# Next Generation of Fiber Optic Loose Tube Cable

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## ABSTRACT

The evolutionary path of outside plant (OSP) fiber optic loose tube cables with the standard 600-lb load rating is leading to higher-fiber-density cables with smaller diameters and lighter weights. With advancements in manufacturing technologies, improved materials, and development of bend-insensitive optical fibers, AFL has developed the next-generation of high-performance 600-lb rated micro-loose tube cable for the communications cabling infrastructure market. This paper will review some of the money-saving attributes related to this new, more compact OSP micro-loose tube cable by comparing the AFL OSP MicroCore® LMHD-Series Fiber Optic Cable to larger, traditional loose tube cables offered by other manufacturers.

## INTRODUCTION

To better understand the comparison between traditional loose tube and the LMHD 600-lb-rated micro-loose tube cable, a brief overview of each design concept is in order. Traditional loose tube cables have been used by the U.S. communications industry for over 40 years. During this time the basic design, including physical size, has not changed much. The cable is made using a single or multiple 2.5 mm to 3 mm O.D., 12-fiber buffer tube stranded around a central strength member to form a cable core. This core is then covered with a polyethylene (PE) jacket with or without an armored layer under the jacket. The cables are tested for performance compliance to well-established industry standards such as Telcordia GR-20-Core "Generic Requirements for Optical Fiber and Optical Fiber Cable" and ICEA S-87-640 "Standard for Optical Fiber Outside Plant Communications Cable." The most common fiber-count range for these stranded loose tube cables is 12 up to 432 fibers.

*Figure 1—Traditional 288F OSP Loose Tube Cable (l) and LMHD OSP MicroCore (r)*

The AFL OSP MicroCore LMHD Loose Tube cable is designed and produced using similar manufacturing techniques as those for traditional loose tube cables, but with one important exception. The LMHD cable uses innovative high-fiber-density buffer tubes. These high-density/high-fiber-count buffer tubes are used to build stranded cable cores which are then jacketed with OSP-rated polyethylene. The finished cable is significantly smaller than traditional loose tube cables, yet the physical and mechanical properties are not compromised. The LMHD-Series has a 600-lb load rating plus the same mechanical and physical robustness expected of an OSP loose tube fiber optic cable. LMHD-Series fiber optic cables are fully compliant to Telcordia GR-20 and other pertinent OSP cabling standards for general communications infrastructure applications. The following tables show side-by-side comparisons for the size and weight of several common traditional loose tube cables and LMHD micro-loose tube cables.

**Table 1—Cable Weight Comparison per 1,000 ft**

| CABLE TYPE | FIBER COUNT | | |
|---|---|---|---|
| | 144F | 288F | 432F |
| LMHD OSP MicroCore | 55 lbs | 48 lbs | 112 lbs |
| Traditional OSP Loose Tube | 119 lbs | 82 lbs | 242 lbs |
| **LMHD Weight Reduction** | **54%** | **45%** | **54%** |

**Table 2—Cable Diameter Comparison**

| CABLE TYPE | FIBER COUNT | | |
|---|---|---|---|
| | 144F | 288F | 432F |
| LMHD OSP MicroCore | 9.9 mm | 12.4 mm | 14.4 mm |
| Traditional OSP Loose Tube | 15.5 mm | 19 mm | 22 mm |
| **LMHD Diameter Reduction** | **36%** | **35%** | **35%** |

The remainder of this paper will highlight how the reduced size and weight of the LMHD-Series offers money-saving opportunities to the cable plant customer.

## SMALLER, LIGHTER CABLE PACKAGES CAN REDUCE SHIPPING COSTS

A main cost factor associated with transporting reels of fiber optic cable is the package size. As the fiber count of a cable increases, the diameter of the cable gets larger. The larger the cable diameter, the larger the reel must be to support bulk lengths of cable. Because of the significantly smaller diameter of the LMHD cable, the size of the reel necessary to support a bulk length of cable is much smaller than that of traditional loose tube cable. For example, in Figure 2, the size difference is depicted in the comparison of the reel sizes necessary to package 30,000 ft. of LMHD and tradition loose tube cable.

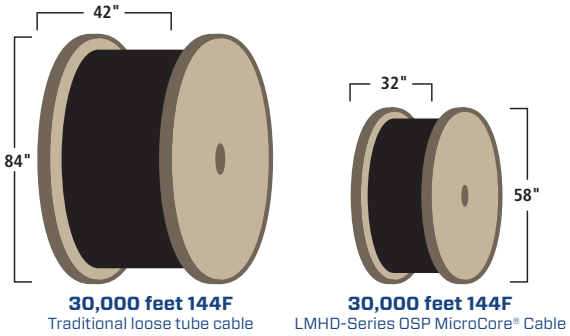


*Figure 2—Size comparison for a 144-fiber, 30,000-ft. reel package. The reel on the left is an 84"x42" standard wood reel used for 30,000 ft of traditional loose tube. The reel on the right shows the smaller reel package that can handle 30,000 ft of LMHD loose tube cable.*

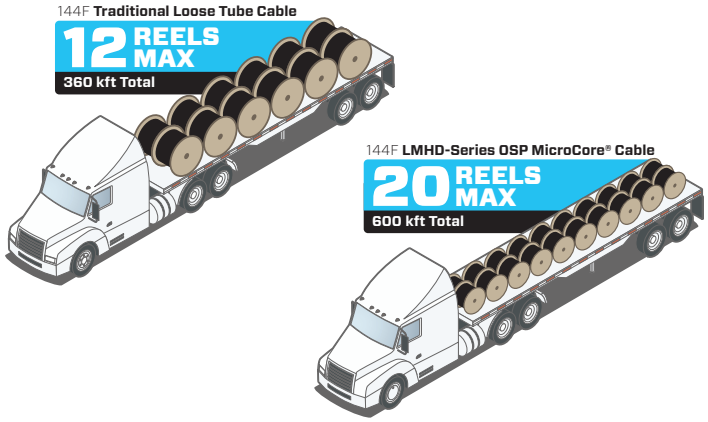


*Figure 3—Standard 53-ft flatbed truck can transport 20, 30,000-ft reels of LMHD 144-fiber on a full track load ((FTL) for a total of 600,000 ft. By comparison, an FTL of traditional loose tube is maxed at 12-reels or a total of only 360,000 ft.*

This smaller, lighter-weight package feature of the LMHD can significantly lower transportation costs by allowing more reels to be transported via a full truckload (FTL). The cost savings for FTL are illustrated in Table 3.

### Table 3—Cost-Savings Comparison (Based on $1,467 for FTL)

| CABLE TYPE | FEET PER REEL | NO. OF REELS ON FTL 53' FLATBED | TOTAL CABLE FOOTAGE | TOTAL WEIGHT LBS PER FULL FB | COST PER FOOT OF CABLE |
|---|---|---|---|---|---|
| AFL LMHD OSP MicroCore (144F) | 30,000 | 20 | 600,000 | 38,000 | $0.0024 |
| Traditional OSP Loose Tube (144F) | 30,000 | 12 | 360,000 | 22,800 | $0.0041 |

With the smaller package, a standard 53" flatbed can carry up to 20 reels (600,000 ft.) of the LMHD. Compare this to only 12 reels (360,000 ft.) of traditional loose tube cable. See Figure 3. Not only can a truck deliver almost two times the cable per truckload, the overall cost/ft to ship the LMHD is 42% lower. In addition to significant cost savings for full truckload deliveries for larger projects, less than truckload (LTL) shipments of a reel or two is also less expensive. Table 4 shows the cost difference to ship a 30,000-ft reel of traditional loose tube compared to the AFL LMHD.

### Table 4—Cost-Savings Comparison for LTL

| CABLE TYPE | FEET PER REEL | LTL FREIGHT RATE (ESTIMATE PER SINGLE REEL) | COST PER FOOT OF CABLE |
|---|---|---|---|
| AFL LMHD OSP MicroCore (144F) | 30,000 | $211.00 | $0.007 |
| Traditional OSP Loose Tube (144F) | 30,000 | $380.00 | $0.013 |

Whether for large volume projects or single-reel shipments, the LMHD offers big savings for shipping costs.

## PATHWAY COST SAVINGS

Cable pathways and spaces are another significant part of the cost for a cabling infrastructure. In general, the more optical circuits required, the more space and hence, the higher the cost of the supporting pathway system. This section explores several pathway environments where the LMHD micro-loose tube cable can save money for the system owner.

### Override Installations

For override installations, i.e., duct pathway environments that have existing cable already present, there is reduced space available for pulling more cables into the route. Based on the usable area within the partially-filled pathway, a determination is made on the available free space and the maximum cable size that can be safely pulled into the partially-filled duct. The smaller cross-sectional area of the LMHD cable, when compared to traditional loose tube cable, gives the customer the ability to add more fibers to that remaining space. Table 5 illustrates a realistic scenario showing how the LMHD allows more fibers to be added to a pre-populated HDPE duct.

**Table 5—Additional Fibers Added to a Pre-populated HDPE Duct**

| CABLE TYPE SUPPORTING MAXIMUM ALLOWABLE CABLE O.D. | CABLE O.D. (mm) | MAXIMUM CABLE O.D. | NO. OF CABLES THAT CAN BE ADDED | NO. OF ADDITIONAL FIBERS |
|---|---|---|---|---|
| LMHD OSP MicroCore (288F) | 12.2 | 0.480" | 2 | 432 |
| Traditional OSP Loose Tube (96F) | 12.2 | 0.483" | 2 | 192 |

***This table highlights the ability to add more fibers into a 1.25" HDPE duct with an existing 288-fiber loose tube cable. The available remaining space can support no more than two cables at 0.500" each. With the LMHD, two 288-fiber cables can be added compared to only two 96-fiber traditional loose tube cables. The LMHD solution adds an extra 240 fibers to the limited space within the pathway.***

### Cost-Savings When Selecting New Pathways

Another area of cable plant design where the LMHD product provides higher fiber counts is in green-field (new) HDPE duct pathway installations. For this type of installation, the HDPE pathway and cable are evaluated as a complete system. Usually, the size of the duct is determined based on the total number of fibers required for the application. Figure 4 shows how the LMHD allows for a smaller, less expensive duct to be used for the cable pathway.

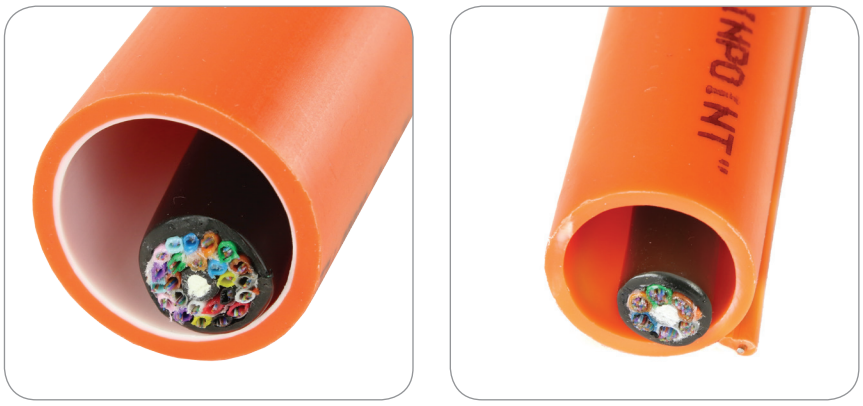

***Figure 4 —The standard maximum fill-ratio recommended by National Electric Code (NEC) for installing a single cable in a duct is 53% with no more than two, 90-degree bends between pull-points. Therefore, a 288-fiber traditional loose tube requires a minimum duct ID of 1 inch (left photo). For the LMHD, the minimum duct size drops to 3/4 inches. The smaller duct size can provide up to a 15% cost-saving on pathway cost (right photo).***

In addition to the pathway savings associated with single-cable installations, the LMHD small size allows for the option to use bundled micro-duct pathways in place of the HDPE duct. Figure 5 shows a comparison between a traditional loose tube 288-fiber minimum duct-size requirement and the micro-duct option for the LMHD.

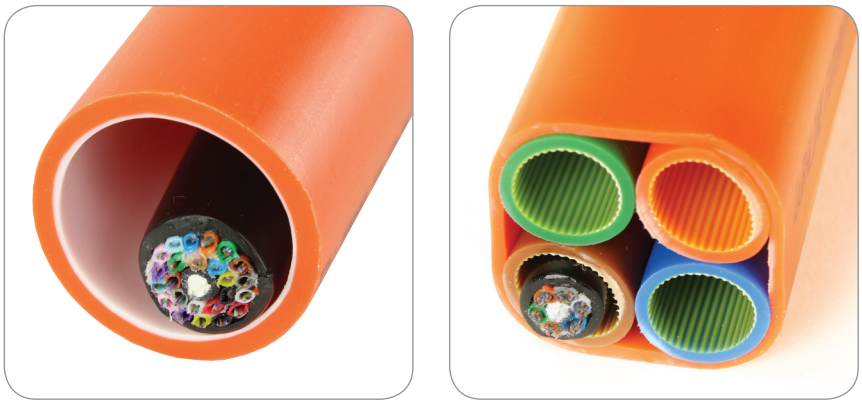

*Figure 5 —The traditional 288-fiber loose tube, whether being air-jetted or pulled into the HDPE duct, requires a minimum duct size of 1" (left photo). In the photo on the right, the smaller LMHD 288-fiber cable can be installed via air-jetting into a 4-way micro-duct where each micro-duct has a 14 mm (0.55") ID. This 4-way micro-duct has the same overall size as the single HDPE duct. This means that total of four LMHD 288 fiber cables can be installed in the same pathway space that can support only one traditional loose tube cable.*

### Lashed-Aerial Installations

When the cable pathway is an aerial messenger wire system, the size and weight of the cable are critical physical features that determine the amount of cable that can be lashed or over-lashed (new cable added to an existing lashed cable messenger system). The smaller, lighter weight LMHD results in lower loading of support structure, therefore allowing more fibers to be added compared to heavier, larger traditional loose tube cables. The following list highlights the benefits of using the LMHD for aerially lashed applications.

When compared to traditional loose tube cable, the LMHD cable offers:

- Reduced messenger loading per cable
- Reduced messenger post-install sag
- More fibers per unit-weight of cable
- Reduced wind and ice-loading due to smaller cross-section
- Smaller slack-loop coils

The smaller, lighter LMHD improves the original return-on-investment of the aerial messenger pathway by allowing the addition of more fibers without needing to perform costly upgrades to the support-wire infrastructure.

## SUMMARY

The AFL LMHD loose tube fiber optic cable series provides significant cost-saving opportunities for the OSP cable plant owner. Because of it smaller size and robust physical design, this next-generation loose tube cable technology provides significant cost-saving opportunities as evidenced in the examples presented in this paper.

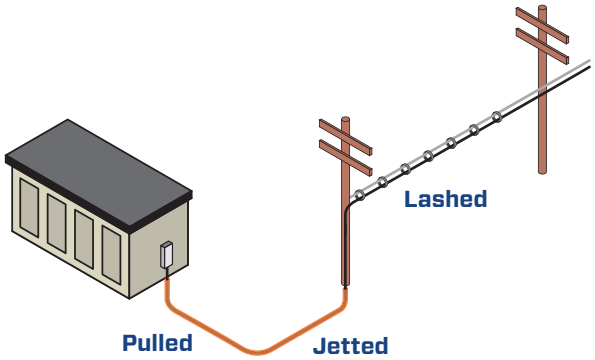


*Figure 6 —Lashed Aerial Loose Tube vs. LMHD*

- Reduced transportation costs—as much as 42% lower per foot cost compared to traditional cable
- Extends the life of current pathway and space infrastructure
- Small size allows for greater pulling and jetting distances, thus reducing handling costs
- More fibers can be installed in override situations reducing the need to install or lease additional pathway
- Can be installed in bundled micro-ducts allowing for pathway fiber-density optimization and lowering the cost of future cable additions
- More cables can be added to existing aerial over-lash pathways

With this next-generation loose tube technology, the cable plant customer has new opportunities to lower the overall cost of their next cabling project. Contact AFL customer service at 800-235-3423 to learn more about the LMHD cable and how it can save you money.

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