch modified choke, see GR487
5.4.10: Fungus Resistance	D	R5-23	N/A	ASTM G21 - Zero rating
GR63 5.4.3 Transportation Vib. Unpackaged Curve 2 OM	E	R5-22	IL B/D/A	OM - IL 4 wavelength / before, during and after/ 2 samples, Mount units as intended to a mounting fixture that mounts directly to vibration table. Simulates environmental vibration
<b>Electrical Requirements</b>				
5.2.1: Bond Clamp Retention	F	R5-1	N/A	Do not apply to Dielectric cables. Applied to armored cable
5.4.7 Corrosion Resistance	F	R5-17	N/A	ASTM B117 Salt Fog 90 days. Aerial only
5.4.7.A: Acidified Saltwater	F		N/A	For below grade only. Can also be used in lieu of corrosion (salt fog) noted above
5.2.2: AC Fault Test	F	R5-2	N/A	Do not apply to Dielectric cables. Applied to armored cable
<b>Conditional Requirements</b>				
5.5.3: Rodent Resistance	G	CR5-26	N/A	One inch radius, Rockwell Hardness R87
5.5.5 Fire Resistance	H	CR5-28 Thru CR5-31	N/A	Material must be flame rated UL95-5VA. Conduct GR771 flame test both horizontal and vertical if used indoors or on CPE. Otherwise UL94V-0
GR-449 5.4.3 Front Plane Connector Disconnect and Re-connect	I		IL B/D/A	Test at -18C, 40C. Use GR449 5.4.3. 10 cycles



FOC Test Plan for Outdoor Fiber Optic Terminals Based on GR-771				
Task	Test Group	Reference Spec.	Optical Monitor	Comments
Splice Tray Handling Test	J		IL B/D/A	50 cycles of tray handling with OM - IL 4 wavelength before, during and after 2 samples @(-5C, 40C). Applies only to closures with splice trays.
Mold Stress Relief Distortion	K			80C (176F) for 14 days. Look for deformation that would effect products form fit and function
NRTL Listing				CPE applications or mounted at Cust.Premise
NRTL Registration			N/A	CPE applications or mounted at Customer Premise or in areas where the general public has access to the installed product.



Notes:

1. Tests noted as A and B are done in sequence
2. Assumes GR326 Connector
3. Assumes GR20 Cable
4. Direct Optical Monitoring through 50% of ports for freeze thaw test. Remaining use dust caps.
5. Dust caps on remaining ports
6. Optical criteria for all four wavelengths (1310, 1490, 1550, 1625 nm) 0.05dB per fiber, no greater than 0.15 dB for 10% of the fibers. Test all four wavelengths unless otherwise noted.
7. Test all port counts sizes unless otherwise noted
8. Each sample must be subjected to each temperature as an example -30C, 23C, 40C. If a sample fails a different sample can be used for the other temperatures
9. Samples A, B and F are each one set of samples with the tests to be conducted in series with the same samples.
10. With the exception of tests requiring the use of test bars, the sample size noted in GR771 shall be doubled. As an example GR771 specifies 2 samples for a test, then test with 4 samples.
11. For the sample set A the same four samples going through the mechanical test sequence shall be used for each temperature. For sheath retention the two samples going through the sequence shall be subjected to sheath retention at room temp. In additional test four additional samples for each temperature extreme -40C and 40C shall be used
12. For products restricted to indoor use only, use the GR63 Indoor temperatures of (-5C to +50C)
13. The maximum total accumulation of water in the closure shall not exceed 1 cm<sup>3</sup> (1 gram of water) per 0.028 m<sup>3</sup> (1 ft<sup>3</sup>) of closure volume. There shall be no evidence of water on any optical components that might be damaged from water exposure
14. The number of days noted under each major heading is the anticipated total test time that includes test set-up, running the test, and data review.
15. For gasket samples that require factory assembly after thermal aging the gaskets shall be witnessed at the factory during assembly.
16. If different cable types are used this must be accounted for in the samples under test.



**Changes: Definition of thin walled optical terminals, elimination of +20 C info test for thin walled units, clarify which tests are required.**

**Additional Notes:**

**Optional Test Method**

Concatenated circuits up to 24 fibers may be monitored but the optical criterion is not increased above that allowed for single fiber circuits. Circuits with 20 to 24 fibers can have no more than 0.15dB total change in insertion loss and circuits with 10 to 19 fibers can have no more than 0.10dB total change in insertion loss. Circuits with less than 10 fibers can have no more than 0.05dB change in insertion loss. RL changes of no more than 2dB are allowed. More than one concatenated circuit will be used to monitor the required number of fibers when that number is greater than 24.

**Method of Concatenation**

Fusion splices will be used at the end of the cable outside the cabinet to join fibers on that end, including the launch and detect pigtails. For field-installed cables, fusion splices will be used inside the cabinet to complete the concatenated circuit. In order for standard, factory stubbed products to be tested; jumpers will be used on the front plane to complete the circuit.

**Definition: Thin Walled Closure-** A closure that serves 12 customers or less, has no express or distribution cables and is intended to provide only drop cables or connectors.

Perform GR-771 Impact testing with the following changes:

**Nonmetallic Thin Walled Optical Terminals/Closures - Below Grade:**

1. FOR thin walled optical terminals the impact force is reduced to 10 ft-lbs.
2. Perform at the following temperatures:
  - If product passes at -40 C at 10 Ft-lbs do not perform -20 C and 0 C. If a failure proceed to -20C test, Must still do +40 C
  - If product passes at -20 C at 10 Ft-lbs do not perform 0 C. If a failure proceed to 0 C, test, Must still do +40 C



- If product passes at 0 C at 10 Ft-lbs Must still do +40 C, if fails at 10 ft-lb then also proceed to +40 C

Information requirement: + 40 C = +104 F determine value where a pass is achieved.

3. Four hits per product under test, as follows: top, bottom, side, and between two hardened connectors.

Pass is no damage to product that will prevent reliable operation, must remain watertight. Apply air pressure (5 PSI for 15 Min) and submerge to verify or use other reliable method. If the hardened connector is damaged and can be replaced this will be considered as a pass.

Sample size is specified in GR-771.

The above criterion is to be applied to section 5.3.7 (Impact) and 5.4.8 (Impact after Chemical Immersion).



**Nonmetallic Thick Walled Optical Terminals/Closures - Below Grade:**

1. Follow the GR with the specified temperature and force. (-18 C and 100 ft-lbs)
2. PLUS the following temperature of -40 C = -40 F.
3. A pass at -40 C at 100 Ft - lbs is a pass for the entire test. No further testing required.
4. If a failure at -40 C then perform the following:
  - Thick Walled definition, typically: no stub and allows for through cables and splicing
  - Once the 100 ft-lb force is achieved at a temperature, no further testing is required.

-40 C = -40 F determine value where a pass is achieved

-18 C = 0 F determine value where a pass is achieved

0 C = +32 F determine value where a pass is achieved

+20 C = +68F determine value where a pass is achieved

+ 40 C = +104 F determine value where a pass is achieved

Four hits per product under test, as follows: top, bottom, side, and between two hardened connectors.

Pass is no damage to product that will prevent reliable operation, must remain watertight. Apply air pressure (5 PSI for 15 Min) and submerge to verify or use other reliable method. If the hardened connector is damaged and can be replaced this will be considered as a pass.

Sample size is specified in GR-771.

The above criterion is to be applied to section 5.3.7 (Impact) and 5.4.8 (Impact after Chemical Immersion).



FOC Test Plan for Indoor Fiber Optic Terminals Based on GR-771					
Task	Test Group	Reference Spec.	Optical Monitor	Sample	Comments
<b>3 General Requirements and Objectives</b>					
3.1 Documentation					
3.1.1 Practices		R3-1			Complete set of documentation in agreement with GR-454, Generic Requirements for Supplier-Provided Documentation
3.1.2 Workcenter Information Package		R3-2			Supplier shall prepare a Workcenter Information Package
3.2 Marking, Packaging and Shipping					
3.2.1 Identification		R3-3			An assembled splice closure shall be Identified by Manufacturers name and model number
		R3-4			Month, Year and Serial Number, on closure and shipping container
		R3-5			NRTL - (fire resistant only)
		O3-6			identifiable without entering closure
3.2.2 Shipping Container and Packaging Arrangement		R3-7			Shipped in single container, packaged in order needed.
		R3-8			Packaging shall be adequate to ensure no damage during shipping, see GR-63 (shipping, handling and storage)
		O3-9			Shipping container and packaging should be reusable, recyclable or biodegradable.
3.2.3 Package Label		R3-10			Clearly labeled with part numbers and names consistent with instructions



FOC Test Plan for Indoor Fiber Optic Terminals Based on GR-771					
Task	Test Group	Reference Spec.	Optical Monitor	Sample	Comments
		R3-11			Consumable materials with shelf life: clearly marked with expiration date on three sides of the closure packaging. SR-NWT-2759
3.2.4 Package Quality		R3-12			Packaging shall be adequate to ensure no damage during shipping, see GR-63 (shipping, handling and storage)
3.2.5 Consumable Materials		R3-13			Consumable materials shall have a minimum shelf life of one year from the date of shipment.
		R3-14			Expiration data shall be clearly shown
		R3-15			Maximum and minimum allowable storage temperatures shall be clearly printed on the packaging.
		R3-16			If consumable material is packaged in another container, the outer container must also be marked with shelf life and storage temps.
3.3 Initial Product Qualification and Periodic Requalification		R3-17			Each splice closure family must be qualified prior to initial product offer and periodically thereafter. Testing performed per Table 6-1 in GR-771
		R3-18			Change in form, fit or function require requalification of the product.
<b>4 Splice Closure Features and Functions</b>					
4.1 Materials					
4.1.1 Metallic		R4-1			Metals shall be resistant and/or protected against general corrosion (stress corrosion, cracking, pitting, etc.)
		R4-2			No Galvanic corrosion
		R4-3			No external wraps or coating shall be necessary to protect from corrosion



FOC Test Plan for Indoor Fiber Optic Terminals Based on GR-771					
Task	Test Group	Reference Spec.	Optical Monitor	Sample	Comments
4.1.2 Non-Metallic		R4-4			Resistant to solvents, stress cracking and creep (based on testing in section 5.4.8)
		R4-5			Materials shall be compatible with chemicals and other materials they might be exposed to.
4.2 Common Closure Requirements					
4.2.1 Cable Compatibility		R4-6			Compliant with VZ.TPR.9418 and VZ.TPR.9437
4.2.2 Cable Entrance Capacity		R4-7			Per GR-771
4.2.3 Cable Termination Hardware		R4-8 thru R4-10			Per GR-771
4.2.4 Bonding and Grounding Hardware		R4-11			Provide hardware to accommodate a #6 AWG or larger conductor
		R4-12			1000 Amps for 20 seconds
		R4-13			Provide hardware and installation instructions for extending electrical continuity of all metallic elements via min #6 copper grounding conductor.
		R4-14			Continuity shall not be affected by re-entry in to the closure
		R4-15			Internal and external ground - easily separable
4.2.5 Closure Mounting Hardware		R4-16			Aerial Closures must include all mounting hardware
		O4-17			Mounting hardware should allow closure to be temporarily supported on the strand during installation
4.2.6 Fiber and Splice Organization		R4-18			GR-769
		R4-19			accommodate mechanical and fusion splices



FOC Test Plan for Indoor Fiber Optic Terminals Based on GR-771					
Task	Test Group	Reference Spec.	Optical Monitor	Sample	Comments
		R4-20			capable of storing fiber from fiber ribbon cables, loose tube cables and core tube cables with fiber bundles
		R4-21			
		O4-22			should accommodate the storage of passive optical components
		R4-23			
		R4-24			
4.2.7 Fiber and Splice Storage Capacity		R4-25			
4.2.8 Fiber and Splice Protection		R4-26 thru R4-28			
4.2.9 Maintenance		O4-30 thru O4-31			
4.2.10 Components		R4-32			fasteners must be captivated
4.2.11 Installation Size and Weight		R4-33			Installation, repair and re-entry with one trained craftsman
		R4-34			Assembled Closure w/o cables, splices and organizers < 22 lbs.
		O4-35			Assembled Closure w/o cables, splices and organizers < 33 lbs.
4.2.12 Safety		R4-36			No sharp edges, comers, burrs or other hazardous features
		R4-37			nontoxic and dermatological safe
4.2.13 Security		CR-38			Equipped with locking device
4.2.14 Tools		R4-39			No special tools required
4.3 Taunt Sheath Closures (TSC's)					
4.3.1 Closure configuration		R4-40			Capable of being installed on previous installed fiber optic cable
4.3.2 Cable Termination		R4-41			Capable of be installed on figure 8 cable



FOC Test Plan for Indoor Fiber Optic Terminals Based on GR-771					
Task	Test Group	Reference Spec.	Optical Monitor	Sample	Comments
		R4-42			Capable of expressing rigid and non-rigid cable.
4.3.3 Cable Capacity		R4-43			Capable of expressing a single distribution cable
		O4-44			Capable of expressing two distribution cables
		R4-45			Branch and drop cable capacity (GR-771, section 4.2.2)
4.3.4 Cable Sheath Opening		R4-46			minimum sheath opening: 50cm
		CR4-47			maximum sheath opening: 91cm
4.3.5 Fiber Splicing		R4-48			must accommodate splicing of fibers in both the upstream and downstream directions
		R4-49			Store splices from added cable(s) without disturbing existing splices
4.3.6 Fiber and Splice Storage		R4-50			capable of storing splices with as little as 25cm of fiber from the express cable without inducing a significant tensile or torsion stress on the fibers or splices
		R4-51			capable of storing fiber slack from the branch or drop cable(s) without inducing significant torsion stress on the splice(s)
4.4 Free Breathing Closures (FBC's)					
4.4.1 Drainage of Condensate		R4-52			FBC must provide means of drainage for condensate
4.4.2 Insect Resistance		R4-53			Shall not permit insect intrusion
4.5 Hermetically Sealed Closures					
4.5.1 Air Valves		R4-54			HSC shall be equipped with Air valve
4.6 Pre-Terminated Closure					
4.6.1 Closure Dimensions		R4-55			A PTC and all attached cables: capable of being pulled into 3" dia. Conduit



FOC Test Plan for Indoor Fiber Optic Terminals Based on GR-771					
Task	Test Group	Reference Spec.	Optical Monitor	Sample	Comments
		R4-56			A PTC and all attached cables: capable of being pulled through a 90 bend in a 3" dia. Conduit having a 3' radius
4.7 Hybrid Fiber Closures (HFCs)					
<b>Electrical Criteria</b>					
5.2.1: Bond Clamp Retention		R5-3	IL B/D/A		1000 Amp AC 20 seconds. (optional) As received before salt fog
<b>Mechanical Criteria</b>					
5.3.1: Cable Clamping	A	R5-3	IL B/D*/A	4 units	OM - IL 4 wavelength / before, during and after/ 2 samples- @ -5C (at installation), 23C & 50C
5.3.2: Sheath Retention	A	R5-4	IL B/D*/A	4 units	OM - IL 4 wavelength / before, during and after/ 2 samples- @ -5C, 23C, 50C (use GR-326 loading based on media type)
5.3.3: Cable Flexing	A	R5-5	IL B/D*/A	4 units	OM - IL 4 wavelength / before, during and after/ 2 samples, 22lbs@ -5C, 50C (use GR-326 loading based on media type)
5.3.4: Cable Torsion	A	R5-6	IL B/D*/A	4 units	OM - IL 4 wavelength / before, during and after/ 2 samples, 22lbs@ -5C, 50C (use GR-326 loading based on media type)
5.3.5: Vertical Drop	All	R5-7	N/A	4 units	Test @-5C, 50C, 30 inches height
5.3.6: Compression	All	R5-8	N/A	4 units	Test (300lbs- 15 min) @ 23C (room temp for metal product)
5.3.7: Impact	All	R5-9	N/A	4 units	Test@-5C & 50C, test at 50ftlbs. Impact 4 locations, front, sides and top.
5.4.6: Water Resistance (Water Spray)	All	R5-16	N/A	4 units	Per 6.4.6 section C.
5.3.8: Central Member Protrusion		R5-10	N/A		No central members used.
<b>Environmental Performance</b>					
5.4.1: Thermal Aging	B	R5-11		4 units	Telcordia requires aging at 90C for 30 days for the gaskets and



FOC Test Plan for Indoor Fiber Optic Terminals Based on GR-771					
Task	Test Group	Reference Spec.	Optical Monitor	Sample	Comments
					sealing components.
5.4.2: Assembly	B	R5-12	N/A	4 units	Should witness installation at -5C & 40C
5.4.3: Temp/Humidity Cycling / OM	B	R5-13		4 units	OM - IL 4 wavelength before, during and after 2 samples @(-5C, 50C) 30 days
5.4.4: Freeze/Thaw OM	B	R5-14	N/A	4 units	Not applicable to indoor terminals.
5.4.6: Water Immersion	B	R5-16	N/A	4 units	Per 6.4.6 section C.
5.4.8.A: Chemical Resistance -Stress Cracking	B	R5-18	N/A	Test Bars	Test bars - 30 test bars per each material type. For purchased products see GR3120 (verify prior testing in other test plans)
5.4.8.B: Chemical Resistance - Chemical Immersion	B	R5-19 thru R5-21	N/A	4 units	Not applicable to indoor terminals.
5.4.9: UV Resistance	C	R5-22	N/A	Test Bars	Not applicable to indoor terminals.
5.5.1 Bulletproof Resistance	E	CR5-23	N/A	4 units	Not applicable to indoor terminals.
5.4.10: Fungus Resistance	E	R5-23	N/A	Test Bars	ASTM G21 - Zero rating (verify prior testing in other test plans)
5.5.5 Fire Resistance	F	CR5-28 Thru CR5-31	N/A	4 units	Per section 6.5.5 w/ cables installed.
GR63 5.4.3 Transportation Vib. Unpackaged Curve 2 OM	G	R5-22	IL B/D/A	4 units	OM - IL 4 wavelength / before, during and after/ 2 samples, Mount to a mounting fixture that mounts directly to vibration table
<b>Electrical Requirements</b>					
5.2.1: Bond Clamp Retention	H	R5-1	N/A	4 units	Do not apply to Dielectric cables. Applied to armored cable
5.4.7 Corrosion Resistance	H	R5-17	N/A	4 units	Not applicable to indoor terminals.
5.4.7.A: Acidified Saltwater	H		N/A	4 units	



FOC Test Plan for Indoor Fiber Optic Terminals Based on GR-771					
Task	Test Group	Reference Spec.	Optical Monitor	Sample	Comments
5.2.2: AC Fault Test	H	R5-2	N/A	4 units	If cabinet has ground point.
<b>Conditional Requirements</b>					
5.5.3: Rodent Resistance	I	CR5-26	N/A	Test Bars	One inch radius, Rockwell Hardness R87
5.5.5 Fire Resistance	I	CR5-28 Thru CR5-31	N/A	4 units	Material must be flame rated UL95-5VA. Conduct GR771 flame test both horizontal and vertical if used indoors or on CPE. Otherwise UL94V-0
NRTL Registration	j		N/A		CPE applications or mounted at Customer Premise or in areas where the general public has access to the installed product.



Notes:

1. Tests noted as A and B are done in sequence
2. Assumes GR326 Connector
3. Assumes GR20 Cable
4. Direct Optical Monitoring through 50% of ports for freeze thaw test. Remaining use dust caps.
5. Dust caps on remaining ports
6. Optical criteria 0.05dB per fiber, no greater than 0.1dB for 10% of the fibers
7. Test all port sizes unless otherwise noted
8. Each sample must be subjected to each temperature as an example -40C, 23C, 65C. If a sample fails a different sample can be used for the other temperatures
9. Samples A, B and F are each one set of samples with the tests to be conducted in series with the same samples.
10. With the exception of tests requiring the use of test bars, the sample size noted in GR771 shall be doubled. As an example GR771 specifies 2 samples for a test, then test with 4 samples.
11. For the sample set A the same four samples going through the mechanical test sequence shall be used for each temperature. For sheath retention the two samples going through the sequence shall be subjected to sheath retention at room temp. In additional test four additional samples for each temperature extreme -40C and 40C shall be used
12. For products restricted to indoor use only, use the GR63 Indoor temperatures of (-5C to +50C)
13. PFOC Qualification of terminals and closures must be conducted using distribution and drop cables (excluding those drop cables that are connectorized) with the minimum and maximum dimensions of each cable type from all manufacturers specified in the Attachment. The maximum distribution cable dimension that must be used is to be determined by the maximum fiber capacity of the closure or terminal under test. The maximum drop cable dimension that must be used is to be determined by the sealing mechanism or grommet specified by the closure or terminal manufacturer for that particular drop cable cross-section. A supplier/cable-dimension test matrix that exercises all combinations of both distribution and drop cables used by Verizon shall be developed as part of the qualification test plan.



## **Additional Notes:**

### **Optional Test Method**

Concatenated circuits up to 24 fibers may be monitored but the optical criterion is not increased above that allowed for single fiber circuits. Circuits with 20 to 24 fibers can have no more than 0.15dB total change in insertion loss and circuits with 10 to 19 fibers can have no more than 0.10dB total change in insertion loss. Circuits with less than 10 fibers can have no more than 0.05dB change in insertion loss. RL changes of no more than 2dB are allowed. More than one concatenated circuit will be used to monitor the required number of fibers when that number is greater than 24.

### **Method of Concatenation**

Fusion splices will be used at the end of the cable outside the cabinet to join fibers on that end, including the launch and detect pigtails. For field-installed cables, fusion splices will be used inside the cabinet to complete the concatenated circuit. In order for standard, factory stubbed products to be tested; jumpers will be used on the front plane to complete the circuit.