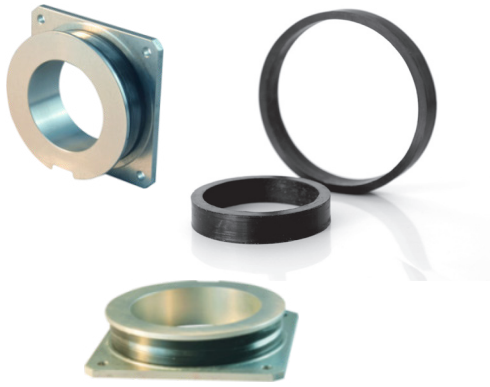
Fiber Gyro Coils (FC series)



Through years of experience and hard work, General Photonics has perfected the art of coil winding for the fiber gyro industry. A suite of advanced polarization test instruments specially designed for testing the quality of fiber coils ensures the consistent production of high performance coils. General Photonics' PM coils can be wound with different winding patterns such as quadrupole, octupole, or other types to minimize the Shupe effect, which degrades the performance of a fiber gyro under temperature-varying conditions. In addition, special Shupe effect mitigation techniques are offered as a special service to customers with special requirements for superior coil performance in the most demanding temperature and vibration environments. Unlike other commercial coils on the market that come with only rudimentary specifications such as insertion loss and PER, which are insufficient to guarantee coil performance in a real world gyroscope, General Photonics offers the most comprehensive testing data on the market. Such data guarantees that the coils received are trouble free, which ultimately reduces troubleshooting, cost, and integration time. Comprehensive test data include polarization crosstalk vs. distance along the fiber at specified temperatures, with resolution of a few cm; PER, IL, etc. Our standard coils are frameless, held together with our specially formulated potting adhesives. However, they can be offered framed using General Photonics' proprietary techniques.

Specifications[1]:

Operating Wavelength[4]	840, 1060, 1310, or 1550 nm
Winding Induced IL	< 0.2 dB/km
PER[2]	> 24 dB, over full temperature range
PER variation over[2] (-40 °C to +80°C)	± 2 dB
Max polarization x- talk peak [2]	< −50 dB at 25 °C <−45 dB over the full temperature range
Number of polarization x-talk peaks above −55 dB [2]	<15 at 25 °C < 30 over the full temperature range
Average polarization x-talk [2]	< −68 dB at 25 °C < −65 dB over the full temperature range
Max bias error[3]	No Shupe mitigation: <2 degrees/hour typical peak-to-peak Level I Shupe mitigation: <1 degree/hour typical peak-to-peak Level II Shupe mitigation: < 0.5 degrees/hour typical peak-to-peak Level III Shupe mitigation: < 0.25 degrees/hour typical peak-to-peak
Fiber length[2]	10 m to 5 km
Fiber diameters[4]	135 µm, 165 µm, 250 µm
Coil ID	15 mm to 120 mm
Coil height	5 to 75 mm
Winding patterns	Quadrupole (Standard) Octupole or others (Special)
Operating Temperature	−40 C° to +80 C°
Storage Temperature	−-55 C° to +100 C°

Notes:
1. Specifications provided in the table above are for a sample coil with an ID of 80 mm and a length of 500 m. Actual specifications depend on many factors such as fiber type, fiber length, coil ID, winding pattern etc.
2. Typical values.
3. Shupe effect spec: defined as the maximum bias error caused by temperature transients of 1 degree per minute from -40 C° to 60 C°. (see Fig 2.a)
4. Specify if others.

Features:

- High Performance
- Fully Specified
- Low Polarization x-talk (PM)
- Low Temperature Sensitivity
- Low Vibration Sensitivity
- Highly Symmetric
- Available Frameless or Framed

Applications:

- Fiber Optic Gyroscope (FOG)
- Autonomous vehicles

Related Products:

- Time Delay Coils (TDC)
- Specialty Coils

Tech Info:

- A Novel Method for Determining and Improving the Quality of a Quadrupolar Fiber Gyro Coil under Temperature Variations
- Tomographic Inspection of Fiber Coils Using Optical Coherence Tomography

FAQ:

- Fiber Coils

Ordering Information:

FC – □ – □ – □ – □ – □ – □□ – □ – □

Winding Type:
Q: Quadrupole
O: Octupole
S: Simple
Others specify

Coil ID:
in mm

Coil Height:
in mm

Coil Length:
in m

Fiber Diameter:
in µm

Wavelength:
15: 1550 nm
13: 1310 nm
10: 1060 nm
83: 830 nm
Others specify

Fiber Type:
SM
PM

Shupe Mitigation Level:
0 = No Shupe
A = Level 1
B = Level 2
C = Level 3

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Shupe Mitigation Options:

Level 1 (Part Number suffix "A"):
General Photonics will perform Shupe mitigation procedures based on an average optimization treatment.

Level 2 (Part Number suffix "B"):
General Photonics will perform additional Shupe mitigation treatment including more involved optimization procedures on each coil.

Level 3 (Part Number suffix "C"):
General Photonics will perform Shupe mitigation procedures based on individual optimization procedures specific to each coil including multiple iterations and multiple test procedures. General Photonics will supply details of Shupe errors versus time with step temperature changes. Shupe peak of less than 0.15°/H (or 0.3°/H peak-to-peak) at temperature steps of 1°C/min. are generally achieved. Before the delivery of production quantities of such high precision coils, a minimum of 3 trial coils should be ordered and manufactured, tested and the performance criteria would need to be agreed by both parties.

Typical Performance:

Low Polarization Crosstalk over Wide Temp Range

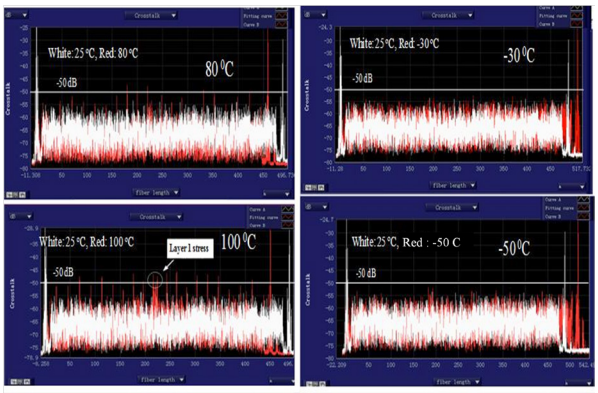

Fig. 1: Polarization crosstalk performance inside coil at -30, -50, 80, and 100°C vs. 25°C

PM Coil: Shupe Effect Mitigation

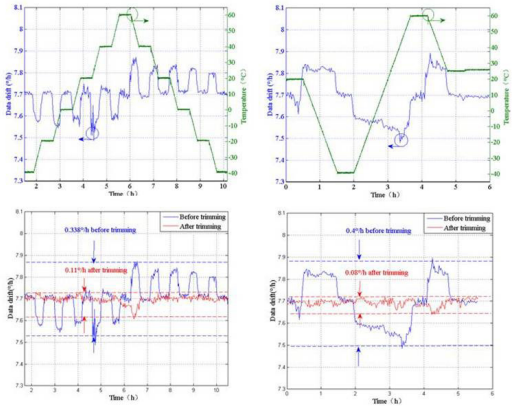

Fig. 2: Rotation rate error with a stairway temperature profile at a temperature c ramp rate of 1°C/ minute. Figures 2c and 2d illustrate the much lower rotation rate error after trimming.

PM Coil: PER Stability performance

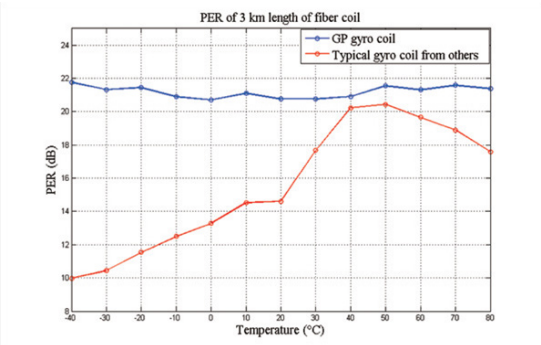

Fig. 3: PER vs. temperature of a 3 km coil from GP (blue) and another vendor (Red). PER variation over a 120°C temperature range: <2dB (GP) vs. >10 dB (others)

PM Coil: PER Repeatability performance

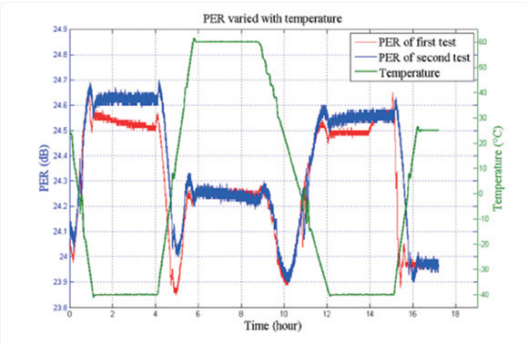

Fig. 4: Typical PER vs. temperature data (Red: 1st test, blue: 2nd test) of a 1.2km coil with PER>24dB and a PER variation of <1dB over a 120 °C temperature range