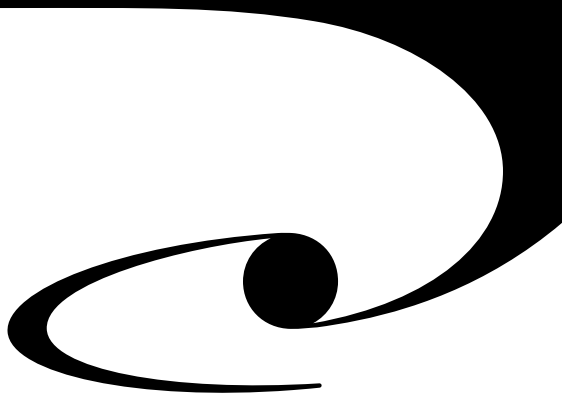
Volition™

Network Solutions



VOLITION INTERCONNECT
VF-45™ STYLE
9/125 µm Single-mode 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, 9/125µM optical fiber interconnect consisting of a "plug" and "socket" that has been designed to have the look and feel of an 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 socket is color coded with a blue door, and the plug is color coded with a blue sliding dust cover.

Volition Plug

The Volition duplex plug construction is composed of a few basic parts. There is a fiber holder which secures two single-mode 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 single-mode patch cords which are factory terminated using the VF-45 plug. These patch cords are supplied in various standard lengths using either riser rated, OFNR, jacketed cable or Low-Smoke Zero-Halogen jacketed cable. Hybrid configurations are also available with either ST style or SC single mode connectors terminated on one end of the duplex patch cord, with a color code as follows: blue boot on one connector and white boot on the other connector.

Volition Socket

The VF-45 socket is designed for field termination, using a hand-held portable field tool kit, 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.

2.0 Test Program

The purpose of the test program is to assess the long term performance of the Volition connector product. A series of optical, environmental and mechanical tests were conducted which exposed them to conditions more severe than those anticipated in actual use. Factory produced Volition patchcords and sockets, assembled using the 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**
Loss	Cold	Impact	Strength of Coupling
Return loss	Temperature Life	Flex	Mating Durability
	Humidity	Twist	
		Cable Retention	

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 48 connectors was selected and measured for loss and return loss.

3.1 Loss and Return Loss

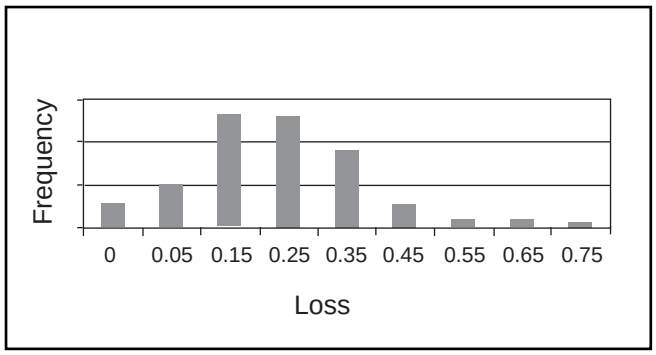
Sample Size: 48 connectors (96 fibers)

Procedure:

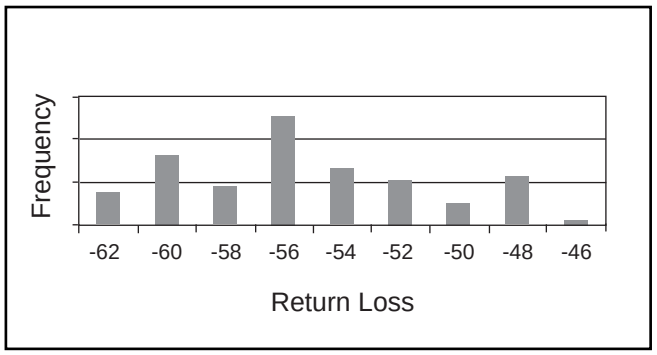
The plugs and sockets for pretest measurements were cleaned. Measurements of loss and return loss at the wavelength of 1310 nm were performed at ambient conditions before any environmental testing.

Results:	Loss (dB)		Return Loss (dB)	
Wavelength	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
1310	0.19	0.14	-56.44	4.13

Loss 1310



Return Loss 1310



4.0 Environmental (Group 2)

A sample of 48 connectors was selected for environmental testing, consisting of cold, temperature life, and humidity.

4.1 Cold (FOTP-188)

Sample Size: 48 connectors (96 fibers)

Procedure:

Measurements of loss and return loss at 1310 nm wavelength 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
1310	0.19	0.34	0.27

Return Loss (dB)

Wavelength	Initial Mean	Mean During	Mean Final
1310	-56.44	-56.51	-56.46

4.2 Temperature Life (FOTP-4)

Sample Size: 48 connectors (96 fibers)

Procedure:

Testing is performed on the samples after completion of the cold test. Measurements of loss and return loss at 1310 nm wavelength 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
1310	0.27	0.32	0.33

Return Loss (dB)

Wavelength	Initial Mean	Mean During	Mean Final
1310	-56.54	-56.04	-56.04

4.3 Humidity (FOTP-5)

Sample Size: 48 connectors (96 fibers)

Procedure:

Testing is performed on the samples after completion of the Temperature Life Test. Measurements of loss and return loss at 1310 nm wavelength 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
1310	0.34	0.36	0.34

Return Loss (dB)

Wavelength	Initial Mean	Mean During	Mean Final
1310	-56.33	-56.46	-56.45

5.0 Mechanical Tests (Group 3)

A sample of 30 connectors was sequentially tested through impact, flex, and twist.

5.1 Impact (FOTP-2)

Sample Size: 30 connectors (60 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.

5.2 Flex (FOTP-1)

Sample Size: 30 connectors (60 fibers)

Procedure:

The impact test samples are then flex tested. The connector - socket 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 (FOTP-36)

Sample Size: 30 connectors (60 fibers)

Procedure:

The flex samples are then twist tested. The connector - socket 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 (FOTP-6)

Sample Size: 30 connectors (60 fibers)

Procedure:

Testing is performed on samples subjected to the twist test. The plug is secured to the traversing stage of an Instron tensile tester. At 0.3 m (11.8 in) from the plug, 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 19.4 N (4.4 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 15 lbs @ 0°	Mean 4.5 lbs @ 90°
1310	0.26	0.26	0.24	0.26	0.23	0.25

Return Loss (dB)

Wavelength	Initial Mean	Impact Mean	Flex Mean	Twist Mean	15 lbs @ 0° Mean	4.5 lbs @ 90° Mean
1310	-56.1	-55.4	-55.6	-55.8	-55.6	-55.7

6.0 Mechanical Tests (Group 4)

A sample of 48 connectors was subjected to strength of coupling, then mating durability tests.

6.1 Strength of Coupling (FOTP-185)

Sample Size: 48 connectors (96 fibers)

Procedure:

The sample is tensile tested with a 33 N (7.5 1bf) force applied at 0º for 5 seconds and insertion loss and return loss are measured initially at the start of the test and after test completion.

Loss (dB)

Wavelength	Initial Mean	Final Mean
1310	0.31	0.32

Return Loss (dB)

Wavelength	Initial Mean	Final Mean
1310	-50.13	-49.79

6.2 Mating Durability (FOTP-21)

Sample Size: 48 connectors (96 fibers)

Procedure:

After the strength coupling test, each connector is subjected to a durability test of 500 insertions. At every 25 insertions, the loss and reflectance are measured, sample is cleaned, then measured again. The results are shown below.

Loss (dB)

Wavelength	Initial Mean	Final Mean
1310	0.32	0.29

Return Loss (dB)

Wavelength	Initial Mean	Final Mean
1310	-49.79	-49.77

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