



**Verizon NEBS™ Compliance: MDU Fiber
“G.657-B.3” Coating Test Requirement**
Verizon Technical Purchasing Requirements
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1.0 PURPOSE

The purpose of this Verizon Technical Purchasing Requirement is to provide FOC testing requirements for qualifying optical coating for UBIF G.657-B3 type optical fiber.

2.0 SCOPE

Coating for UBIF G.657-B3 fiber.

3.0 REFERENCES

GR-20-CORE, Issue 2, July 1998	Generic Requirements for Optical Fiber and Optical Fiber Cables

4.0 ACRONYMS

FOC	Fiber Optic Components
ITL	Independent Testing Laboratory
MDU	Multi-Dwelling Unit
PMD	Polarization Mode Dispersion
FOTP	Fiber Optic Test Procedure
B/D/A	Before, During and After

5.0 TEST REQUIREMENTS FOR MDU FIBER COATING

Verizon is considering testing on the optical fiber coatings to insure product reliability over 25 years for the MDU applications. The following table contains the test requirements for qualifying an MDU optical fiber coating to avoid premature failure during its intended use and over its purported and typical installation period. All testing shall be performed by a Verizon-approved ITL.



6.0 GENERAL CONDITIONS FOR MEASUREMENTS

The environmental conditions for measurement are specified in the specific tests as defined in the following table.

7.0 PASS/FAIL CRITERIA

The pass/fail criteria for each of the criteria specified in this document are defined in the criteria table.

Test Criteria MDU Fiber Coating

Coating Qualification Test Criterion	Pass/Fail Criteria	FOTP	IEC	Comments
Mechanical Characteristics	Reference Document			
Proof test	GR-20-CORE Section 4.4.1	FOTP-31	IEC 60793-1-30	Eliminates weak flaws when proof tension is set to just below or just above the tension expected during the “in use phase”. (125 kpsi on 5 mm radius) UBIF for MDU fibers should be screen tested at 100-200 kpsi (=0.69-1.38 GPa; ≈ 1-2% elongation) To be done on colored fibers (to eliminate weak flaws created at the post coloring stage)
Proof test for minimum strain level (%)	≥1			Confirmed by Audit
Proof test for minimum stress level (GPa or kN/mm ²)	0.7 (0.69 Gpa) 100 kpsi			Confirmed by Audit
Strip Force (un-aged and aged) Samples – Per GR-20 (10 per test condition)	GR-20-CORE Section 4.4.2	FOTP -178	IEC-60793-1-32	
Peak Strip Force (N)	$1.0 \leq F \leq 8.9$			If strip force is too close to the low limit at 23C, it could fail the GR-20 requirement at 45°C
Average Strip Force (N)	$1.0 \leq F \leq 5.0$			



Coating Qualification Test Criterion	Pass/Fail Criteria	FOTP	IEC	Comments
Termination Temperature Extremes 0°C and 45°C Aging 30 days at 85°C and 85%-RH 14 days water immersion at 23°C 30 days at 85°C in a representative filling compound or low molecular weight mineral oil.				
Tensile Strength Samples Per FOTP-28 (30)	GR-20-CORE Section 4.4.3	FOTP-28	IEC-60793- 1-31	
Median Dynamic Tensile Strength (unaged, 0.5m gauge length), (GPa/kpsi) WP50% WP15%	≥ 3.80/550 ≥ 3.14 (455)	FOTP-28	IEC-60793- 1-31	
Median Dynamic Tensile Strength (aged at 85±2°C and 85±5% humidity for 30 days, (0.5m gauge length), (GPa/kpsi) WP50% WP15%	≥ 3.03/440 ≥ 2.76/400	FOTP-28	IEC-60793- 1-31	
Stress Corrosion Parameter Samples – Per FOTP-28 (15 per stress rate)		FOTP-28	IEC-60793- 1-33	Fatigue testing in tension is the only method allowed by GR-20/TIA standards. In addition to n value, tensile testing provides a measure of coating mechanical robustness. For the life time expectation of 25 years in the field, we are considering □22 or above.
Stress Corrosion (nd)	GR-20-CORE Section 4.4.4	FOTP-28	IEC 60793- 1-33	
Stress Corrosion Parameter (unaged)	≥ 20	FOTP-28	IEC 60793- 1-33	≥ 20



Coating Qualification Test Criterion	Pass/Fail Criteria	FOTP	IEC	Comments
Stress Corrosion Parameter (aged at 85±2°C and 85±5% humidity for 30 days)	≥ 20	FOTP-28	IEC 60793-1-33	≥ 20
Macrobend Induced Attenuation Loss (dB) Samples Minimum of 15 fibers.	GR-20-CORE Section	FOTP-62	IEC-60793-1-47	It tests the basic property and see if the sepc is still met
100 turns around a mandrel of 60 mm radius @ 1550nm in dB	≤ 0.05			
100 turns around a mandrel of 30 mm radius @ 1625nm in dB	≤ 0.1			
1 turns around a mandrel of 32 mm radius @ 1550nm in dB	≤ 0.05			
1 turn R= 10 mm @ 1550 nm 1 turn R=10 mm @1625 nm	≤ 0.03 dB ≤ 0.1 dB			
1 turn R=7.5 mm @1550 nm 1 turn R=7.5 mm @1625nm	≤ 0.08 dB ≤ 0.25 dB			
1 turn R=5 mm @1550 nm 1 turn R=5 mm @1625nm	≤ 0.15 dB ≤ 0.45 dB			
High Power Two Point Bend Test Samples - Min of One sample.	P=23 dBm at 5 mm bend radius for 168 hours			No damage to coating.
Resistance to Chemicals				
Wasp Spray – Sample Size: R6-78 All R6-80 10 Length-per 6.6.8 R6-81 30 Length-per 6.6.8	GR-20-CORE Section 6.6.8. R6-78 visual R6-80 Strippability R6-81 Tensile Strength			(No swelling/separation) Coating Strip Force 4.4.2 Dynamic Tensile Strength 4.4.3



Coating Qualification Test Criterion	Pass/Fail Criteria	FOTP	IEC	Comments
Ground Water Immersion Detergent Chlorine Fuels Aqueous Ammonia	GR-326-CORE 5.3.8			No coating delamination No unzipping No pistoning No swelling
Cable Filling Compound Compatibility 30 days at 85°C in a representative filling compound or low molecular weight mineral oil	GR-20-CORE Section 6.3.4 R6-41 Strip Force R6-42 Strip tool comp R6-43 no cracking, splitting or delamination R6-44 mandrel wrap/ inspection			No coating delamination No unzipping No pistoning No swelling
Environmental Characteristics				
Temperature Dependence Sample Length – Min 1 km			IEC-60793-1-52	
Attenuation Change @1310nm, 1550 nm, and 1625 between [-60°C, +85°C], dB/km Measurements – B/D/A	$\Delta \leq 0.05$ dBkm			
Water Immersion Sample Length Minimum of 1, km			IEC-60793-1-53	
Attenuation Change @1310nm, 1550nm and 1625nm 23±2°C 30 day water soak, dB/km	$\Delta \leq 0.05$ dBkm			
Temperature Humidity Cycling Sample Length – Minimum 1, km	FOTP-72 Schedule C (30 days)			
Attenuation Change @1310nm, 1550 nm, and 1625 nm between [-10°C, +85°C] and 95% relative humidity, dB/km Measurement B/D/A	$\Delta \leq 0.05$ dBkm			
Dry Heat Sample Length – Minimum			IEC-60793-1-51	



Coating Qualification Test Criterion	Pass/Fail Criteria	FOTP	IEC	Comments
1, km				
Attenuation Change @1310nm, 1550nm and 1625 nm due to Temperature Aging at 85±2°C for 30 days, dB/km Measurements – B/A	$\Delta \leq 0.05$ dBkm			
Damp Heat Sample Length – 1 km			IEC-60793-1-50	
Attenuation Change @1310nm, 1550 nm, and 1625 nm due to Temperature Aging at 85±2°C and relative humidity □85% for 30 days, dB/km Measurements B/A	$\Delta \leq 0.05$ dBkm			
Optical Transmission Characteristics				
Fiber Attenuation, dB/km Sample Length – Min 2, km		FOTP-61	IEC 60793-1-40	
Attenuation @1310 nm	≤ 0.35			
Attenuation @1460 nm	≤ 0.25			
Attenuation @1550 nm	≤ 0.2			
Attenuation @1625 nm	≤ 0.22			
Attenuation @1383±3 nm	≤ 0.35			
Hydrogen Exposure			IEC60793-2-50 Annex C.5	
Attenuation at 1383 nm (dB/km) maximum attenuation value within the stated ranges after hydrogen exposure	$\leq (0.31-0.35)$		IEC60793-2-50	
Chromatic Dispersion (Dispersion-Unshifted) Sample Length – Min 2 km	GR-20-Core Issue 2 Section 4.2.3	FOTP -175	IEC-60793-1-42	
Zero dispersion wavelength range (nm)	1300 - 1324			
Zero dispersion slope (ps/nm ² .km)	≤ 0.092			



Coating Qualification Test Criterion	Pass/Fail Criteria	FOTP	IEC	Comments
Polarization Mode Dispersion (PMD) Sample Length – Min 2 km		FOTP-113,122,124	IEC-60793-1-48	
PMD Link Design Value, ps/□km	≤ 0.06		IEC-60794-3	
Maximum Individual Fiber	≤ 0.1			
Cutoff Wavelength Dispersion Unshifted (Class Iva) Samples – Min of 15 different samples	GR-20-CORE Section	FOTP-80	IEC 60793-1-44	
Cutoff Wavelength for fibers range (nm)	1190-1360			Reference only. (Not pass/fail)
Cable Cutoff Wavelength (nm)	≤1260			
Mode Field diameter (MFD) Samples – Min of 15 different samples		FOTP-191	IEC 60793-1-45	
Nominal 1310nm value selected from this (range) in μm	8.6 - 9.6μm (Tolerance: ± 0.6μm)			
Geometrical Specifications				
Glass Geometry Samples – Min of 15 different samples		FOTP-48	IEC 60793-1-20	
Cladding Diameter (Fiber Characteristic)	125±1μm			
Core/Cladding Concentricity (Fiber Characteristic)	≤ 0–8μm			
Cladding Non-circularity (Fiber Characteristic)	≤ 1.0%			
Fiber Curl (meters radius of curvature)	≥ 2	FOTP-111	IEC 60793-1-34	
Coating Geometry Samples – Min of 15 different samples		FOTP-55	IEC 60793-1-21	
Coating Diameter (colored fibers)	240 um ≤ OD ≤ 260 um			
Coating/Cladding Concentricity	≤ 12μm			
Coating Non-Circularity	≤ 5%			



8.0 TEST PROCEDURES