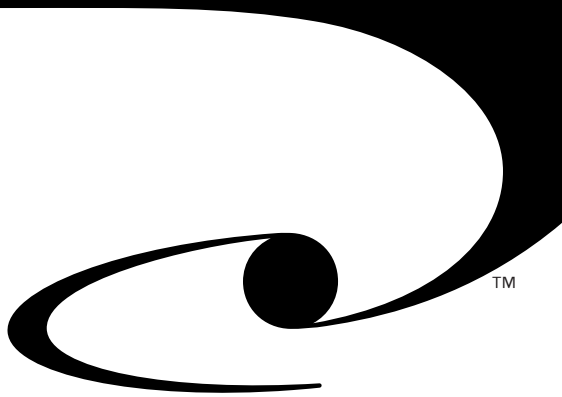
Volition™

Cabling System



3M™ VOLITION™ INTERCONNECT VF-45 STYLE

50/125 µm Fiber

Technical Report

3M *Innovation*

1.0 Product Description & Requirements

Volition™ Interconnect (VF-45™) Socket and Patch Cords

The Volition VF-45 Interconnect from 3M is a two-part, optical fiber interconnect consisting of a "plug" and "socket" that has been designed to have the look and feel of T568A or B, 8-pin modular jack commonly known as an RJ-45. The molded plastic construction of the plug and socket provides a low cost, higher density alternative to traditional ferrule fiber optic connectors.

The sockets and patch cords are available with 62.5/125 µm or 50/125 µm fiber. This report presents data from tests on product with 50/125 µm fiber.

Volition Plug

The Volition duplex plug construction is composed of a few basic parts. There is a fiber holder which secures two fibers in place. The shroud and boot protect the fibers and secure the cable to the connector. The integrated moveable door acts as a dust cover, improving the durability of the connector in the field.

3M provides patch cords which are factory terminated using the VF-45 plug. These patch cords are supplied in various standard lengths using either riser rated PVC jacketed cable or Low-Smoke Zero-Halogen jacketed cable. Hybrid configurations are also available with either ST* style or SC connectors terminated on one end of the duplex patch cord.

Volition Socket

The VF-45 socket is designed for field termination in the same environment as the copper RJ-45 outlet jack is today. The socket face and keystone latching mechanism mimics the RJ-45, providing the same density in panel applications, as well as craft familiarity in termination. The socket is comprised of a fiber holder, which secures two fibers at a time and simplifies termination. The main body and door of the socket create a shell which provides protection from dust. The VF-45 socket is field terminated using a hand-held portable field tool kit.

2.0 Test Program

The purpose of the test program is to assess the long term performance of the 3M Volition connector product. A series of optical, environmental and mechanical tests were conducted which exposes them to conditions more severe than those anticipated in actual use. All tests are performed in accordance with ANSI/TIA/EIA-568-A. Factory produced Volition jumpers and sockets assembled using Volition field mount tooling (normal customer installation), were installed into a test system.

A list of tests performed is presented below.

New Product	Environmental	Mechanical	Mechanical
Group 1	**Group 2**	**Group 3**	**Group 4 (Per TIA 568A)**
Loss and	Cold	Impact	Strength of Coupling
Return loss	Temperature Life	Flex	Mating Durability
	Humidity	Twist	(Vibration)*
		Cable Retention	

*not required by TIA 568A

Sample Preparation:

Samples were prepared according to product instructions (P/N# 78-8097-61360-A) with approved Volition field tools.

3.0 New Product (Group 1)

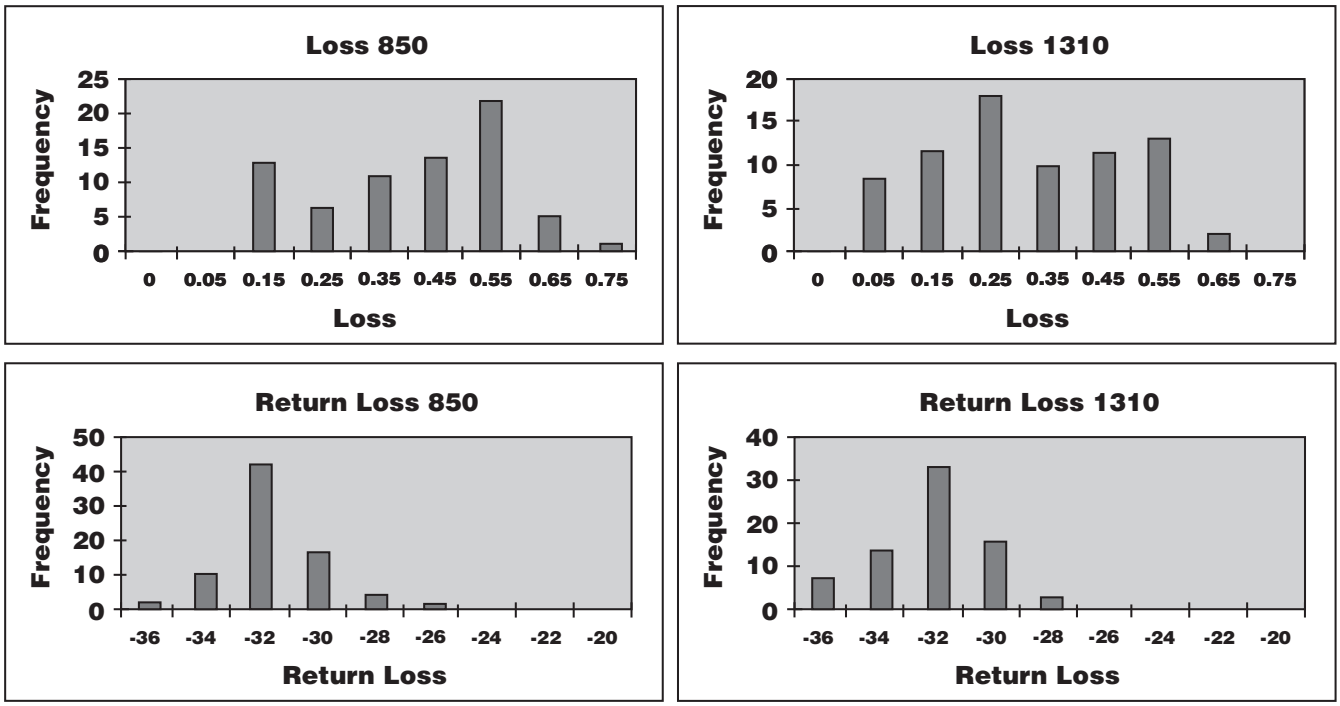
A sample of 37 connectors were selected and measured for loss and return loss.

3.1 Loss and Return Loss

Sample Size: 37 (74 fibers)

Procedure:

The plugs and sockets for pretest measurements were cleaned as described in section 1.7.4 of ANSI/TIA/EIA-568-A. Measurements of loss and return loss at wavelengths of 850 nm and 1310 nm were performed at ambient conditions before any environmental testing.



Results:	Loss (dB)		Return Loss (dB)	
Wavelength	Mean	Std. Dev.	Mean	Std. Dev.
850	0.37	0.17	-32.7	1.57
1310	0.28	0.17	-33.3	1.83

4.0 Environmental (Group 2)

A sample of 16 connectors was selected for environmental testing, consisting of Cold, Temperature Life, and Humidity.

4.1 Cold

Sample Size: 16 (32 fibers)

Procedure:

Measurements of loss and return loss at 850 nm and 1310 nm wavelengths are performed at the start and finish of the test at 22°C (71.6°F). The test samples are subjected to 96 hours (4 days) at -10°C (14°F). Additional measurements are made every 15 minutes at -10°C (14°F) during test to monitor performance.

Loss (dB)				
Wavelength	Initial Mean	Mean During	Mean Final	Maximum Increase (Start - Finish)
850	0.36	0.33	0.36	0.02
1310	0.29	0.22	0.27	0.02

Return Loss (dB)				
Wavelength	Initial Mean	Mean During	Mean Final	Maximum Increase (Start - Finish)
850	-31.5	-31.5	-31.8	0.09
1310	-32.4	-32.4	-32.6	0.03

4.2 Temperature Life

Sample Size: 16 (32 fibers)

Procedure:

Testing is performed on samples after exposure to the Cold Test. Measurements of loss and return loss at 850 nm and 1310 nm wavelengths are performed at the start and the finish of the test at 22°C (71.6°F). The test samples are subjected to 336 hours (14 days) at 60°C (140°F). Additional measurements are made every hour at 60°C (140°F) during the test to monitor performance.

Loss (dB)

Wavelength	Initial Mean	Mean During	Mean Final	Maximum Increase (Start - Finish)
850	0.31	0.30	0.29	0.42
1310	0.20	0.22	0.20	0.36

Return Loss (dB)

Wavelength	Initial Mean	Mean During	Mean Final	Maximum Increase (Start - Finish)
850	-31.9	-31.9	-31.9	2.33
1310	-32.4	-32.7	-32.7	1.16

4.3 Humidity

Sample Size: 16 (32 fibers)

Procedure:

Testing is performed on samples after exposure to the Temperature Life Test. Measurements of loss and return loss at 850 nm and 1310 nm wavelengths are performed at the start and the finish of the test at 22°C (71.6°F), and every 15 minutes during the test at 40°C (104°F) with 90-95% relative humidity.

Loss (dB)

Wavelength	Initial Mean	Mean During	Mean Final	Maximum Increase (Start - Finish)
850	0.29	0.23	0.23	0.06
1310	0.22	0.19	0.18	0.03

Return Loss (dB)

Wavelength	Initial Mean	Mean During	Mean Final	Maximum Increase (Start - Finish)
850	-32.0	-32.1	-32.1	0.50
1310	-32.6	-32.7	-32.7	0.52

5.0 Mechanical Tests (Group 3)

A sample of 10 connectors was sequentially tested through Impact, Flex, and Twist.

5.1 Impact

Sample Size: 10 (20 fibers)

Procedure:

The connector is placed in the impact test fixture by hanging a 1.5 m (59 in) length of cable with the connector on the end. The connector is raised to the horizontal position and released in a manner so that it strikes a concrete block. This is repeated 8 times, then cleaned and measured for insertion loss and return loss. The connector is also inspected for any physical damage.

.2 Flex

Sample Size: 10 (20 fibers)

Procedure:

The impact test samples are then Flex tested. The connector - coupling is mounted onto the swingarm of the 3M Flex tester. A 0.5 kg (1.1 lb) load is attached to the cable 250 mm (9.8 in) from the pivot point. The connector is then cycled through 0°, +90°, 0°, -90°, 0°, about the center axis of the connector for 100 cycles. At the completion of the test, the connector is measured for insertion loss and return loss.

5.3 Twist

Sample Size: 10 (20 fibers)

Procedure:

The flex samples are then Twist tested. The connector - coupling is mounted onto the swingarm of the 3M Twist tester and the swingarm is locked in the 0° position. A 15 N (3.3 1bf) load is attached to the cable 250 mm (9.8 in) from the pivot point. The weight is rotated about the cable axis 2.5 revolutions in one direction, reversed for 5 revolutions, and reversed for 5 more revolutions for a total of 10 cycles. At the completion of the test, the connector is measured for insertion loss and return loss.

5.4 Cable Retention

Sample Size: 10 (20 fibers)

Procedure:

Testing is performed on samples subjected to the Twist Test. The coupling is secured to the traversing stage of an Instron tensile tester. At 0.3 m (11.8 in) from the coupling - connector, the cable is secured to the stationary base by wrapping the cable 3 times around a 76 mm (3 in) mandrel. A load of 66 N (15 1bf) at 0° is applied to the connector for 5 seconds, then released. Additional testing is performed after the first cable retention test in the same manner, but with 2.0 N (4.5 1bf) at 90°. Values for insertion loss and return loss are measured 10 seconds after releasing the load.

5.5 Results of Mechanical Tests (Group 3)

Loss (dB)

Wavelength	Mean Initial	Mean Impact	Mean Flex	Mean Twist	Mean 66 N (15 1bf) @ 0°	Mean 20N (4.5 1bf) @ 90°	Maximum Increase (Start - Finish)
850	0.26	0.29	0.30	0.28	0.27	0.27	0.15
1310	0.15	0.17	0.18	0.17	0.17	0.18	0.26

Return Loss (dB)

Wavelength	Mean Initial	Mean Impact	Mean Flex	Mean Twist	Mean 66N (15 1bf)@ 0°	Mean 20N (4.5 1bf) @ 90°	Maximum Increase (Start - Finish)
850	-32.8	-32.8	-32.8	-32.8	-32.8	-32.8	0.74
1310	-32.4	-32.4	-32.3	-32.3	-32.3	-32.3	1.21

6.0 Mechanical Tests (Group 4)

Thirty samples are subjected to Vibration testing, and thirty separate samples go through strength of coupling, then mating durability.

6.1 Strength of Coupling

Sample Size: 11 (22 fibers)

Procedure:

Thirty samples are Tensile tested with a 33 N (7.5 1bf) force for 5 seconds and insertion loss and return loss are measured.

Loss (dB)

Wavelength	Initial Mean	Final Mean	Maximum Increase
850	0.42	0.42	0.10
1310	0.43	0.43	0.14

Return Loss (dB)

Wavelength	Initial Mean	Final Mean	Maximum Increase
850	-33.15	-33.5	0.71
1310	-35.3	-35.3	0.21

6.2 Mating Durability

Sample Size: 11 (22 fibers)

Procedure:

After the samples are pulled with a 33 N (7.5 1bf) force they are subjected to a durability test of 500 insertions. Every 25 insertions, the loss and reflectance are measured, cleaned, then measured again. The results are shown below.

Loss (dB)

Wavelength	Initial Mean	Final Mean	Maximum Increase
850	0.42	0.41	0.12
1310	0.43	0.42	0.06

Return Loss (dB)

Wavelength	Initial Mean	Final Mean	Maximum Increase
850	-33.5	-33.4	0.94
1310	-35.3	-35.3	0.93

6.3 Vibration (not required by TIA 568-A)

Sample Size: 12 (24 fibers)

Procedure:

Thirty samples from group 4 are subjected to a Vibration Test from 10 to 55 Hz, 1.5 mm p-p amplitude. The samples are attached to the vibration table via a 10 port patch panel. The connectorized samples are tested in 3 axis (X, Y, Z) for 30 minutes in each axis, at a sweep rate of 1 octave per minute.

Loss (dB)

Wavelength	Initial Mean	Axis X	Axis Y	Axis Z	Maximum Increase
850	0.48	0.51	0.49	0.47	0.16
1310	0.37	0.42	0.39	0.37	0.21

Return Loss (dB)

Wavelength	Initial Mean	Axis X	Axis Y	Axis Z	Maximum Increase
850	-33.4	-33.4	-33.5	-33.6	0.47
1310	-35.1	-35.2	-35.2	-35.2	0.24

7.0 Conclusion

Throughout this test program the Volition™ fiber optic connector from 3M met or exceeded all targeted performance requirements. The excellent test results demonstrate the low insertion loss, environmental stability and physical robustness of this optical fiber termination method. This connector will ensure a reliable data transmission circuit.

For information concerning specific agency approvals please contact your 3M Telecom representative.

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