QUALITY OSP FIBER OPTIC CABLE INSTALL

Fiber Optic Cable Today
PCCA Web Portal
Process Improvements
Fiber Optic Association (FOA)

March 2020

Gerry Harvey
Corning Field Engineer (retired)
LACK OF CONSISTENT FIBER OPTIC CABLE INSTALLATION METHODS

- Manufacturers Have Different Cable Installation MBR (Minimum Bend Radius) Under Load (15 X Cable OD, 20 X Cable OD, etc.)
- No Standardized OSP Installation Methods
  - Most Procedures Have not Been Updated in Over 15 Years
  - International Standards are not USA Pertinent
  - US Standards are not Specific Enough
- Some Recommend Improper Equipment - Cable Wrapping Machines
WHAT’S DRIVING THE INDUSTRY CHANGE

- Fiber Optic Cable Packing Density Increasing
- Market Demand for Dry Cables
- Bend Insensitive Fibers May Mask Cable Damage
- Old Thumb Rule of Minimum Bend Radius =
  - 15X or 20X Cable OD Under Load
  - And 10x Cable OD for No Load are **No Longer Universally Valid**
Corning Cable Miniaturization Has Occurred Through Coordinated Effort

Tracking fiber density over time (fibers per mm²)

As fiber counts have risen...
...cable diameters have fallen

5.5x greater fibre density

Trend is upwards
FIBER OPTIC CABLE TODAY

- SZ Bunching Unit
- Spider Web Ribbon with Ringmark
- Water Blocking Tape
- Strength Members
- Ripcords
- Sheath

6,912F Wrapping Tube Cable

- Outside Diameter: 35 mm (1.38 in)
- Weight: 750 kg/km (504 lbs/1,000 FT)
MARKET CHANGES MOVING TOO FAST FOR STANDARDS AND VENDOR WEBSITES

- Standard OSP Typically 600 lbs and Designed to Pull or Jet
  - Fiber Counts up to 6,912 fibers - 1.38 in (35.0mm) OD
  - How Many Fibers Can Fit in a 2.0 in duct?
- MicroCables Typically 300 lbs and Designed to Jet
  - Fiber Counts up to 432 fibers (Loose Tube) and 864 fibers (Ribbon)
  - How Many Fibers Can Fit in an 18/14 mm and 20/16 mm Microduct?
- Some MicroCables are 600 lbs and are designed to Jet or Pull
“DRY” CABLE OR GEL-FREE
NO GREASE OR GEL

- New Water Blocking Materials Tapes and Powders
  - Reduce Time to Prepare Cable
  - Reduce Potential Ribbon Damage Due to Solvent Cleaning
  - Cleaner Splice Cases and Equipment Racks/Floors
- Cables Don’t Take a Set
- Cables Will Recover From Localized Compression
BEND INSENSITIVE FIBERS CAN HIDE CABLE DAMAGE

- Cables Shifting from Standard G652D Fibers - 2” Minimum Bend Diameter to G657A Fibers - ¾” Minimum Bend Diameter
- Leads to Potential Masking Cable Internal Damage
  - Delamination of Ribbon Matrix or Loose Fiber Coating
  - Core Tube/ Buffer Tubes Crushed
  - GRP Strength Elements Fractured and Compromised
CONTRACTOR OPPORTUNITIES

► Use Required Fiber Optic Tools, not “Whatever is on the “Truck”
► Do not Force Install
► Follow Critical Installation Steps
► “Soon” Use PCCA Web Portal for Safe Cable Install
CRITICAL INSTALLATION STEPS

1. Utilize Tools that Provide **Minimum Cable Installation Diameter** Under Load

2. **Pull Forces Less Than** Manufacturer’s Cable Installation Load

3. **Figure 8 Cable Slack** During Install to Minimize Cable Twist

4. **Prevent Impact** to Cable to Prevent Crush

PCCAnet.org/safecableinstall
MAINTAIN PULL FORCES UNDER RATED LOAD

- Continuously Monitor Tension/ Use Swivel or
- At Minimum Use Proper Cable Maximum Rated Load Breakaway Swivel
MAINTAIN BEND CONTROL – MINIMUM CABLE INSTALLATION DIAMETER UNDER LOAD

- Rollers and Sheaves
  - Snow Shoes/ Cable Routing Guides
- Duct and Split Duct on Modified Tooling
- Capstans
- Cable Jetting Equipment
IMPROPER TOOLS FOR AERIAL

Stringing Blocks Must Not Be Used for Angle Pulls and Take-up/ Payoff Roller
IMPROPER TOOLS FOR UNDERGROUND

- No Stringing Block
- No Lip Roller w/o Field Modifications
IMPROPER BEND CONTROL FOR UNDERGROUND

Protect Cable Over Handhole/Manhole Lips

Conduit Feeding Sheaves Violate Bend Diameter
IMPROPER CAPSTAN - NO COLLAPSIBLE REEL
PROPER OR MODIFIED TOOLS MAINTAIN BEND CONTROL

Split Cable Feeders

Split Duct Tied to Lip Roller

Duct Tied to Lip Roller
MINIMUM CABLE INSTALLATION DIAMETER

- Fiber Optic Cable Manufacturers
  - Minimum Bend Diameter Short Term
  - Minimum Bend Diameter Long Term
- Tooling Manufacturers
  - Diameter - Rollers/Sheaves
  - Effective Diameter – Quadrant Blocks
- Equipment Manufactures
  - Pulling Capstans
  - Aerial Placing Trucks
    - Fairleads
  - Cable Plows
    - Slide Chutes
    - Plow Chutes
VISION FOR SYSTEM IMPROVEMENTS

- First Focus is to implement steps for Quality Cable Install
  - Cable Installation
  - Tooling
  - Equipment
  - Handholes
- Expand to Include Buffer Tube/ Optical Fiber Routing in Splice Points for Splice Closures/ Frames
- Next Phase for Connector Handling/ Cleaning, Optical Testing/Troubleshooting and System Documentation
- Design
- Integrate sister organizations
  - CGA - Common Ground Alliance
  - FOA - Fiber Optic Association
  - FBA - Fiber Broadband Association
PCCA Web Portal on Safe Cable Install (Release 1) to Include:

- Fiber Optic Cable Critical Attributes
  - Cable OD
  - Cable Weight
  - Cable Minimum Bend Diameter (Loaded and Unloaded)
  - Cable Pull Tension (Short Term and Long Term)
- Appropriate Tooling (Sheaves/Blocks)
- Appropriate Equipment – Pulling (Capstans) or Jetting (Conduit)
PCCA WEB PORTAL FOR SAFE CABLE INSTALL

- Contractor Requirements
  - Fiber Optic Cable Manufacturer (Pull Down from Menu)
  - Input the Part Number

- Note – Terrific Support from Greg Smela of PCCA for Building the Portal
Model XS-100-B

Model XS-100-B used as a Static Wire Stringing Block shown with a No. 8 Ball Clevis Fitting. Also can be used with ball hook, Y-clevis, eye, etc. Works well on large transmission towers, too. Should usually be used with Urethane sheave lining or ductile iron.
Safe Cable Install

Cable Manufacturer Selection: (*)

- AFL
- CommScope
- Corning
- OFS
- Prysmian
- Sumitomo
- Superior Essex

Select Manufacturer
# Safe Cable Install Database

Enter the manufacturer part number in the field and select Go. Then, choose the product you'd like to learn about by selecting the icons on the right. There are two - one expands the listing detail and the other allows you to download a pdf of the listing. You may also download any portion of the resulting list as a CSV file.

<table>
<thead>
<tr>
<th>AFL Catalog PN</th>
</tr>
</thead>
<tbody>
<tr>
<td>LWSE-3456-K-C-144-24-00N1D</td>
</tr>
</tbody>
</table>

Start Over
## Safe Cable Install Database

Enter the manufacturer part number in the field and select Go. Then, choose the product you’d like to learn about by selecting the icons on the right. There are two - one expands the listing detail and the other allows you to download a pdf of the listing. You may also download any portion of the resulting list as a CSV file.

<table>
<thead>
<tr>
<th><strong>AFL Catalog PN</strong></th>
<th>LWSE-3456-KC-144-24-00NTD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cable Weight</strong></td>
<td></td>
</tr>
<tr>
<td>lbs/1000ft (KG/KM)</td>
<td>403 (600)</td>
</tr>
<tr>
<td><strong>Max. Tensile Load Short-Term</strong></td>
<td></td>
</tr>
<tr>
<td>lbs (N)</td>
<td>607 (2700)</td>
</tr>
<tr>
<td><strong>Max. Tensile Load Long-Term</strong></td>
<td></td>
</tr>
<tr>
<td>lbs (N)</td>
<td>182 (810)</td>
</tr>
<tr>
<td><strong>Cable OD</strong></td>
<td></td>
</tr>
<tr>
<td>inches (mm)</td>
<td>1.20 (30.5)</td>
</tr>
<tr>
<td><strong>MBD Installation</strong></td>
<td></td>
</tr>
<tr>
<td>inches (mm)</td>
<td>48 (1220)</td>
</tr>
<tr>
<td><strong>MBD Operation</strong></td>
<td></td>
</tr>
<tr>
<td>inches (mm)</td>
<td>36 (916)</td>
</tr>
</tbody>
</table>

[Spec Sheet](https://www.afglobal.com/productlist/Product-Lines/Fiber-Optic-Cable/Wrapping-Tube-Cable-(WTC)-with-SWR/doc/250urn-WTC-SWR-Cable.aspx)

**Date Submitted**: 02-25-2020 07:43:34
### 250 μm Wrapping Tube Cable (WTC) with SpiderWeb Ribbon® (SWR®)

#### Temperature Specifications

<table>
<thead>
<tr>
<th>TEMPERATURE RANGE</th>
<th>OPERATION</th>
<th>STORAGE</th>
<th>INSTALLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-40°F to +158°F (-40°C to +70°C)</td>
<td>-40°F to +158°F (-40°C to +70°C)</td>
<td>-22°F to +140°F (-30°C to +60°C)</td>
</tr>
</tbody>
</table>

#### Mechanical Data—Non-Armored

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>FIBER COUNT</th>
<th>BINDER UNIT</th>
<th>NOMINAL DIAMETER (INCHES)</th>
<th>WEIGHT (LBS/1,000 FT)</th>
<th>MAX TENSILE LOAD (LBS)</th>
<th>MIN BEND RADIUS (INCHES)</th>
<th>MAX TENSILE LOAD (LBS)</th>
<th>MIN BEND RADIUS (INCHES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LWSE-144-9-C-144-1-00N1D</td>
<td>144</td>
<td>1 X 144F</td>
<td>0.41 (10.5)</td>
<td>57 (85)</td>
<td>607 (2700)</td>
<td>9 (229)</td>
<td>182 (810)</td>
<td>6 (158)</td>
</tr>
<tr>
<td>LWSE-288-9-C-72-4-00N1D</td>
<td>288</td>
<td>4 X 72F</td>
<td>0.47 (12.0)</td>
<td>71 (105)</td>
<td>607 (2700)</td>
<td>10 (254)</td>
<td>182 (810)</td>
<td>7 (180)</td>
</tr>
<tr>
<td>LWSE-432-9-C-72-6-00N1D</td>
<td>432</td>
<td>6 X 72F</td>
<td>0.53 (13.5)</td>
<td>91 (135)</td>
<td>607 (2700)</td>
<td>11 (270)</td>
<td>182 (810)</td>
<td>8 (203)</td>
</tr>
<tr>
<td>LWSE-576-9-C-72-8-00N1D</td>
<td>576</td>
<td>8 X 72F</td>
<td>0.59 (15.0)</td>
<td>111 (165)</td>
<td>607 (2700)</td>
<td>12 (300)</td>
<td>182 (810)</td>
<td>9 (225)</td>
</tr>
<tr>
<td>LWSE-864-9-C-72-12-00N1D</td>
<td>864</td>
<td>12 X 72F</td>
<td>0.69 (17.5)</td>
<td>145 (215)</td>
<td>607 (2700)</td>
<td>14 (350)</td>
<td>182 (810)</td>
<td>11 (279)</td>
</tr>
<tr>
<td>LWSE-1152-K-C-144-8-00N1D</td>
<td>1152</td>
<td>8 X 144F</td>
<td>0.73 (18.5)</td>
<td>161 (240)</td>
<td>607 (2700)</td>
<td>15 (370)</td>
<td>182 (810)</td>
<td>11 (279)</td>
</tr>
<tr>
<td>LWSE-1728-K-C-144-12-00N1D</td>
<td>1728</td>
<td>12 X 144F</td>
<td>0.91 (23.0)</td>
<td>242 (360)</td>
<td>607 (2700)</td>
<td>18 (460)</td>
<td>182 (810)</td>
<td>14 (345)</td>
</tr>
<tr>
<td>LWSE-3456-K-C-144-24-00N1D</td>
<td>3456</td>
<td>24 X 144F</td>
<td>1.20 (30.5)</td>
<td>403 (600)</td>
<td>607 (2700)</td>
<td>24 (610)</td>
<td>182 (810)</td>
<td>18 (458)</td>
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</tbody>
</table>
### Mechanical Data—OSP Armored

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>FIBER COUNT</th>
<th>BINDER UNIT</th>
<th>NOMINAL DIAMETER</th>
<th>WEIGHT</th>
<th>SHORTTERM / INSTALLATION</th>
<th>LONGTERM / STORAGE /STATIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>INCHES (MM)</td>
<td>LBS/1,000 FT (KG/KM)</td>
<td>MAX TENSILE LOAD LBS (N)</td>
<td>MIN BEND RADIUS INCHES (MM)</td>
</tr>
<tr>
<td>LWSL-144-9-C-144-1-1051D</td>
<td>144</td>
<td>1 X 144''</td>
<td>0.63 (16.0)</td>
<td>148 (220)</td>
<td>607 (2700)</td>
<td>13 (320)</td>
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<tr>
<td>LWSL-288-9-C-72-4-1051D</td>
<td>288</td>
<td>4 X 72''</td>
<td>0.69 (17.5)</td>
<td>172 (255)</td>
<td>607 (2700)</td>
<td>14 (350)</td>
</tr>
<tr>
<td>LWSL-432-9-C-72-6-1051D</td>
<td>432</td>
<td>6 X 72''</td>
<td>0.75 (19.0)</td>
<td>202 (300)</td>
<td>607 (2700)</td>
<td>15 (380)</td>
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<tr>
<td>LWSL-576-9-C-72-8-1051D</td>
<td>576</td>
<td>8 X 72''</td>
<td>0.81 (20.5)</td>
<td>235 (350)</td>
<td>607 (2700)</td>
<td>16 (410)</td>
</tr>
<tr>
<td>LWSL-864-9-C-72-12-1051D</td>
<td>864</td>
<td>12 X 72''</td>
<td>0.91 (23.0)</td>
<td>286 (425)</td>
<td>607 (2700)</td>
<td>18 (460)</td>
</tr>
<tr>
<td>LWSL-1728-K-144-12-1051D</td>
<td>1728*</td>
<td>12 X 144''</td>
<td>1.14 (29.0)</td>
<td>410 (610)</td>
<td>607 (2700)</td>
<td>23 (580)</td>
</tr>
</tbody>
</table>

*NOTE: Modified temperature performance*

### Optical Fiber

<table>
<thead>
<tr>
<th>FIBER COUNT</th>
<th>FIBER DESIGNATOR</th>
<th>MFD</th>
<th>MAXIMUM ATTENUATION (CABLED) dB/km</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1310 NM</td>
</tr>
<tr>
<td>144, 288, 432, 576, 864</td>
<td>9 (ITU-T G.652/D/657.A1)</td>
<td>9.2 ± 0.4 µm</td>
<td>≤0.40</td>
</tr>
<tr>
<td>1152, 1728, 3456</td>
<td>K (ITU-T G.652/D/657.A1)</td>
<td>8.6 ± 0.4 µm</td>
<td>≤0.40</td>
</tr>
</tbody>
</table>

### Stripe Ring Fiber Identification

<table>
<thead>
<tr>
<th>R NO.</th>
<th>STRIPE RING MARKING</th>
<th>R NO.</th>
<th>STRIPE RING MARKING</th>
<th>FIBER COUNT</th>
<th>BINDER UNIT (BU)</th>
<th>RING MARKINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>7</td>
<td></td>
<td>144'</td>
<td>No Binder Unit</td>
<td>1-12 Ring Marking</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>8</td>
<td></td>
<td>288'</td>
<td>4 Binder Units</td>
<td>1-6 Ring Marking</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>9</td>
<td></td>
<td>432'</td>
<td>6 Binder Units</td>
<td>1-6 Ring Marking</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>10</td>
<td></td>
<td>576'</td>
<td>8 Binder Units</td>
<td>1-6 Ring Marking</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>11</td>
<td></td>
<td>864'</td>
<td>12 Binder Units</td>
<td>1-12 Ring Marking</td>
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<tr>
<td>6</td>
<td></td>
<td>12</td>
<td></td>
<td>1152'</td>
<td>12 Binder Units</td>
<td>1-12 Ring Marking</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1728'</td>
<td>12 Binder Units</td>
<td>1-12 Ring Marking</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3456'</td>
<td>24 Binder Units</td>
<td>1-12 Ring Marking</td>
</tr>
</tbody>
</table>

*For binder units 13-24, the second binder unit is clear*

www.AFLglobal.com or (800)235-3423

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Specifications are subject to change without notice.
CONTRACTOR PROCESS STEPS FOR OSP

- Builds From Design to Documentation
  - Initial Work Addresses:
    - Cable Installation
      - Critical Cable Attributes
      - Tooling
      - Equipment
    - Cable Hardware Preparation and Build
      - Splice Closures
      - Frames
      - Snow Shoes
    - Splicing, Testing and Documentation
  - Output for Contractor is Quality Assurance Install for Your Client
PROCESS IMPROVEMENTS

- American Polywater Providing Link to Pull Planner on PCCA Website
  - Thanks Tom Fredericks
- Running Line Dynamometer
- Breakaway Swivels
  - Recommend Tooling Vendors Change Design to 575 lbs +/- 25 lbs or 550 lbs +/- 50 Lbs
  - Maximize Pulling Potential for Contractor to Maximize FO Cable’s Capability
- Over-under Figure Eighting Techniques to Preclude Flipping Cable
- Plastic Mesh Pulling Grips for Lowest Profile Congested Duct Pulls
- Implement More Reasonable Cable Slack for Handholes
FOA – FIBER OPTICS ASSOCIATION

- Great Resource for Training Material and Fiber Optic Certifications
- FOA.org - Jim Hayes
- https://foa.org/NECA301.html (Fiber Optic Cable Installation Guide)
- The FOA Reference Guide to Fiber Optics (in English, Spanish and French)
- The FOA Reference Guide to Premises Cabling
- The FOA Reference Guide to Outside Plant Fiber Optics
- The FOA Outside Plant Construction Guide
- The FOA Reference Guide To Fiber Optic Network Design
- The FOA Reference Guide To Fiber Optic Testing
PLEASE PROVIDE FEEDBACK

- Members and Associate Members
  - Are We Addressing All of Your Needs
  - What are We Missing
  - Share Success Stories

- Decision on Release of Tool
  - PCCA Members Only
  - Open to Public
  - Develop a Limited Contractor Access for the Tool and not full access to PCCA data