Volume 2, Issue 3
July 2, 2003

Friends of Fiber Optics

In this issue we present four subjects. I hope you find this issue useful. Please consider how we can assist you in meeting your fiber optic goals. You may see something that you'd like to see in a more focussed structure.

We've been helping clients meet fiber optic challenges, solve and avoid fiber optic problems for 23 years. It's unlikely that we cannot help you. Call so we can discuss your needs.

Part 1: Category 1 Testing- Much Ado Nothing?
Part 2: True of False: Modified Method B Testing Works.
Part 3: True of False: FTTD Costs Less Than UTP/Fiber Networks [The Answer Will Surprise You]
Part 4: Difficult Connectors? Try an Alcohol Flush!

We appreciate your interest in our newsletter, Eye on Fiber Optics. As this is free, feel free to distribute it. Associates can obtain their own copies by requesting it at our web site, www.ptnowire.com.

At the end of this newsletter, you'll find lists of future subjects.

Feel free to send or call us with your comments or experiences. If you'd like to see a specific subject, let us know.

For Pearson Technologies Inc.,

Eric

Eric R. Pearson, CPC, CFOS
President, Pearson Technologies Inc.
800-589-2549, fax: 509-693-5670,
www.ptnowire.com, fiberguru@ptnowire.com

Part 1: Category 1 Testing- Much Ado Nothing?

Executive Summary

Insertion loss testing in accordance with TIA/EIA-568 B requires a mandrel wrap and a Category 1 light source. We examined the differences in power loss for 62.5 μm fiber links from 2 m to 200 m when tested with different category sources. The test data support the following conclusions.

Mandrel wrapping reduces insertion loss measurements of a category 1 source by 0.10 dB/pair in the link.

With mandrel wrapping, a Category 1 source produces loss values that are 0.02 dB/pair higher than those produced from a Category 2 source. Within the boundaries of CPRs tested, Category 2 sources will produce essentially the same losses as Category 1 sources.

Expansion of the range of definition for Category 1 CPR will enable older light sources to be used with no detriment to the accuracy of the measurement of the power loss of the link.

Mandrel wrapping produces loss measurements below those expected, even if typical attenuation rates and connector losses are used. These low loss measurements can allow conditions of reduced reliability to be accepted during network certification by the insertion loss test. In addition, low loss measurements could result in certified links failing to function.

Tests performed with a Category 1 source without a mandrel have better agreement with calculated typical loss values than those obtained from any of the other three test conditions: a Category 1 source with a mandrel; and a Category 2 source with and without a mandrel.

Introduction

TIA/EIA-568 B changed the manner in which insertion loss tests are to be made. This revision added two requirements: that the source be a Category 1 source and that the launch reference lead be wrapped around a mandrel of a specific diameter, which depends on the fiber core diameter and the jacket diameter. While the mandrel is not expensive, a new light source can be.

In order to assess the impact of these two changes, Pearson

Technologies conducted comparisons of losses made with Category 1 and Category 2 sources. In addition, Pearson Technologies conducted tests with and without mandrels.

Test Procedure

The tests were of:

two 100 m coils of 62.5 μm tight tube fiber;
one, two segment link of 200 m;
two, 2 m patch cords; and
a four fiber 5.44 m premises cable.

All connectors were SC.

The Category 1 source was from Alcoa Fujikura/Noyes [AFL]. This source had an 850 nm CPR of -25.00 and 25.04 dB at, just within the -25.0 dB requirement for a category 1 source.

The 1300 nm CPR was -21.78 to -21.97 dB with multiple tests. These values are within the 1300 nm, Category 1 definition of -21 dB to -25 dB.

The Category 2 sources were from Fotec, with an 850 nm CPR that ranged from -22.71 to -23.48 dB for serial number 81265 and -22.66 dB to -22.74 dB for serial number 70628. The 1300 nm CPR ranged from -21.45 to -20.96 [S/N 70924]. This wavelength is category 1.

Pearson Technologies ran two sets of tests with different source reference leads.

Analysis

We present the results from the two source reference leads in Tables 1 and 2. From basic optics, we would expect the losses to range from high to low as: category 1 without mandrel, category 2 without mandrel, category 1 with mandrel and category 2 with mandrel. The test results show slightly different relationships.

Without a mandrel in both cases, Category 1 losses are generally higher than those of category 2. This relationship is to be expected from the increased core fill and increased NA fill of the category 1 source. The average loss increases were 0.17 and 0.24 dB [Table 1].

METHOD B INSERTION LOSS DATA

link ID	length, m	reference lead set	Cat. 1 w/o mandrel ⇒end A	Cat. 1 w/o mandrel ⇒end B	Cat. 1 w mandrel ⇒end A	Cat. 1 w mandrel ⇒end B	Cat.2 w/o mandrel ⇒end A	Cat.2 w/o mandrel ⇒end B	Cat.2 w mandrel ⇒end A	Cat.2 w mandrel ⇒end B	link notes	typical loss, dB	% of typical value	
1	100	850 nm, 1	-0.74	-0.62	-0.47	-0.44	-0.90	-0.85	-0.48	-0.45	38b	0.90	52%	49%
2	100	cat. Lead 5	-1.08	-1.17	-0.83	-0.89	-0.74	-0.75	-0.81	-0.81	44	0.90	92%	99%
3	200	set 1 SC/SC	-1.21	-1.29	-1.04	-1.13	-1.01	-1.01	-0.96	-1.03	44+38b	1.50	69%	75%
4	5.44		-0.54	-0.70	-0.29	-0.44	-0.30	-0.39	-0.35	-0.43	blue	0.62	47%	71%
5	5.44		-0.37	-0.77	-0.42	-0.44	-0.37	-0.51	-0.39	-0.43	orange	0.62	68%	71%
6	5.44		-0.48	-0.64	-0.30	-0.51	-0.27	-0.47	-0.28	-0.45	green	0.62	49%	83%
7	5.44		-0.62	-0.54	-0.43	-0.32	-0.39	-0.25	-0.42	-0.28	white	0.62	70%	52%
8	2		-0.76	-0.64	-0.41	-0.36	-0.50	-0.29	-0.46	-0.36	jumper 1	0.60	68%	60%
9	2		-0.72	-0.55	-0.44	-0.55	-0.49	-0.24	-0.42	-0.25	jumper 2	0.60	73%	92%
												average=	65%	72%

DIFFERENCES

link ID	length, m	reference lead set	Cat. 1 w/o -w mandrel		Cat. 1-Cat. 2 w mandrel		Cat. 2 w/o -w mandrel		Cat. 1-Cat. 2 w/o mandrel	
1	100	850 nm, 1	-0.27	-0.18	0.01	0.01	-0.42	-0.4	0.16	0.23
2	100		-0.25	-0.28	-0.02	-0.08	0.07	0.06	-0.34	-0.42
3	200		-0.17	-0.16	-0.08	-0.10	-0.05	0.02	-0.20	-0.28
4	5.44		-0.25	-0.26	0.06	-0.01	0.05	0.04	-0.24	-0.31
5	5.44		0.05	-0.33	-0.03	-0.01	0.02	-0.08	0.00	-0.26
6	5.44		-0.18	-0.13	-0.02	-0.06	0.01	-0.02	-0.21	-0.17
7	5.44		-0.19	-0.22	-0.01	-0.04	0.03	0.03	-0.23	-0.29
8	2		-0.35	-0.28	0.05	0.00	-0.04	0.07	-0.26	-0.35
9	2		-0.28	0	-0.02	-0.30	-0.07	0.01	-0.23	-0.31
		average=	-0.21	-0.20	-0.01	-0.07	-0.04	-0.03	-0.17	-0.24

positive difference means cat. 2 has higher loss than cat. 1.
the opposite would be expected

link ID	length, m	reference lead set	Cat. 1 w mandrel ⇒end A	⇒end B	Cat.2 w mandrel ⇒end A	⇒end B	link notes	typical loss, dB	% of typical value	
1	100	850 nm,	-0.47	-0.53	-0.46	-0.53	38b	0.90	51%	59%
2	100	set 1 ST/SC	-0.76	-0.78	-0.73	-0.80	44	0.90	81%	89%
3	200	set 1 SC/SC	-0.89	-1.04	-0.92	-1.07	44+38b	1.50	61%	71%
4	5.44		-0.38	-0.23	-0.41	-0.29	blue	0.62	67%	47%
5	5.44		-0.25	-0.24	-0.28	-0.29	orange	0.62	45%	47%
6	5.44		-0.46	-0.48	-0.45	-0.44	green	0.62	73%	71%
7	5.44		-0.36	-0.36	-0.34	-0.33	white	0.62	55%	54%
8	2		-0.40	-0.19	-0.42	-0.23	jumper 1	0.60	70%	38%
9	2		-0.37	-0.32	-0.38	-0.36	jumper 2	0.60	63%	60%
1	100	1300 nm, 1	-0.19	-0.25	-0.21	-0.23	38b	0.67	31%	34%
2	100		-0.49	-0.49	-0.57	-0.55	44	0.67	85%	82%
3	200		-0.57	-0.71	-0.66	-0.75	44+38b	1.04	63%	72%
4	5.44		-0.33	-0.14	-0.30	-0.29	blue	0.60	50%	48%
5	5.44		-0.17	-0.14	-0.22	-0.17	orange	0.62	35%	27%
6	5.44		-0.44	-0.42	-0.40	-0.42	green	0.62	65%	68%
7	5.44		-0.25	-0.25	-0.23	-0.27	white	0.62	37%	44%
8	2		-0.33	-0.13	-0.39	-0.16	2m jumper 1	0.60	65%	27%
9	2		-0.27	-0.26	-0.29	-0.29	2m jumper 2	0.60	48%	48%
									58%	55%

link ID	length, m	reference lead set	Cat. 1-Cat.2, with mandrel ⇒end A	⇒end B	link notes
1	100	850 nm,	-0.01	0.00	38b
2	100		-0.03	0.02	44
3	200		0.03	0.03	44+38b
4	5.44		0.03	0.06	blue
5	5.44		0.03	0.05	orange
6	5.44		-0.01	-0.04	green
7	5.44		-0.02	-0.03	white
8	2		0.02	0.04	2m jumper 1
9	2		0.01	0.04	2m jumper 2
		average=	0.01	0.02	
1	100	1300 nm, 1	0.02	-0.02	
2	100		0.08	0.06	
3	200		0.09	0.04	
4	5.44		-0.03	0.15	
5	5.44		0.05	0.03	
6	5.44		-0.04	0.00	
7	5.44		-0.02	0.02	
8	2		0.06	0.03	
9	2		0.02	0.03	
		average=	0.03	0.04	

Category 1 losses without a mandrel are generally higher than those with a mandrel. Again, this relationship is as expected. The average loss increases were 0.21 and 0.20 dB [Table 1].

Category 2 losses without a mandrel are generally higher than those with a mandrel. Again, this relationship is as expected. The average loss increases were 0.04 and 0.03 dB [Table 1]. This small increase might be a result of repeatability in the test procedure.

With a mandrel in both cases, Category 1 losses are approximately the same as those of Category 2 [Table 1]. The largest difference at 850 nm is 0.10 dB, with averages in opposite directions of 0.01 and 0.07 dB. Both of these averages are well within the repeatability of the test procedure.

With a difference source reference cable and a mandrel, the losses with a Category 2 source were generally slightly higher than that of a Category 1 source. However, the size of this difference is very small, 0.01 and 0.02 dB [Table 2]. Since the increase is small, we attribute this to the variability in the test procedure. With this attribution, we conclude that the insertion losses are essentially the same.

The 1300 nm tests showed the same relationship: Category 2 losses were slightly higher than Category 1 losses. The 1300 nm differences are slightly larger, 0.03 and 0.04 [Table 2]. From the data in Tables 1 and 2, we interpret the small average differences to indicate no significant difference between Category 1 and 2 testing from 2 to 200 m links. This interpretation is valid at both 850 and 1300 nm. This conclusion implies no insertion loss difference for CPRs from -22.71 dB [Category 2] to -25.04 dB [Category 1].

With this interpretation, we propose that the definition of Category 1 be expanded into some of the CPR values for Category 2 to allow current testers to be used without replacement. The proposal for expansion will require additional testing.

The absolute losses are of interest equal to that of the differences presented above. The absolute losses indicate a potential for measured losses being below actual link losses. Using maximum and typical values [Table 3], we calculate the anticipated losses [Table 4].

Wavelength	Attenuation Rate		Connector Loss	
	Maximum	Typical	Maximum	Typical
850 nm	3.5	3.0	0.75	0.30
1300 nm	1.5	0.7	0.75	0.30

Table 3: Cable and Connector Loss Rates

Wavelength, nm	Length, m	Maximum	Typical	Units
850	5.44	1.52	0.62	dB
	100	1.85	0.90	dB
	200	2.20	1.50	dB
1300	5.44	1.51	0.60	dB
	100	1.65	0.67	dB
	200	2.55	1.04	dB

Table 4: Anticipated Insertion Losses

Comparison of the typical values in Table 4 to loss measurements in Table 1 indicates a disturbing trend. First, mandrel tests with both Category 1 and 2 sources produce losses less than the typical values. As a crude qualitative statement, the measured losses with mandrels are 27 % to 99 % of the typical values. The averages are 65 % and 72 % [Table 1] and 58 % and 55 % [Table 2] of the typical loss values. These data suggest that the loss experienced by a transmitter receiver pair may be larger than that measured with a mandrel wrap method.

Such a bias is the reverse of what is desired: if we were to err, we would like the test procedure to provide a slight overestimate of the actual loss. These data show the reverse condition to be true.

This bias can result in conditions of reduced reliability being accepted by the insertion loss test. Errors made by installers, to both connectors and cables, will tend to increase the loss. Additionally, these errors tend to reduce the reliability of the network. In addition, links certified may not function properly.

These low loss measurements may be due to inconsistency between the insertion loss test method and the cable attenuation rate and connector loss test methods. Only the Category 1 tests without a mandrel come close to values calculated from typical cable attenuation rates and connector losses. This relative agreement is shown by the salmon colored cells in Table 1.

Conclusions

The small difference in insertion loss between the sources used indicates that there may have been much ado nothing, or at worst, ado very little.

We caution the reader to avoid extrapolating these results outside of the boundaries stated herein. CPRs higher or lower than those tested, lengths longer than those used, and links with more connector pairs than those tested may produce different conclusions. In addition, the 50 μm fiber may produce slightly different results.

We suggest that the standard committee redefine the Category boundaries, based on this and additional testing.

Finally, the mandrel wrap tends to produce losses that are lower than we would expect from the usual equation of "length x attenuation rate + connector loss x number of pairs." This situation indicates two possibilities: of acceptance of conditions that reduce the reliability of the network and of acceptance of links that will not function. For the good of the fiber optic industry, we believe that this subject should be addressed by one of the standards committees.

We provide a final statement as a limited conclusion: the definitions of Categories 1 and 2 plus the mandrel wrap seem to provide conditions that generate the same loss measurements from sources with different CPRs.

Acknowledgements

We thank Mr. Chris Blair of Alcoa-Fujikura for loan of the Category 1 source, Mr. Mark Galapon for termination of the 2m and 5.44 m cables, Mr. J. Hayes, for his comments, and all my industry friends who graciously withstood and responded to my emails on the subject of Category sources.

Part 2: True of False: Modified Method B Testing Works.

Executive Summary

Many optical power meters have fixed ports. These fixed ports do not enable a single power meter to be used for the Method B test required by TIA/EIA-568 B. In response to this situation, some manufacturers have recommended use of a ‘modified’ Method B test procedure. In this Part, we present the results of our testing of links by both a true Method B procedure and by a modified Method B procedure. We used Category 1 and 2 sources with mandrel wrapped launch leads. We tested links of 5.44 m, 100 m and 200 m.

The test results indicated good agreement between losses made by both methods. The Category 1 source had consistently higher losses with the true Method B test than with the modified Method B test. The average increase was 0.075 dB.

Similarly, the Category 2 source had generally higher losses with the true Method B test than with the modified Method B test. The average increase was 0.02 dB. Since the differences were small, both the standard Method B test and the modified Method B test produce valid results.

The test results also indicated good agreement between Method B losses made by with Category 1 and Category 2 sources: the average difference was 0.005 dB. However, the average difference between these two sources was higher for the modified method, an average of 0.06 dB. We consider this difference small and acceptable.

Overview of The Methods

TIA/EIA-568 B requires insertion loss testing be performed by Method B of TIA/EIA-526-14 A [Figures 1 and 2]. This method requires a removable adapter on the power meter to enable testing in accordance with Method B. Many, but not all, power meters have fixed ports. Such fixed ports allow Method B testing for only one connector type.

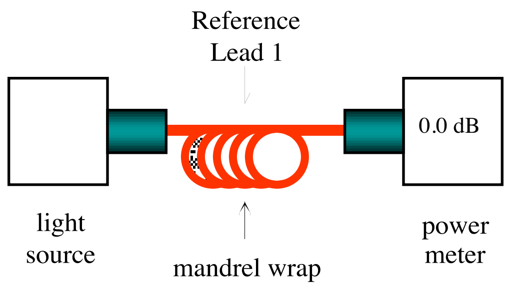

Figure 1: Reference Set Up for Method B

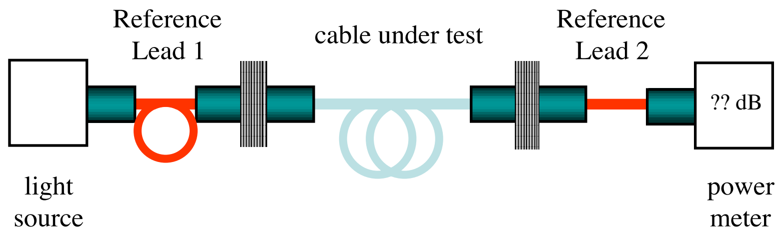

Figure 2: Test Set Up for Method B

To address this issue, connector manufacturers have recommended use of a modification to Method B [Figures 3 and 4]. Being of a curious and skeptical nature, we wondered how close the test results would be if both methods were used on the same links. Hence, this test effort and this report.

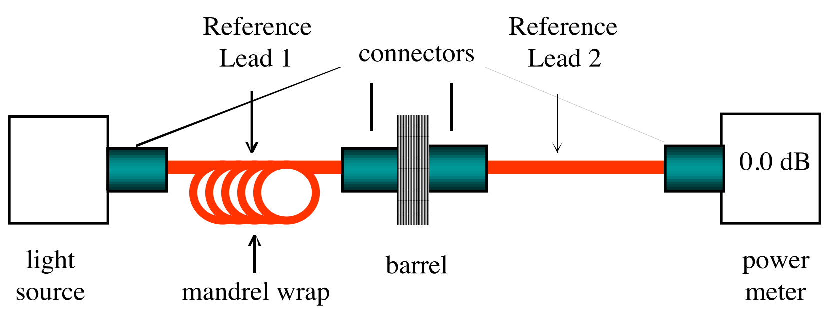

Figure 3: Reference Set Up for Modified Method B

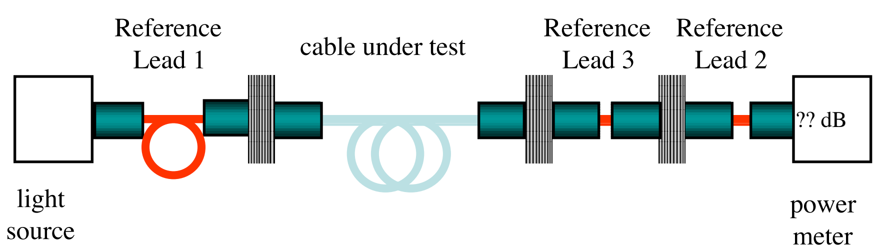

Figure 4: Test Set Up for Modified Method B

Test Procedure

We used cables and coils of 62.5 μm fiber with SC connectors. The lengths were 5.44 m, 100 m, and 200 m. The 5.44 m cable was a premises cable with four terminated fibers. The 100 m fibers were coils of tight tubed fibers. The 200 m link was formed by connecting the two 100 m links together. We performed a Method B and a modified Method B test on the same cables with the same reference cables.

We performed tests with an Alcoa-Fujikura/Noyes Category 1 source [Figure 5] and a Fotec Category 2 source . The power meter was from Fotec. With both sources, the launch reference had a mandrel wrap to comply with TIA/EIA-568 B. We measured the loss in both directions.

Figure 5: The Alcoa Fujikura Category 1 Source

Test Results

We present the test results and the differences between the Method B and the modified Method B tests in Table 5. Note that the Category 1, Method B losses are consistently higher than the modified losses. However, the bias is small, an average of 0.08 dB.

Note that the Category 2, Method B losses are consistently higher than the modified Method B losses. There is one exception, the blue fiber, fiber 4. This exception may have been due to dirt on the core during the modified test. However, the bias is small, an average of 0.02 dB.

Conclusion

The small difference between the two methods, indicates no hidden problems in the modified method. There is a need for an additional defect free cable. This conclusion applies only to the conditions tested.

			Cat. 1				Cat.2				
		reference	w mandrel 2 lead		w mandrel 3 lead		w mandrel 2 lead		w mandrel 3 lead		
link ID	length, m	lead set	⇒end A	⇒end B	⇒end A	⇒end B	⇒end A	⇒end B	⇒end A	⇒end B	link notes
1	100	850 nm, 1	-0.45	-0.47	-0.37	-0.38	-0.51	-0.54	-0.49	-0.50	38b
2	100		-0.84	-0.81	-0.74	-0.72	-0.79	-0.81	-0.76	-0.78	44
3	200		-0.97	-0.94	-0.94	-0.83	-0.95	-0.92	-0.94	-0.87	44+38b
4	5.44		-0.34	-0.42	-0.26	-0.46	-0.33	-0.36	-0.31	-0.48	blue
5	5.44		-0.43	-0.44	-0.35	-0.36	-0.46	-0.48	-0.38	-0.46	orange
6	5.44		-0.31	-0.36	-0.2	-0.29	-0.34	-0.34	-0.31	-0.37	green
7	5.44		-0.35	-0.35	-0.3	-0.27	-0.35	-0.37	-0.33	-0.32	white

	Cat. 1: difference with mandrel, 2 lead-3 lead		Cat. 2: difference with mandrel, 2 lead-3 lead		link notes
	-0.08	-0.09	-0.02	-0.04	38b
	-0.10	-0.09	-0.03	-0.03	44
	-0.03	-0.11	-0.01	-0.05	44+38b
	-0.08	0.04	-0.02	0.12	blue
	-0.08	-0.08	-0.08	-0.02	orange
	-0.11	-0.07	-0.03	0.03	green
	-0.05	-0.08	-0.02	-0.05	white
average=	-0.08	-0.07	-0.03	-0.01	

	difference, category 1-2 with mandrel, 2 lead		difference, category 1-2 with mandrel, 3 lead		link notes
	0.06	0.07	0.12	0.12	38b
	-0.05	0.00	0.02	0.06	44
	-0.02	-0.02	0.00	0.04	44+38b
	-0.01	-0.06	0.05	0.02	blue
	0.03	0.04	0.03	0.10	orange
	0.03	-0.02	0.11	0.08	green
	0.00	0.02	0.03	0.05	white
average=	0.01	0.00	0.05	0.07	

Part 3: True of False: FTTD Costs Less Than UTP/Fiber Networks [The Answer Will Surprise You]

Executive Summary

Two years ago, the Fiber Optic LAN Section [FOLS, www.fols.org] of the TIA and Pearson Technologies Inc. issued a cost model. This model compares the true cost of horizontal UTP and vertical fiber network to the cost of a centralized fiber cable network, aka fiber to the desk [FTTD] and collapsed back bone. That model included several scenarios in which FTTD had a initial installed cost below that of traditional networks. In addition, it created a cost model that users could use to determine whether their cost factors supported the use of a centralized fiber cable network.

Early this year, the FOLS again asked Pearson Technologies to examine the model for opportunities to update the cost factors. We agreed, and were extremely surprised with the results.

The revised model demonstrates that the centralized fiber system is lower in cost than ever before. In many cases, centralized fiber has an initial installed cost less than that of typical networks. We were not trying to achieve this goal. In fact, we biased the model slightly against fiber.

The most surprising result is the cost advantage of fiber to the zone [FTTZ], which many schools are using. With this network configuration, FTTZ can be $400-$500 less expensive than the horizontal UTP and vertical fiber network. That's a savings of about 2/3 of the cost of a traditional network. Wow!

During the last two years, most prices have fallen. In addition, 100BaseF NICs and media converters have dropped from $200-$300/end to $100-$150/end. All these reduced prices favor the fiber cost analysis.

Finally, we modified the model to include the cost of power for dedicated environmental control for the telecommunication rooms. This inclusion made a small shift in favor of fiber.

Mr. John Struhar, Chairman of the FOLS, will unveil the model and its results at the BICSI Conference in Nashville in mid August. After that time, the model will be available from the FOLS website or from yours truly. Mr. Struhar can be reached at: jmsjr1@att.net.

Part 4: Difficult Connectors? Try an Alcohol Flush!

Executive Summary

While rare, the internal structure of fiber connectors can be contaminated or be dirty. In either case, the dirt can prevent fibers from fitting through a connector. In this situation, the connector can be cleaned with 99 % isopropyl alcohol to flush the internal structure. The alcohol evaporates, allowing epoxy and/or quick cure adhesives to cure properly.

Procedure

Last summer, I presented a training program during which students and I had problems feeding fiber into a connector, both during a dry fit and after the connectors were filled with epoxy. I was unable to solve the problem, as I was facilitating the program of 12 trainees. We forced our way through by using many spare connectors.

I mentioned this problem to a friend who is a cable guru. He suggested filling a syringe with 99 % isopropyl alcohol, placing the needle firmly against the inside of the ferrule, and forcing alcohol through the ferrule. If the problem is contamination, the alcohol may clean the connectors.

Last month, I had the same problem while building reference leads for a US Air Force training program. After losing 7, I started cleaning all connectors, as described above. The problem, like the alcohol, evaporated.

Coming in Future Issues

Product Update: Evaluation of Cleave and Leave Connector Products
The Problem With OTDR Ghosts
How to Minimize the Complications from Ghosts
The Hidden Cost of Cheap Training
Do You Need to Know About Repeatability?
Case Study: Field Fusion Splicing
Case Study: Planning, Installing and Certifying The FTTD Network
Do You Need to Know About Multimode Reflectance?
Planning to Upgrade to GbE or 10 GbE? Don't Fusion Splice Multimode Fiber!
LED vs. VCSEL Insertion Loss Testing
Fusion Splicing Fiber from Different Manufacturers
Comparison of OTDRs
Tips on Using OTDRs for Training
The Three Benefits of Fiber Sales Training

Previous Articles, White Papers & Other Publications

Honey, I Shrunk the Wiring Closet!
Spreadsheet for Comparing Costs of All Fiber to Fiber and Copper Networks
Improving Fiber Network Reliability Through Choice of Certification Strategy
Maximizing Fiber Optic Network Reliability Through Choice of Installer
The Novice's 10 Minute Introduction to Fiber Optics
Myths and Reality: Fiber Vs. Copper

<u>Eye on Fiber, Vol. 1, Issue 1</u>
The Six Subtilties of Accurate Singlemode Testing
Unstable Test Measurements? Don't Blame the Test Equipment!
A Personal Perspective: Concern for the Future

<u>Eye on Fiber, Vol. 1, Issue 2</u>
How to Test Installed Links According to TIA/EIA-568

B.1 and B.3
Evaluation of the Panduit Prepolished SC Connector
The Proof Is In: Test Data Prove the Value of a Precision Cleaver
A Pearson Personal Perspective: Will Fiber Miss the Data Networks Boat?

Eye on Fiber, Vol. 2, Issue 1
Full Evaluation of the Panduit Prepolished SC Connector
Pay Less and Spend More: The Lesson of Total Hardware Cost

Eye on Fiber, Vol. 2, Issue 2
Part 1: Which Connector Installation Method to Use? The Qualitative Answer: It Depends
Part 2: Connector Installation Cost Model: A Strategy for Profitability
Part 3: How to Avoid Cursing at Cursers: An Introduction To Interpretation of OTDR Traces
Part 4: Fiber Optic Connector Update: Yesterday Today, and Tomorrow

Training Programs, Presentations and Schedules

FiberPro™ 1: The Essentials for Success, monthly in the Atlanta, GA area; available for on site presentations.
FiberPro™ 2: Do It Right the First Time, Every Time- Advanced Connector Installation and Advanced FOA Certification. See schedule on web site. Available for on site presentations.
FiberPro™ 3: Certifying and Troubleshooting Fiber Optic Cable Systems for Maximum Reliability and Advanced FOA Certification. See schedule on web site. Available for on site presentations.
FiberPro™ 4: Advanced Training and Advanced FOA Certification for Splicers, available for on site presentations.
FiberPro™ 5: Fiber Optic Network Design, Certification and Costing, June 16-18, Atlanta, GA; 8/15-17/03, Nashville, TN; 11/17-19/03, Tampa, FL. Available for on site presentations.

Presentation: Certifying Fiber Optic Networks For Maximum Reliability [Alternate], BICSI Conference, 8/18-21/03, Nashville, TN.

Presentation: Fiber Optic Connectors: Today, Tomorrow and Yesterday: An Update, IICIT Conference, 9/18-19/03, Orlando, FL.

Presentation: How Not to Curse at Cursers, FTTH Conference, New Orleans, LA, 10/7-9/03.