



**Verizon NEBS™ Compliance: Single Mode
Optical Fusion Splices and Splicing Systems**
Verizon Technical Purchasing Requirements
VZ.TPR.9403
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CHANGE CONTROL RECORD:

Version	Date	Action*	Reason for Revision
1	08/21/2007	New	New Document
2	08/19/2008	Change	Updated optical requirement section
3	10/23/2009	Change	Changed optical criteria and sample size
* New, Add, Delete, Change, Reissue			



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1.0 PURPOSE

The purpose of this Verizon Technical Purchasing Requirement document is to provide FOC testing requirements for Single Mode Optical Splices and Splicing Systems.

2.0 SCOPE

FOC Products

3.0 REFERENCES

Verizon FOC Memo #36, 2006	2006 Executive Summary for 17 GR's
GR-765-CORE, Issue 1, September 1995	Generic Requirements for Single Fiber Single Mode Optical Splices and Splicing Systems
GR-1089-CORE, Issue 4, June 2006	Electromagnetic Compatibility and Electrical Safety – Generic Criteria for Network Telecommunications Equipment

4.0 ACRONYMS

A	After
B	Before
D	During
FOC	Fiber Optic Components
IL	Insertion Loss
ITL	Independent Testing Laboratory
OM	Optical Monitoring



5.0 TEST REQUIREMENTS FOR SINGLE MODE OPTICAL FUSION SPLICES AND SPLICING SYSTEMS

Verizon is considering using Single Mode Optical Splices and Splicing Systems for all applications as required. Single Mode Optical Splices and Splicing Systems should meet all the requirements specified in GR-765 (as applicable). The splice sleeve is considered part of the splicing system product, and protected splices must undergo Splicing Test Series C (Section 5.2.3). All the testing must be completed by a Verizon approved ITL to the guidelines on the following pages.

FOC GR-765 Single Mode Optical Splices and Splicing Systems Test Program				
Task Name	Samples (or Groups)	Sample Size	Test Description	OM
Single Mode Optical Splices and Splicing Systems				
General Requirements and Objectives				
3.1: Documentation				
3.1.1: Practices				
3.1.2: WIP				
3.1.3: Safety				
3.1.4: Compatibility With Other Systems				
3.1.5: Fiber Preparation/Storage				
3.1.6: Adhesives				
3.2 General Splice Criteria				
3.2.1: Dimensions				
3.2.2: Interface with Optical Fibers				
3.2.3: Environmental Sealing				
3.2.4: Strain Relief				
3.2.5: Closed Splice				
3.2.6: Universal Installation				
3.3 Marking, Packaging and Shipping				
3.3.1: Marking				
3.3.2: Package Label				
3.3.3: Packaging and Shipping				
3.4: Quality (Not from GR-765)			TL 9000 Certified	
Features, Functions, Performance				



FOC GR-765 Single Mode Optical Splices and Splicing Systems Test Program				
Task Name	Samples (or Groups)	Sample Size	Test Description	OM
Criteria				
4.1 Equipment: General Requirements and Objectives				
4.1.1: Portability				
4.1.2: Carrying Case				
4.1.3: Surface Finish and Markings			Chemical Resistance	
4.1.4: Display and Controls				
4.1.4.1: General display criteria				
4.1.4.2: State of charge Indicator				
4.1.4.3: General Control Criteria				
4.1.5: Fiber Contacting Devices				
4.1.6 Features				
4.1.6.1: Support Equipment				
4.1.6.2: Proof Testing Capability				
4.1.6.3: Fiber Alignment				
4.1.6.4: Settings and Adjustments				
4.1.6.5: Splice loss Estimation System				
4.1.6.6: Fiber Misalignment Detection				
4.1.6.7: Electrode Life				
4.1.6.8: Maximum Yield by Preventative Maintenance.				
4.1.6.9: Save Splicing in Manholes, Basements, Vaults				
4.1.7: Product Information				
Optical Performance Criteria				
4.2 Splice Optical Criteria				
4.2.1: Mean Splice Loss				
4.2.2: Splice Yield			Passive Alignment - Req: 95% \leq 0.05 dB, 5% \leq 0.10; Active Alignment - Req: 95% \leq 0.05 dB, 5% \leq 0.05 dB	



FOC GR-765 Single Mode Optical Splices and Splicing Systems Test Program				
Task Name	Samples (or Groups)	Sample Size	Test Description	OM
4.2.3: Splice Reflectance Criteria				
4.2.4: Sensitivity to Fiber Geometry				
4.2.4.1: Diameter Mismatch				
4.2.4.2: Core/Cladding Concentricity Error				
4.2.3: Splice Reflectance Criteria				
4.2.3: Splice Reflectance Criteria				
4.3 Fusion Splice Strength Criteria			Tensile load of unprotected splices Req: 95% @ 4.4 N Tensile Load Obj: 95% @ 8.8 N Tensile Load CR: w/splice holder - 95% @ 22 N Load	
Mechanical and Storage Environments Criteria *				
4.4 Equipment: Mechanical and Storage Environments Criteria	Series A			
4.4.1: Initial Operation		2 units	Polisher should function properly as received and be capable of polishing product that meets the requirements specified in sect. 4.21. And 4.2.2	
4.4.2 Cleave Angle Tolerance	40 cleaves per unit	2 units	Cleave Angel of 3 degrees, random orientations	
4.4.3: Shock				
(a): Edgewise Drop and Cornerwise Drop	40 splices per unit	2 units	3 in. drop, each corner and edge	B/A
(b): Bottom Surface Drop	40 splices per unit	2 units	30 in. Drop on bottom surface of the Polisher	B/A
4.4.4: Vibration, Transportation	40 splices per unit	2 units	1 sweep; 1.5G, 10HZ to 500HZ, 0.1 Octave/minute, 3 principle axes	B/A
4.4.5: Storage Environment	40 splices per unit	2 units	-40° C, UC/RH, 24 Hrs; 60° C, 95% RH, 24 Hrs	B/A
4.5 Equipment: Electrical Requirements				
4.5.1: AC Powered Equipment		1 unit		



FOC GR-765 Single Mode Optical Splices and Splicing Systems Test Program				
Task Name	Samples (or Groups)	Sample Size	Test Description	OM
4.5.2: Battery unit		1 unit		
4.5.3: Battery Operation		1 unit		
4.5.3.1: Battery Lifetime		1 unit	Define Battery lifetime in terms of polishing cycles (Room temp and 0° C)	
4.5.3.2: Time-out Interlock		1 unit		
4.5.3.3: State of Battery Charge		1 unit		
4.5.4: Electromagnetic Compatibility		1 unit		
(a) Electromagnetic Interference		1 unit	Section 3 or GR-1089	
(b) Electrostatic Discharge		1 unit	Section 2 or GR-1089	
(c) Lightning Surges		1 unit	Section 4.5.9 or GR-1089	
(d) Electric Safety		1 unit	Section 7 or GR-1089	
4.6: Material and Consumables Criteria		1 unit		
4.6.1 Coefficient of Thermal Expansion		1 unit	Mechanical Splices only	
4.6.2 Toxicity		1 unit		
4.6.3 Fungus Resistance		1 unit		
4.6.4 Shelf Life		1 unit		
4.6.5 Index Matching Material		1 unit	"Should not be Required"	
Environmental Performance				
4.7: Fiber Splicing - Installation Conditions	Series B			
4.7.1: Low Temperature Installation	40 splices	1 unit	-18° C, UC/RH, Must meet Section 4.2 Req for loss/RL/Yield	B/A
4.7.2: High Temp & High Humidity Installation	40 splices	1 unit		
High Temp & Humidity	40 splices	1 unit	38° C to 90° C, Must meet Section 4.2 Req for loss/RL/Yield	B/A
Condensing	40 splices	1 unit	35° C to 100° C, Must meet Section 4.2 Req for loss/RL/Yield	B/A
4.7.3: High Temp, Low Humidity Installation	40 splices	1 unit	50° C to 15° C, Must meet Section 4.2 Req for loss/RL/Yield	B/A
4.7.4: High Altitude	80 splices	1 unit	12,000 ft., Must meet Section 4.2 Req for loss/RL/Yield	B/A
4.7.5 Electrode Ware	40 w/factory settings 40 w/optimized arc	1 unit	Performed at 20C UC/RH, 0C UC/RH and 32C 90%RH - electrodes to be conditioned to 1000 arcs	A



FOC GR-765 Single Mode Optical Splices and Splicing Systems Test Program				
Task Name	Samples (or Groups)	Sample Size	Test Description	OM
4.7.6: Vibration During Operation	10 splices	1 unit	Amplitude of +/-0.003 in., 10 Hz to 55 Hz to 10 Hz, 1-minute sweep, sweeping until polishing has completed.	B/A
Splice Environmental Life Test Criteria (Verizon specific)				
4.8: Splice Environmental Life Test Criteria	Series C			
4.8.3 Temperature Cycling	1	80 Splices		B/D/A
4.8.4 Humidity/Condensation Cycling	2	80 Splices		B/D/A
4.8.5 Fluid Immersion	3	80 Splices	Organism exposure not required	B/D/A
4.8.2 Splice Vibration	4	80 Splices		B/A
4.8.3 Temperature Cycling	5	80 Splices		B/D/A
4.8.6 Environmental Degradation (Tensile)	6	80 Splices		B/A

Terminology

OM - Optical Measurements / Monitoring All Fibers - to be done at 1310nm/1490nm/1550nm/1625nm

B - Before

D - During

A - After

B - Before

Important: All the samples listed in Series A, B and C must be divided equally in all 4 fiber types G.652D, G.657A, G657B and UBIF (Corning's Clear Curve, OFS's EZBend, Draka's BBelite)

Optical Requirements		
Insertion Loss	RL	Yield
Passive Alignment System Loss (Mean) Req: 0.05 dB	Max: -65	100 %
Active Alignment System Loss (Mean) Req: 0.05 dB	Max: -65	100 %

Use GR-765 as a guideline for specifics