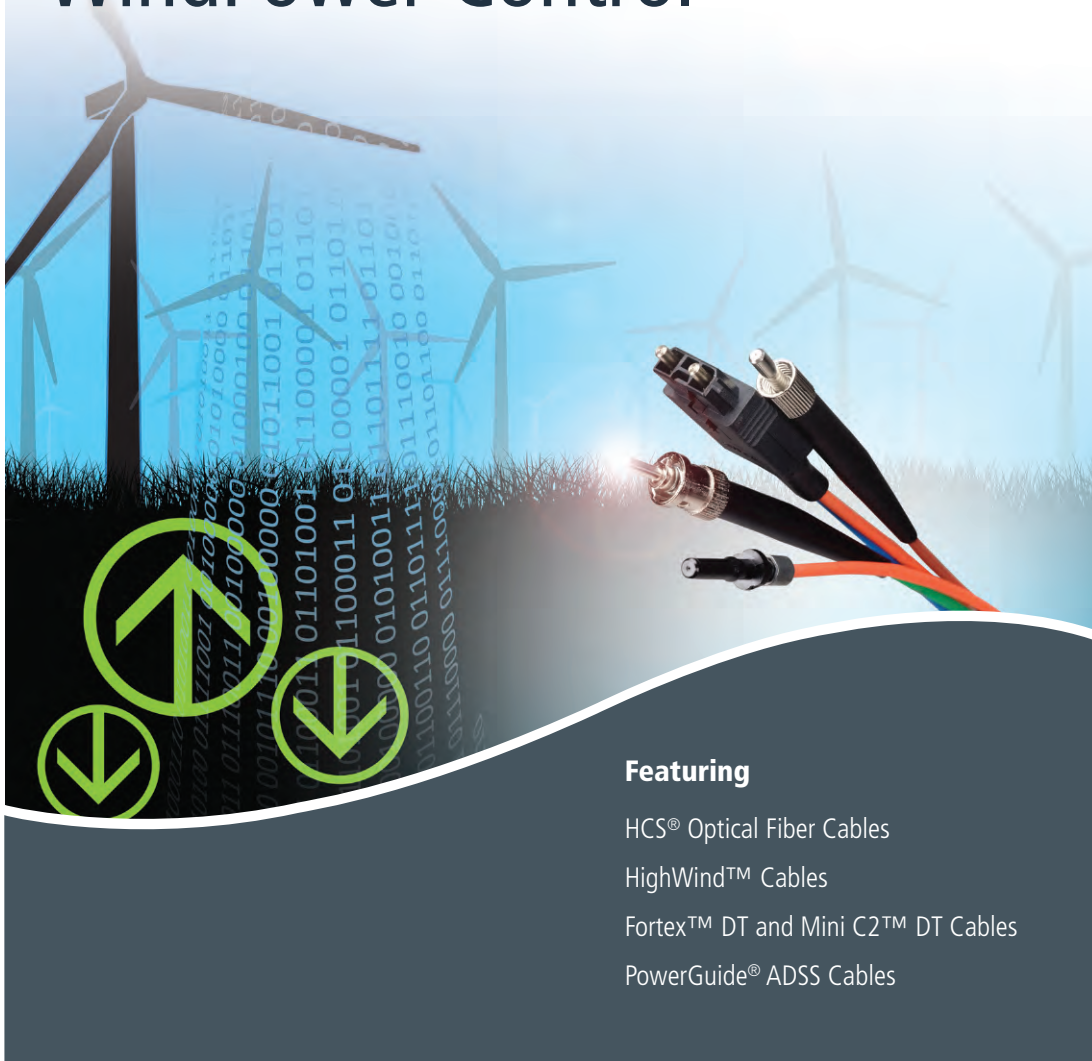




A Furukawa Company

Optical Fiber Solutions for

WindPower Control



Featuring

HCS® Optical Fiber Cables

HighWind™ Cables

Fortex™ DT and Mini C2™ DT Cables

PowerGuide® ADSS Cables

Fiber Optics in the Wind Farm

In the quest for energy, windpower is proven and plays an increasingly important role. As a leading supplier of industrial-grade fiber optic links for wind towers OFS is committed to renewable energy generation. Cables using HCS® fiber from OFS often extend from the turbine to the controls at the base of the tower, providing reliable high-speed data transfer and isolation from electrical surges in harsh environmental conditions. We also support advanced windpower applications, such as strain-, load-, and temperature sensors used in turbine rotors and blades, with specialty optical fibers and fiber Bragg gratings customized for your application.

A key advantage of optical fiber is its immunity to EMI/RFI, especially in the noisy environment created when power is generated and transmitted. OFS has taken fiber's advantages even further with rugged, durable cables, connectors, and the hand-held tools used to safely and quickly terminate the appropriate cable lengths on site.

Advantages of Fiber vs Copper

- Supports higher data rates over longer distances
- Is immune to EMI (electromagnetic interference) and noise
- Is lighter and smaller than copper
- Is more secure in communication transmissions

Diverse Solutions from One Company

OFS is a world-leading designer, manufacturer and supplier of optical fiber, optical fiber cable, connectivity, optical components, fusion splicers, and specialty photonics products. We create solutions beginning with fiber and building on cabling and other componentry, working together among our design, production, and research divisions to provide the fiber optic solutions you need in any industry, any environment.

With renewable energy
and climate concerns

on the rise,

OFS can help you

develop and expand

WindPower capacity.



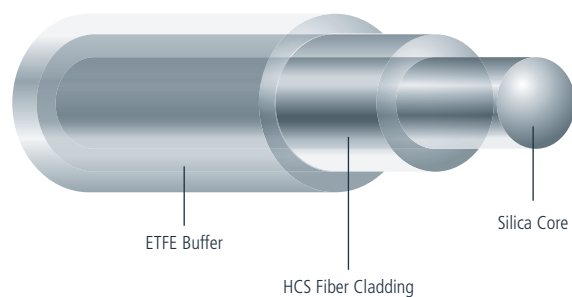
Optical data links are used throughout wind farms in different ways. Links on the turbine run from the control box at the base of the tower to the nacelle at the top. Interconnections run between individual towers within the farm. Links also run from turbines back to the central operations center.

Turbine towers are exposed to the weather, and many of the windiest regions are also located where the conditions are extreme. Optical fiber is flexible and strong, with a tensile strength greater than steel, but the cable design must offer enough protection to the fiber so that it meets the lifetime requirements of the wind farm.

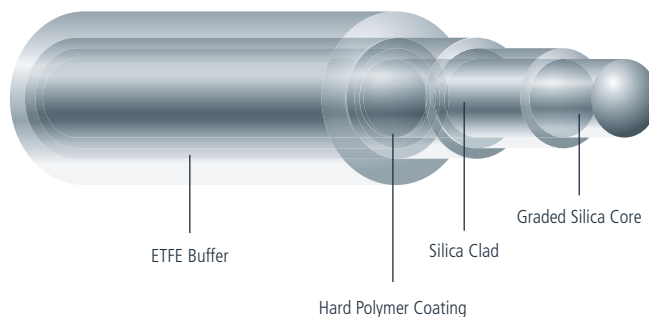
Considering that there are so many different wind farm applications, more than one fiber optic cable solution is needed. OFS's wide selection offers options for each application.

Turbine Data Links

HCS optical fiber cables are used to connect the turbine's controls to the nacelle. These fibers have a hard fluoropolymer coating, buffered with ETFE for superior abrasion, chemical and temperature performance. This robust fiber is twice the diameter of standard telecommunications grade fiber and offers a wider temperature range as well as Crimp & Cleave termination system that simplifies termination or repair on site with easy-to-use tools. The step- or graded-index multimode fibers can be cabled in several designs under our HighWind™ Cable tradename.



Step-Index Construction



Graded-Index Construction

What is HCS® Optical Fiber?

The HighWind Cables described in this brochure are HCS fiber cables. This class of cables, specifically, is compatible with Crimp & Cleave termination to make on-site installations and repairs easier.

HCS fiber is very strong, rugged and flexible and is designed to be quick and easy to terminate in the field. Its key feature is a hard polymer material applied over the glass that creates a durable anchor for the crimped connector. Compared to standard telecommunications fiber, it also has a wider temperature range of -65° to +125°C.

HCS Fiber Choices

The fiber you choose is dependent upon the other components and the protocol used in your turbine controls systems. The options that follow each offer:

Tensile strength: >650 kpsi Proof test: \geq 150 kpsi

200 μ m HCS Step-Index Fiber:

the standard on many installed turbines

Dimensions: 200/230/500 Numerical Aperture: 0.37

Attenuation @ 650 nm <10 dB/km, @ 850 nm <6 dB/km

62.5 μ m HCS Graded-Index HCS Fiber

Dimensions: 62.5/200/228/500 Numerical Aperture: 0.275

Bandwidth @ 850 nm >200 MHz-km, @ 1300 >500 MHz-km

Attenuation @ 850 nm <3.5 dB/km, @ 1300 <1.2 dB/km

50 μ m HCS Graded-Index HCS Fiber

Dimensions: 50/200/228/500 Numerical Aperture: 0.20

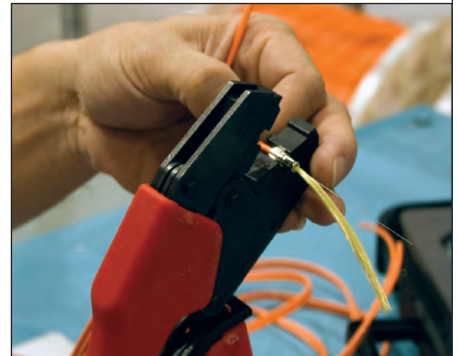
Bandwidth @ 850 nm >400 MHz-km, @ 1300 >400 MHz-km

Attenuation @ 850 nm <2.8 dB/km, @ 1300 <1.0 dB/km

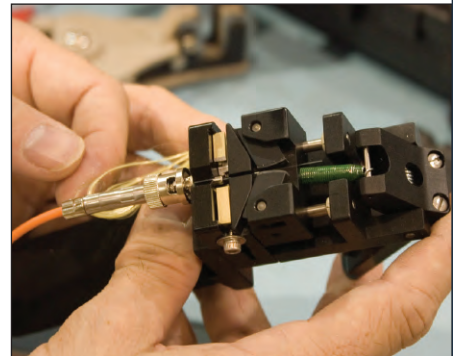
Crimp & Cleave Connectorization

OFS offers three main connector styles for HCS fiber products that incorporate Crimp & Cleave technology (a fourth, the F07, is also available). The connectorization process takes three minutes or less using simple tools included in our Termination Kit. Performance can be verified using a portable Insertion Loss Testing Kit. If lengths are known, OFS can supply factory-terminated assemblies.

Crimp
connector directly onto
the fiber coating
for strong, solid connector
retention.



Cleave
the fiber end face with
the pull of a trigger and
no consumables.






Finished!
a connectorized cable
ready to plug in to your
application.

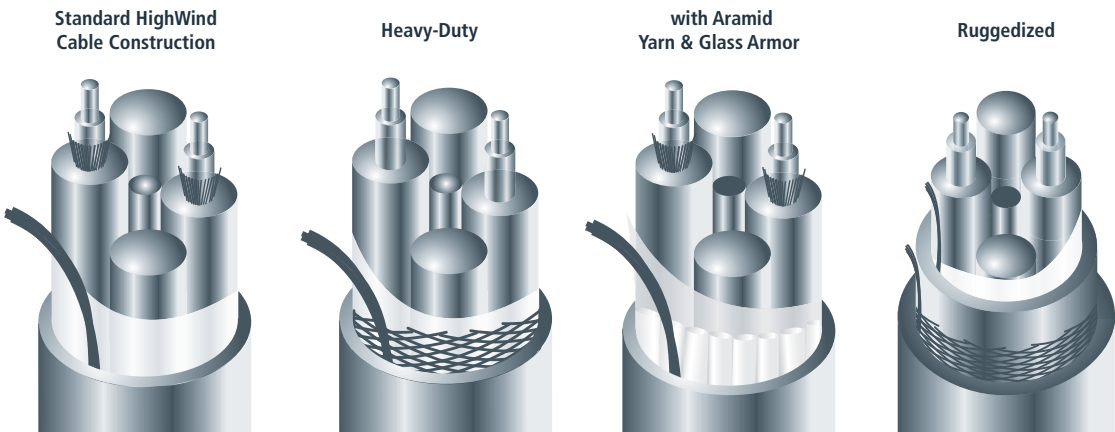


HighWind Cable Design Options and Order Number Guide

HighWind Outdoor Water-Blocked Breakout Cables:

Choose your cable according to the connector style used in your system, the fiber size for your protocol, the number of fibers you wish to include in a single cable, and/or the level of protection needed for the anticipated environment of your application. Below are common choices.*

Crimp & Cleave Connectors	Fiber Type		
	200 μm Step-Index	62.5 μm Graded-Index	50 μm Graded-Index
For ST® and SMA Connector Styles: ST: compatible with the most popular datacom transceivers. Bayonet mount offers quick disconnect.  SMA or Harsh Environment SMA: most rugged offering, threaded mount for maximum pull resistance. 	2.5 mm Sub-unit Cables with Aramid Yarn		
	2 Fibers AC02602-10 AC02843-10 Heavy Duty	C17764 C17767 Armored	C19648 C19651 Armored
	4 Fibers AC01284-10	C17765 C17768 Armored	C19649 C19652 Armored
	6 Fibers AC01285-10	C17766 C17769 Armored	C19650 C19653 Armored
For V-Pin Connector Style: Compatible with Avago's versatile link transceivers. Recommended when lowest cost and field termination are needed. 	2.2 mm Sub-unit Cables without Aramid Yarn		V-Pin Connectors are not compatible with 50 or 62.5 μm fiber sizes
	2 Fibers BC06145-02 C10686 Ruggedized	4 Fibers BC06145-04	



* Other HighWind Cable options are available beyond those illustrated here, including: higher fiber counts, various jacket colors, cable printing, UL ratings, and more.

Cables to Connect Within the Wind Farm

Interconnection of turbines sometimes requires cables to be buried in conduit or directly in the ground. In other installations, such as those in rocky areas, the cables require aerial connections. Underground, the cables must offer protection from rodents, moisture, and freeze and thaw cycles. For communications links from the towers to the central computer, you need a variety of cable features that protect your data en route and remain easy to install and connectorize. For long and short spans with exposure to icing, heat, and the sun's radiation, OFS offers a full portfolio of cables.

Fortex DT Cables:

Lighter weight, but highly durable

All-Dry—replaces messy gels with super-absorbent yarn

Available in two versions—light armor or single jacket

Mini C2 DT Cables:

Smaller size, weight, and fiber counts

All-Dry—replaces messy gels with super-absorbent yarn

PowerGuide ADSS Cables:

All Dielectric Self-Supporting

For aerial to underground installations

Available with a variety of single-mode or multimode fibers

Various span lengths up to over 1000 meters*

Reduces wind and ice loading

* Exact span lengths depend on loading conditions, fiber counts, and clearance requirements.

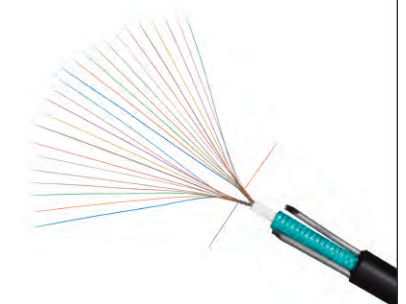
Fortex DT Cable:
Light Armor



Fortex DT Cable:
Single Jacket



Mini C2 DT Cable



PowerGuide
ADSS Cable



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