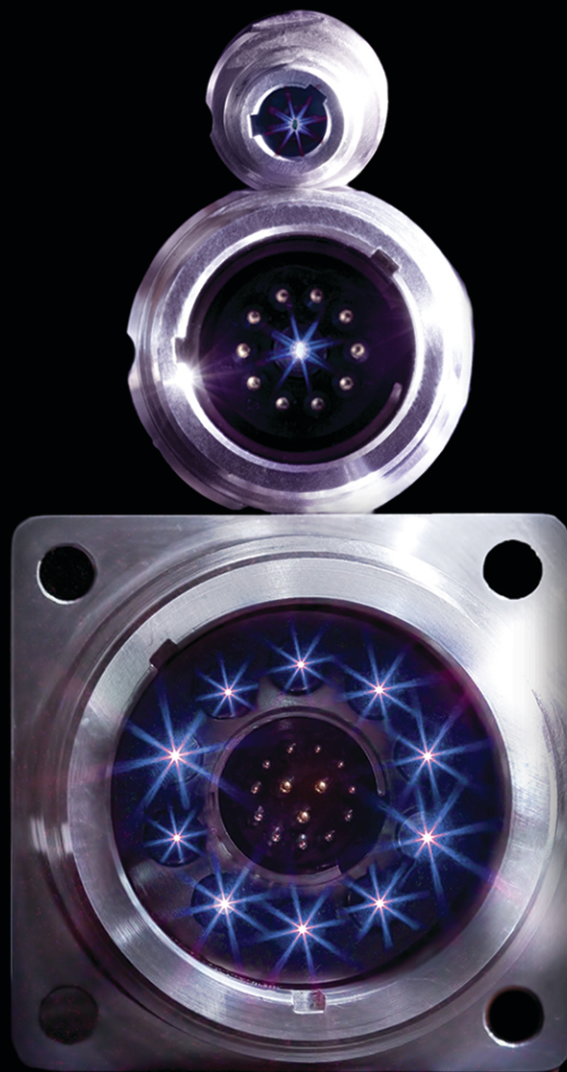


BIRNS Millennium™ Interconnect Solutions



*High Performance . . .
Under Pressure®*

www.birns.com

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Established in 1954, BIRNS is a global leader in the design and manufacturing of high performance connectors, penetrators and cable assemblies for deep ocean use. BIRNS solutions are found worldwide on submarines and submersibles, diving bells and decompression chambers; ROVs, AUVs and UUVs; and on everything from massive manned systems to photonics masts and intricate towed arrays. Everywhere, BIRNS interconnect products deliver superior performance: faster data transfer for better telemetry and communications, and safer, more reliable power distribution in severely demanding environments.

BIRNS' comprehensive Quality Management System is integrated throughout each process, from sales, design, and production to receiving, in-process and final inspection, through delivery and customer service. The entire QMS is process-based and dedicated to evidence-based continual improvement, with consistent, extensive employee training, involvement, and internal oversight.

BIRNS' QMS is certified to ISO 9001:2015 by DNV GL. BIRNS' Oxnard facility is certified by the US Navy's Submarine Maintenance Engineering, Planning and Procurement (SUBMEPP) division to NAVSEA S9320-AM-PRO-020. All cognizant BIRNS QA personnel and production technicians are certified¹ to both J-STD-001 and WHMA-A-620-A Class 3², and BIRNS is also DD-2345-certified and DOS/DDTC/ITAR registered.

BIRNS QUALITY POLICY

BIRNS' policy is to design, make and deliver high performance products that consistently exceed expectations for quality, value and overall customer experience.

To that end we maintain an unwavering customer focus; continually improve our processes, products, and services; use a process-based QMS and evidence-based decision making; and adhere to strict ethical standards and sustainable business practices.



1. IPC-certified trainers/certifiers are on staff full-time.
2. Class 3 is for products where continued high performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when required, such as life support or other critical systems.

Introduction/General Features

The BIRNS Millennium series is a high performance, high density dry-mate interconnect range suitable for deep submergence applications to 6km depth. This series is available with solid (molded) or oil-filled cables in straight or 90° configurations and offers high and low voltage, coax, fiber optic, and electro-coax, electro-optical and electro-opto-coaxial hybrids. Non-coax configurations are open-face rated to 6,000 meters without need for glass sealing—even with PBOF cables.

BIRNS Millennium cable assemblies provide quantifiably superior performance characteristics: faster data transfer rates and greater signal bandwidth, lower optical insertion loss, greater depth capability, less RF loss and better VSWR. This has been achieved through meticulous and innovative engineering and rigorous testing, and includes a range of industry-leading design features described in detail in the rest of this section. The result is a powerful, robust subsea connector series providing the highest performance field-proven interconnect solutions on the market.



BIRNS 3P-2C6 electro-coax connector pair with 90° PRO-020 cable overmolding

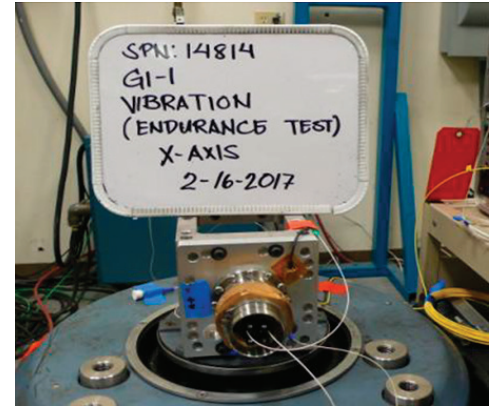


BIRNS electrical oil-filled (PBOF) cable assembly

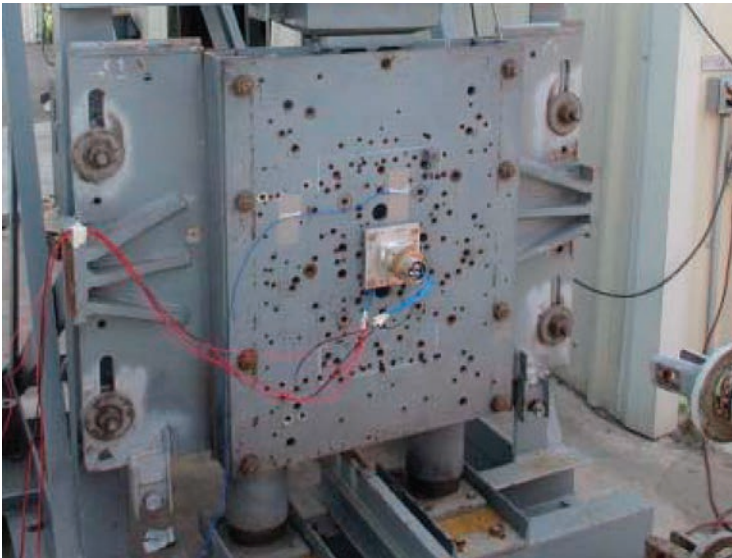


BIRNS 30-4F2 electro-optical SM titanium connector pair on high-performance BIRNS EOM cable with Next-Gen PUR overmolding

BIRNS rigorously inspects, tests, and qualifies products to assure reliability in use and high performance under pressure. Representative connectors have been subjected to extreme temperature operational testing; hot and cold thermal shock; variable frequency and endurance vibration testing; and extended hydrostatic testing (including open-face) at 1°C.



Exploratory, variable-frequency, and endurance vibrational testing performed per MIL-STD-167-1A, Type 1, Table III, to 14 Hz—no signal discontinuities before, after, or during vibration.

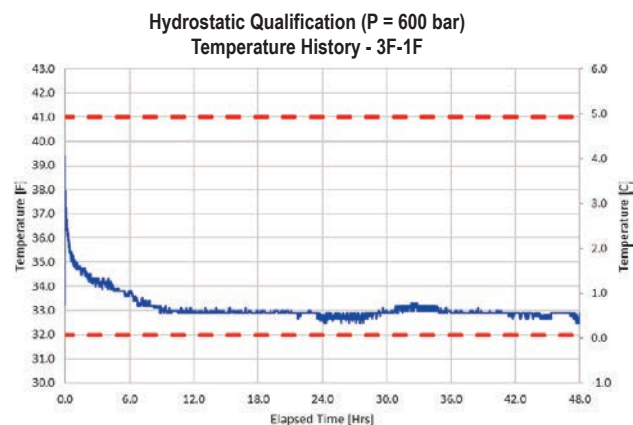
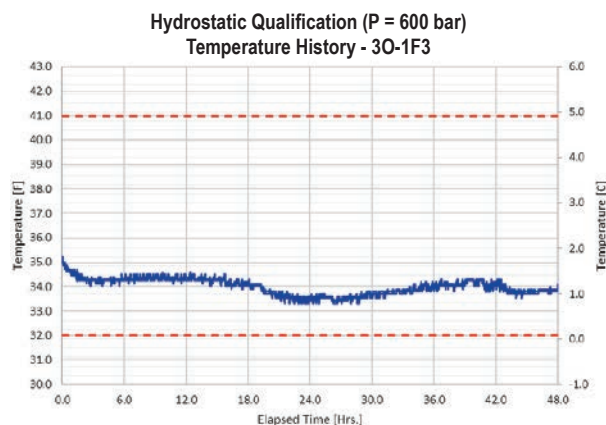
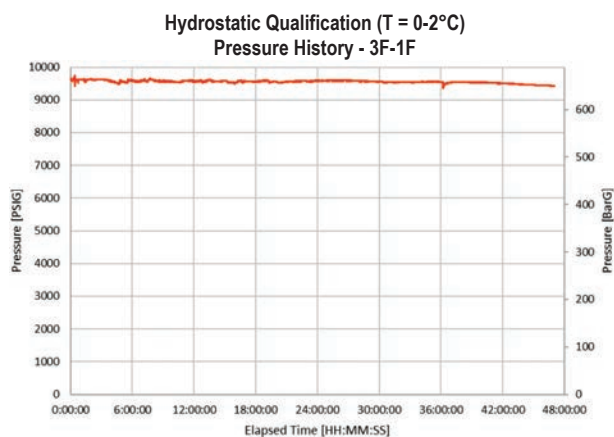
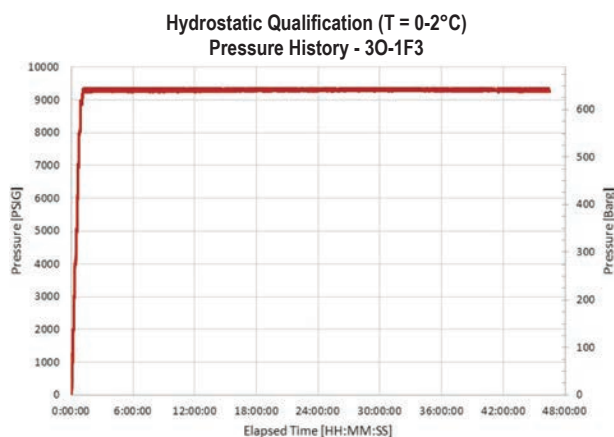


Operational signal transmission during shock testing of BIRNS connectors per MIL-S-901D Grade A Class I Type C, with impacts from the TOP/BACK (L) and SIDE (R).

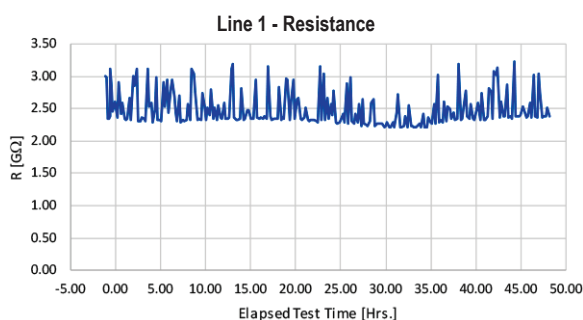
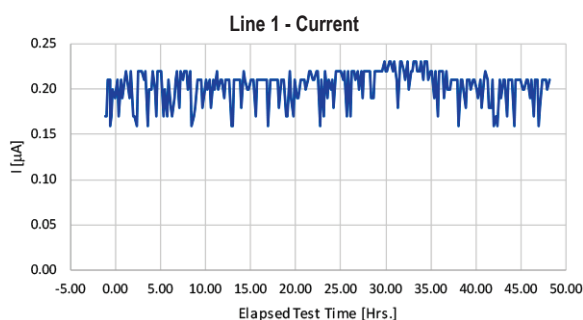
Qualification and verification of products' ability to reliably withstand high pressure is fundamental to BIRNS' product development. Connectors and cable assemblies are subjected to hydrostatic testing while mated and open-face. Sometimes high pressure is combined with low temperature to more accurately simulate actual conditions at hadal (6km) seawater depth.



Preparing various inserts for high-pressure open-face hydrostatic testing.



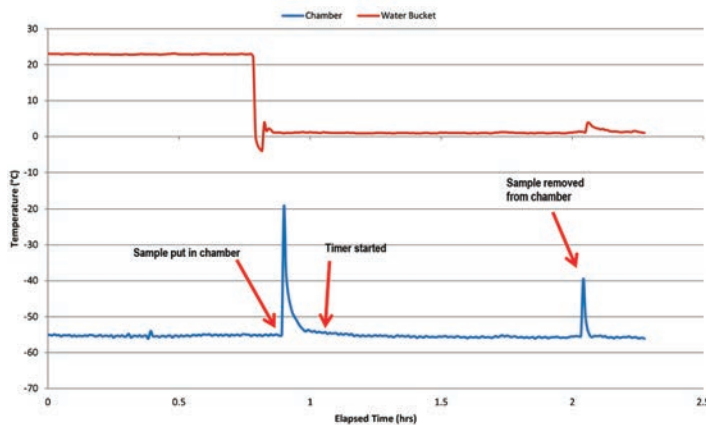
Extended (48-hour) continuous cold-water hydrostatic testing of the 3F-1F and 30-1F3, optical and electrical testing performed concurrently.



IR and leakage current for three electrical conductors during 48-hour hydrostatic testing at 1°C.

For some applications, it's important to know that BIRNS products also withstand temperature extremes and thermal shock. Select EO connectors have been successfully tested (operational and non-operational) through the temperature range of -40°C to $+70^{\circ}\text{C}$, as well as hot and cold thermal shock. This is your assurance that BIRNS connectors and cable assemblies provide reliable service and superior performance.

14814 Birns G1-6 Thermal Shock Cold Climatic Chart



Outside the environmental test chamber.



Inside the test chamber at -55°C .



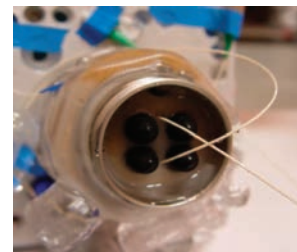
Inside the test chamber at $+65^{\circ}\text{C}$.



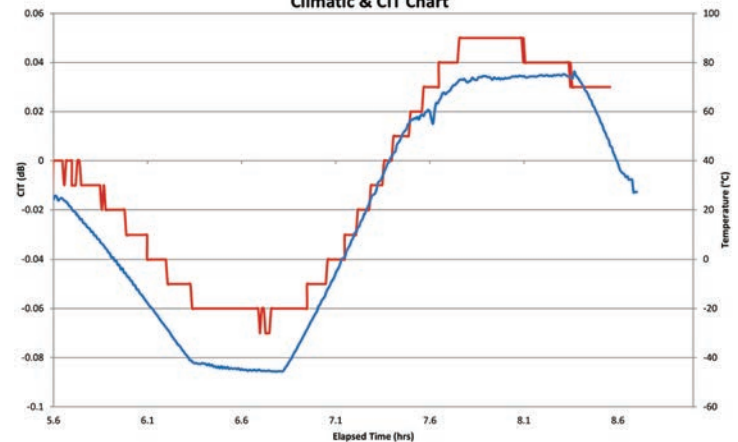
After over an hour at -55°C , the connector is plunged into 0°C ice water.



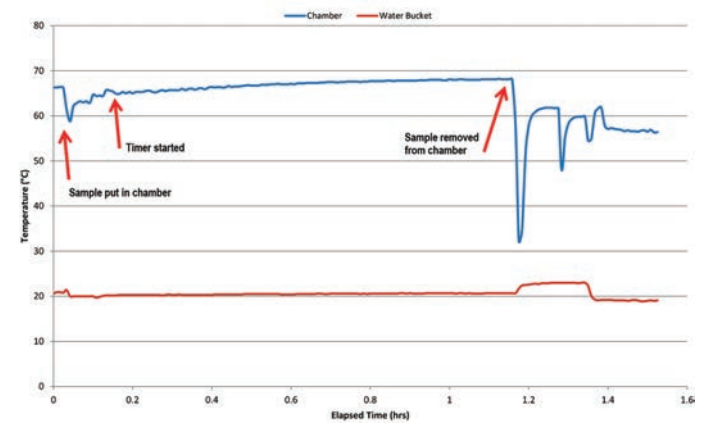
After the test is completed, the BIRNS connector is embedded in ice...but still transmits optical signal.



14814 Birns G1-3 Operational Temperature Climatic & CIT Chart



14814 Birns G1-4 Thermal Shock Hot Climatic Chart

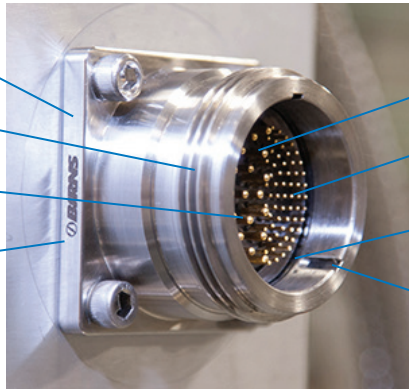


Shells available in SS or TI

Square Acme threads resist mechanical damage

Open-face pressure resistance is standard

Shells are individually serialized for quality and traceability



Replaceable, interchangeable inserts

Conductors: 22-, 20-, 16-, 14- and 10-AWG, optical fiber, and RF in same connector

Dual redundant O-ring seals ensure long-term sealing reliability

Three key options available for purposeful incompatibility

Sturdy hard phosphor bronze coupling rings resist mechanical damage

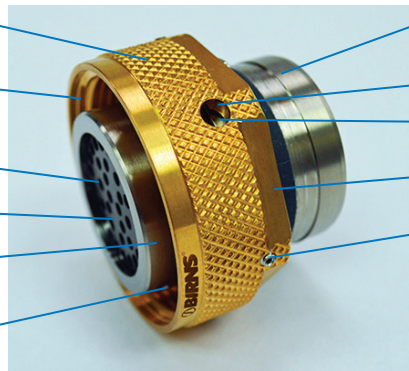
Special coupling ring Higbee threads facilitate proper coupling

Heat-treated BeCu sockets keep spring strength

Replaceable, interchangeable inserts

Shells are individually serialized for quality and traceability

Dual integral long, square keys provide long-term positive indexing



Shells available in SS or TI (with Delrin or Ti coupling rings)

Drain/view holes provide visual coupling verification

Positive stops preclude over-tightening

Coupling rings have hex flats for ease of loosening

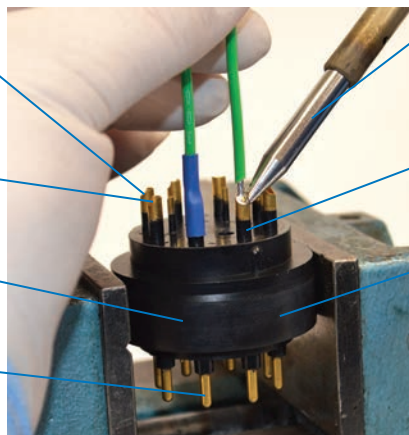
Locking set screws preclude vibration-loosening in service

All solder pots are scalloped and face outward, making it easier to place wires into solder pots, reducing termination mistakes, costs, and technician fatigue

Solder pots accept the largest stranding of any wire size

Inserts can be terminated outside the shell for convenience and cost reduction

Thick (50 μ m) gold plating over Ni underplate on all pins and sockets minimizes contact voltage drop

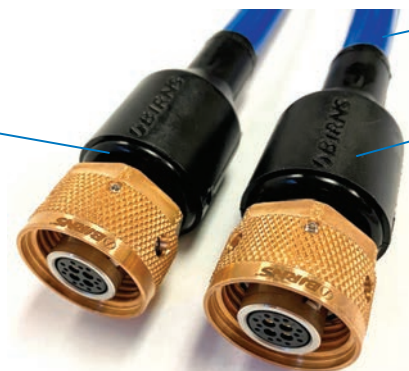


Soldering access is unrestricted by wings or other obstructions

Insulated solder pots are easy to cover with heat-shrink tubing, increasing IR between contacts

Inserts have smooth, molded-in O-ring lead-in chamfers (don't cut O-rings during installation) for sealing

Assemblies are completely configurable (length, tolerance, labeling, shield treatment, solder type, overmolding material, clocking, rotation)



BIRNS high-performance cable stock

Next-Gen PUR pressure overmolding

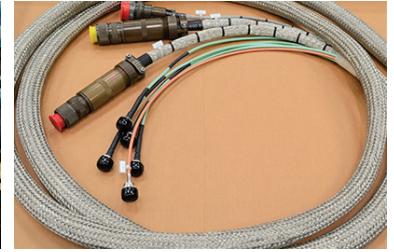
BIRNS performs multiple value-added services in the fabrication of Millennium cable assemblies—many of which are available on a subcontract basis.



High-performance cable assembly connectorization and overmolding. BIRNS is SUBMEPP-certified to NAVSEA S9320-AM-PRO-020, and offers three PUR grades to meet customers' needs.



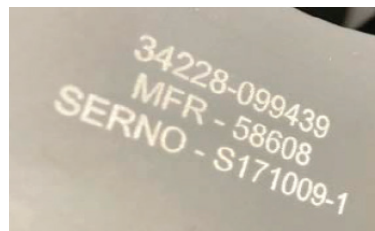
BIRNS' professional assembly, filling (on request) and testing of oil-filled cable assemblies provides turn-key solutions that reduce costs and optimize reliability.



BIRNS' team is expert at electrical¹, optical and SHF RF terminations and wire harness assembly.



BIRNS' skilled mechanical team terminates steel and aramid-fiber strength members, often combined in EOM cables with optical SMF or MMF and/or low or high-voltage electrical lines.



Custom laser-etching of metal parts is available, as is a choice of six standard cable-marking methods.

1. All technicians are certified to J-STD-001 and WHMA-A-620A Class 3. IPC-certified trainers/certifiers are on staff full-time.



BIRNS' custom-engineered programmable hydrostatic system has automated digital data recording capabilities. It can simultaneously run three independent pressure circuits in six chambers at pressures up to 20,000 PSI (138 MPa), in fresh or salt water.



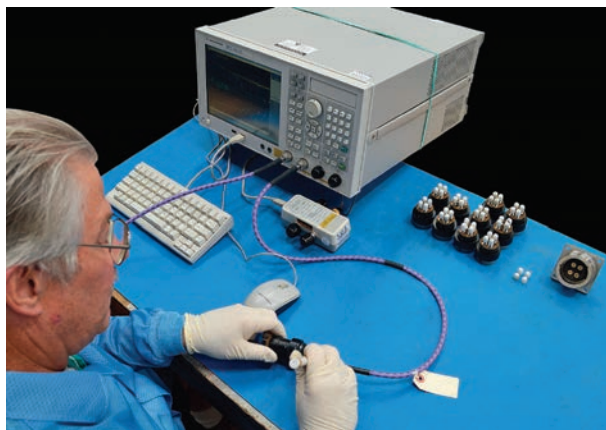
Low temperature/high pressure test capability simulates actual conditions at depth, with long-term continuous pressure testing in a controlled 2°C ($\pm 1^\circ\text{C}$) environment; programmable, automated multiple pressure cycles; real-time electrical and optical test data recording; and continuous digital output of pressure and temperature data.



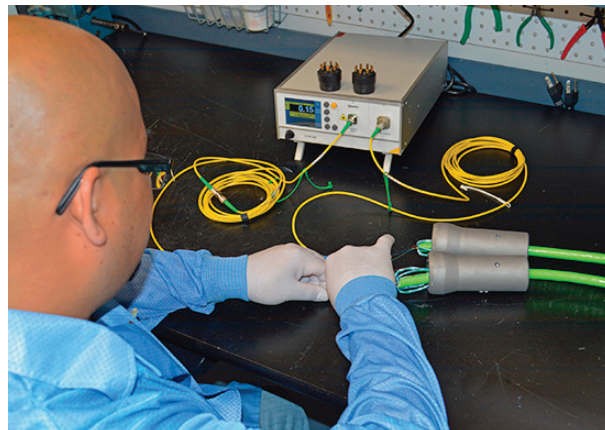
Final acceptance tests using a Kikusui TOS9213S DC DWV/IR Tester with high voltage scanners. Our custom-made programmable system permits simultaneous testing of up to 16 electrical circuits at voltages up to 6kV, even while under hydrostatic pressure.



Testing of complex wire harnesses at voltages up to 2100VDC/1200VAC, with a CAMI 829A HVX-21 128-line test system meeting all IPC/WH-MA-A-620B electrical test requirements.



Insertion loss and VSWR testing from 100 kHz to 18GHz using a Keysight Technologies E5063A ENA high frequency vector network analyzer.



EIA-455-A testing of electro-optical connector assemblies using an Opto-Test OP940-SM-13/15 Return Loss Meter with dual wavelength InGaAs detectors.

Receptacle Assemblies

1. Using your system circuitry needs, determine the required QUANTITY and SIZES of lines (electrical, RF, optical), and select the appropriate pin configuration from the BIRNS Millennium Pin Configuration chart. (See Pin Configurations, Page 12.) The pin configuration determines the shell size and pin number (e.g. "3M-16").

Pro Tip: if none meet your needs, contact BIRNS for a custom configuration.

2. Select the desired Receptacle type: FR, OR, BR (e.g. "3M-16-FR"). (See Graphical Overview, Page 18.)

Pro Tip: when using OR or BR, remember Nut/Washer sets. See Nuts & Tools, Page 58.

Select the shell material, Key Options, and inboard termination as needed. See Part Numbering, Receptacles (non-optical), Page 21. For optical or electro-optical receptacles, see Part Numbering, Optical/EO Receptacles, Page 39.

Cable Assemblies

1. The Receptacle determines its CP mate (e.g. "3M-16-CP"). Select the CP shell material and Key Options. See Cable Plugs, Page 26.

Pro Tip: standard (K0) CPs universally fit ALL Receptacles! If Key Options are needed, make sure the CPs have appropriate Keys. See Key Options, Page 19.

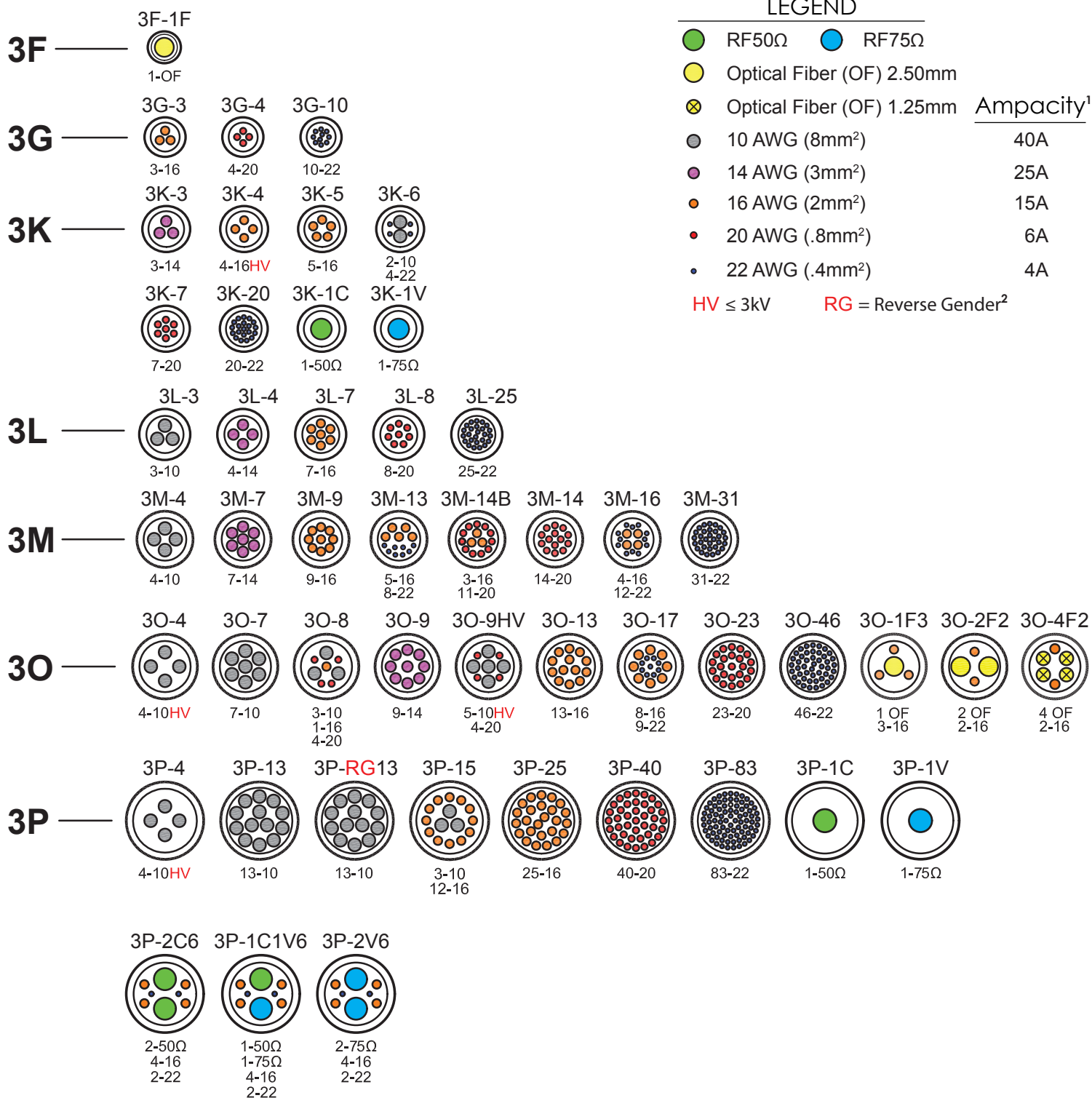
2. Select MOLDED (solid) or OIL-FILLED cable. For MOLDED cable, see Part Numbering, Molded Cable Assemblies, Page 28, and specify cable type or part number. See Cable Stock, Page 14, and Molded Cable Assembly Configuration Guide, Page 30.

Pro Tip: if no cable exists, contact BIRNS to develop new cable.

3. For OIL-FILLED cable, see Page 42, Oil-Filled Cable Assemblies, and select backshell (Hose Attachment), hose angle, hose OD, hose type, cable length, wiring diagram, wire type and insulation, special termination method(s) such as twists per inch, shield treatment, length tolerance, back-potting, clocking, rotation, and oil-fill material.

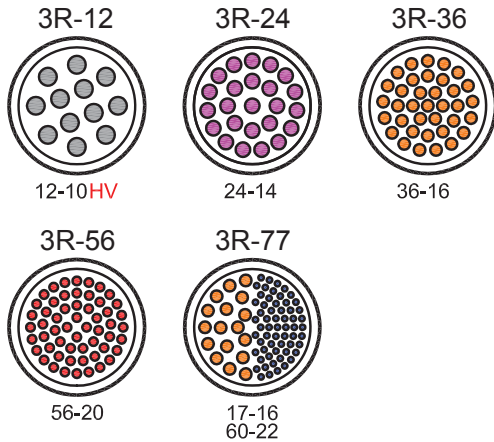
Incidentals & Accessories

- Value-added services, such as termination, overmolding and testing: see Value-Added Services, page 9.
- Sealing caps: see Caps, DSPs & DSRs, Page 48.
- Nuts and Tools: see Nuts & Tools, Page 58.












1. BIRNS ampacity values are informational guidelines, exclusive of bundling derating and ambient temperature adjustments. Electrical designers must consider all factors affecting ampacity. See the "Electrical Performance" page for more information.
2. In RG configurations, sockets are in the Receptacle and pins are in the Cable Plug.

3R —



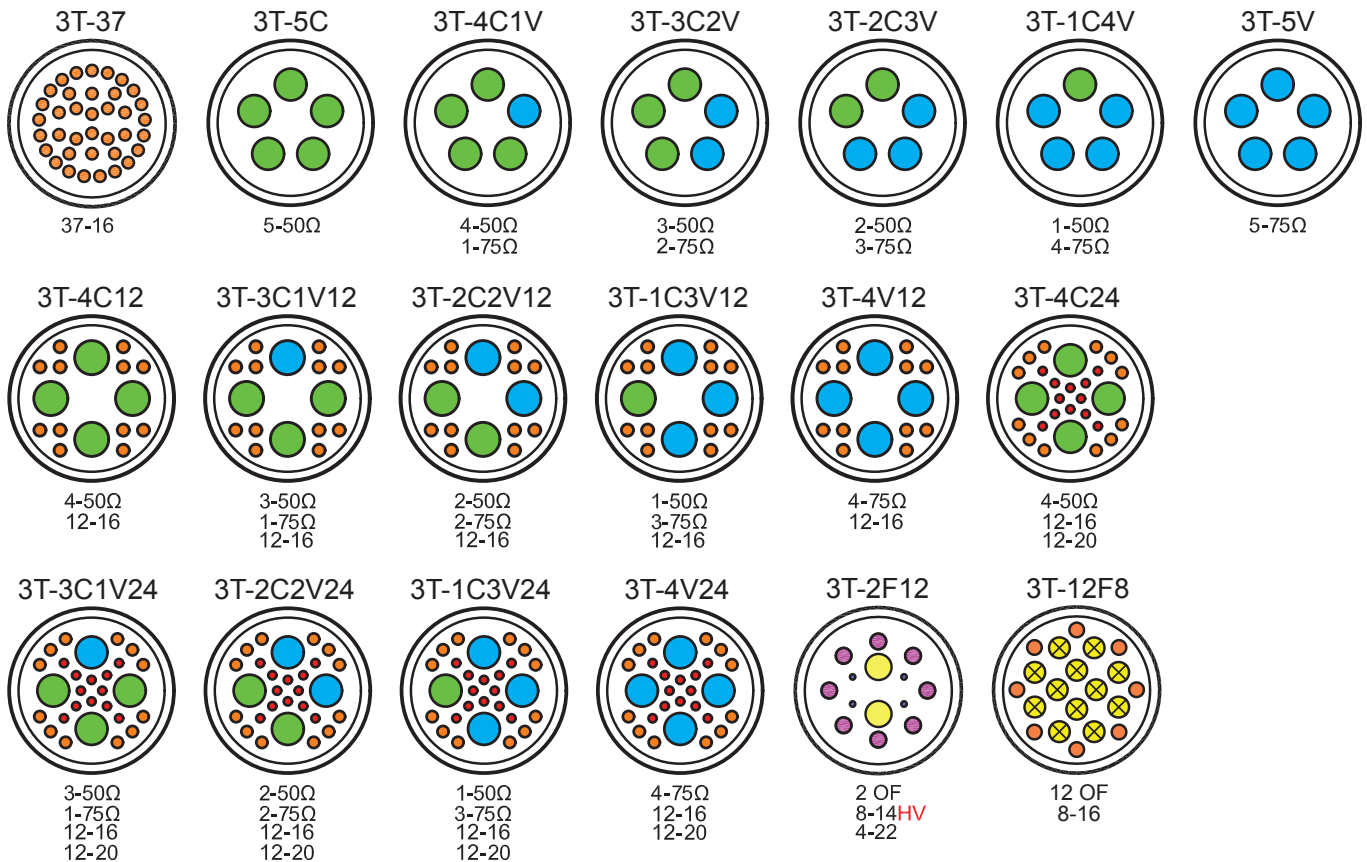
LEGEND

	RF50Ω		RF75Ω
	Optical Fiber (OF) 2.50mm		
	Optical Fiber (OF) 1.25mm		Ampacity ¹
	10 AWG (8mm ²)		40A
	14 AWG (3mm ²)		25A
	16 AWG (2mm ²)		15A
	20 AWG (.8mm ²)		6A
	22 AWG (.4mm ²)		4A

HV ≤ 3kV

RG = Reverse Gender

3T —


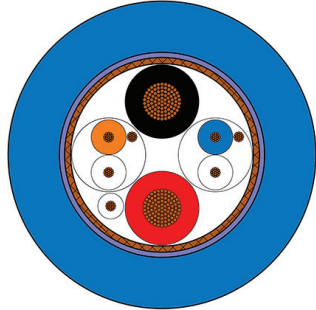



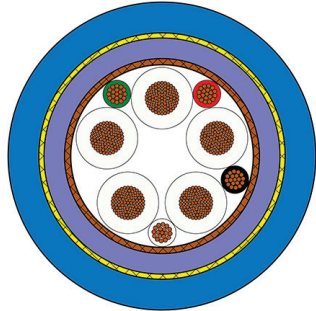


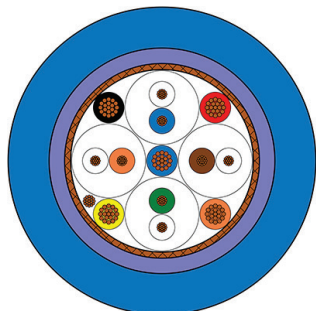


*The 3T-2F12-CP is presently depth-limited to 2,000m (open-face).

1. BIRNS ampacity values are informational guidelines, exclusive of bundling derating and ambient temperature adjustments. Electrical designers must consider all factors affecting ampacity. See the "Electrical Performance" page for more information.

BIRNS is developing a series of exclusive, custom cables for select BIRNS Millennium pin configurations, many of which are kept in stock. BIRNS cables are color-coded as follows:

ELECTRICAL: ■ **OPTICAL:** ■ **RF:** ■ **ELECTRO-OPTICAL:** ■ **ELECTRO-RF:** ■ **OPTO-RF:** ■

Applicable Pin Configurations	Cable Description	Cable Part No. & Illustration
<p>3K-6</p>  <p>2-10 4-22</p> <p>3K-POM-ST.9</p>	<p>Power & Signal</p> <ul style="list-style-type: none"> • 2 x 5.3 mm² (10 AWG) 2.0 kV power • 2 x 0.33 mm² (22 AWG) SF/FTP 300V signal • SF overall shield • 6000 msw (19,800 ft.) rated • Ø17.7 mm (Ø.695 in.) nominal OD • 191 mm (7.5 in.) bend radius 	 <p>52A-246 Electrical Cable</p>
<p>3O-9HV</p>  <p>5-10HV 4-20</p> <p>3O-POM-ST.12</p> <p>3O-4</p>  <p>4-10HV</p> <p>3O-POM-ST.12</p> <p>3P-4</p>  <p>4-10HV</p> <p>3P-POM-ST.12</p>	<p>Power & Control</p> <ul style="list-style-type: none"> • 5 x 5.3 mm² (10 AWG) 3kV power • 4 x 1.0 mm² (18 AWG) 600V control • SF overall shield • 5 kN (1,100 lbs.) breaking strength • 7000 msw (23,100 ft.) rated • Ø20.6 mm (Ø.810 in.) nominal OD • 254 mm (10 in.) bend radius 	 <p>52A-266 Electrical Cable</p>
<p>3M-13</p>  <p>5-16 8-22</p> <p>3M-POM-ST.9</p> <p>3M-16</p>  <p>4-16 12-22</p> <p>3M-POM-ST.9</p>	<p>Power & High Speed Signal</p> <ul style="list-style-type: none"> • 5 x 1.5 mm² (15 AWG) 600V power • 4 x 0.33 mm² (22 AWG) SF/FTP 300V signal • SF overall shield • 7000 msw (23,100 ft.) rated • Ø19.1 mm (Ø.750 in.) nominal OD • 191 mm (7.5 in.) bend radius 	 <p>52A-278 Electrical Cable</p>

ELECTRICAL: ■ OPTICAL: ■ RF: ■ ELECTRO-OPTICAL: ■ ELECTRO-RF: ■ OPTO-RF: ■

Applicable Pin Configurations

Cable Description

Cable Part No. & Illustration

3O-23

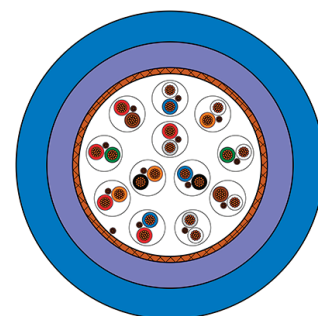


23-20

3O-POM-
ST.12

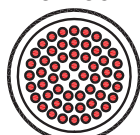
Signal & Control

- 12 x 0.52 mm² (20 AWG) SF/FTP
- 300V signal or control
- SF overall shield
- 6000 msw (19,800 ft.) rated
- Ø18.6 mm (Ø.732 in.) nominal OD
- 186 mm (7.5 in.) bend radius



52A-301 Electrical Cable

3R-56



56-20

3R-POM-
ST.12

3P-40

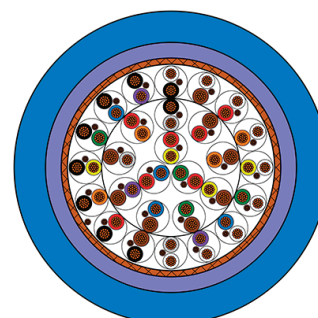


40-20

3P-POM-
ST.13

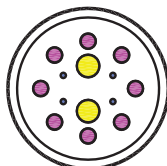
Signal & Control

- 28 x 0.52 mm² (20 AWG) SF/FTP
- 300V signal or control
- SF overall shield
- 6000 msw (19,800 ft.) rated
- Ø26.3 mm (Ø1.035 in.) nominal OD
- 263 mm (10.4 in.) bend radius



52A-302 Electrical Cable

3T-2F12

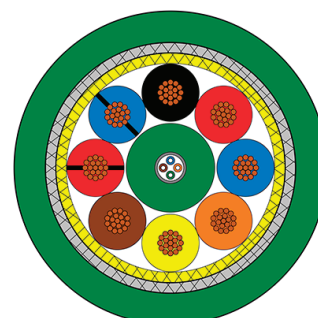


2 OF
8-14HV
4-22

3T-FM-CP

Optical & Power

- 4 x SMF in SS tube
- 8 x 2.08 mm² (14 AWG) 1kV power
- 26 kN (6,000 lbs.) break strength
- 6000 msw (19,800 ft.) rated
- Ø15.5 mm (Ø.610 in.) nominal OD
- 280 mm (11.0 in.) bend radius



52A-277 EOM Cable

ELECTRICAL: ■ OPTICAL: ■ RF: ■ ELECTRO-OPTICAL: ■ ELECTRO-RF: ■ OPTO-RF: ■

Applicable Pin Configurations

Cable Description

Cable Part No. & Illustration

3O-1F3 3O-2F2 3O-4F2



3O-POM-ST.12 3O-POM-ST.12 3O-POM-ST.12

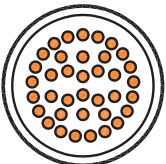
Optical & Power/Signal/Control

- 4 x SMF in SS tube
- 6 x 0.52 mm² (20 AWG) 600V power/signal/control
- 71 kN (16,000 lbs.) break strength
- 6000 msw (19,800 ft.) rated
- Ø15.5 mm (Ø.610 in.) nominal OD
- 254 mm (10 in.) bend radius



52A-304 EOM Cable

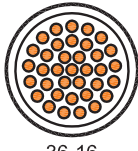
3T-37



37-16

3T-POM-ST.12

3R-36

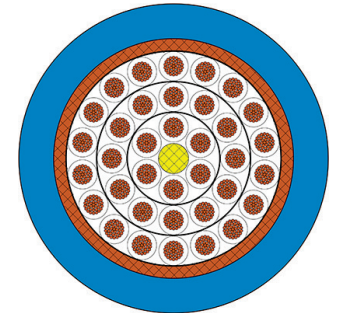


36-16

3R-POM-ST.12

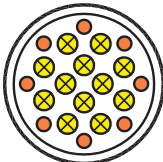
Power

- 36 x 2.08 mm² (14 AWG) 600V
- SF overall shield
- 6000 msw (19,800 ft.) rated
- Ø27.4 mm (Ø1.080 in.) nominal OD
- 254 mm (10 in.) bend radius



52A-305 Electrical Cable

3T-12F8

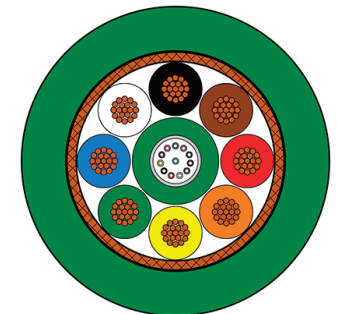


12 OF 8-16

3T-POM-ST.19

Optical & Power

- 12 x SMF in SS tube
- 8 x 1.5 mm² (15 AWG) 600V
- SF overall shield
- 6000 msw (19,800 ft.) rated
- Ø14.0 mm (Ø.550 in.) nominal OD
- 150 mm (6 in.) bend radius



52A-306 EO Cable

ELECTRICAL: ■

OPTICAL: ■

RF: ■

ELECTRO-OPTICAL: ■

ELECTRO-RF: ■

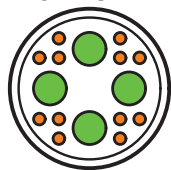
OPTO-RF: ■

Applicable Pin Configurations

Cable Description

Cable Part No. & Illustration

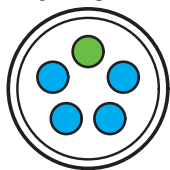
3T-4C12



4-50Ω
12-16

3T-POM-
ST.12

3T-1C4V

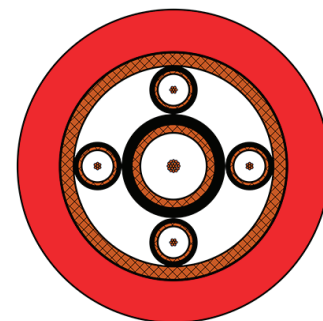


1-50Ω
4-75Ω

3T-POM-
ST.12

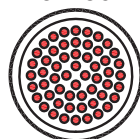
RF Signal

- 4 x 75Ω coax (RG179)
- 1 x 50Ω coax (RG58)
- SF overall shield
- 6000 msw (19,800 ft.) rated
- Ø15.0 mm (Ø.590 in.) nominal OD
- 150 mm (6.0 in.) bend radius



52A-307 RF Cable

3R-56



56-20

3R-POM-
ST.12

3P-40



40-20

3P-POM-
ST.13

3O-46

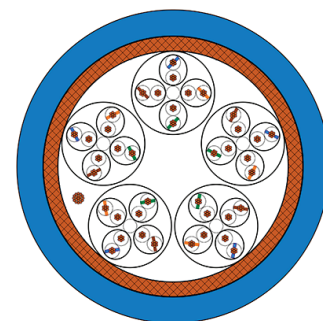


46-22

3O-POM-
ST.16

Signal & Control

- 5 x LAN bundle, each 4 x 0.31 mm² (23 AWG) F/UTP
- SF overall shield
- 6000 msw (19,800 ft.) rated
- Ø26.9 mm (Ø1.060 in.) nominal OD
- 254 mm (10.0 in.) bend radius



52A-308 Electrical Cable

3K-1C



3K-POM-
ST.9

3P-1C

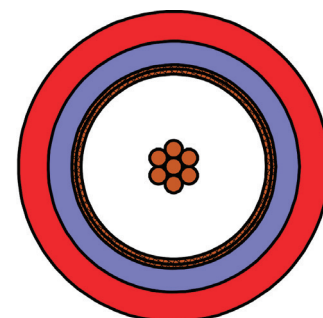


1-50Ω

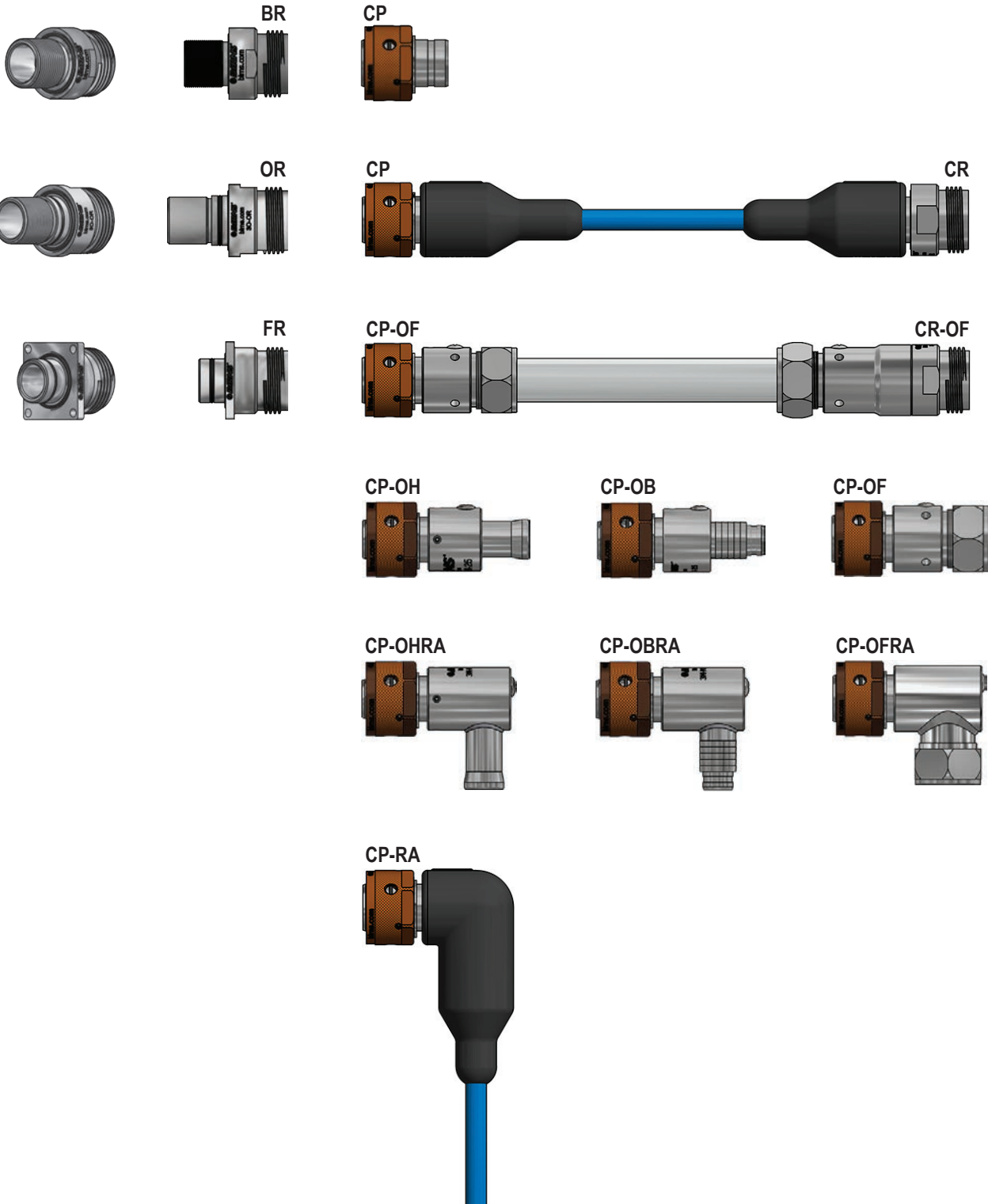
3P-POM-
ST.12

RF Signal

- 1 x 50Ω coax (RG214), 11GHz max
- 3.1 mm² (12 AWG) center conductor
- SF overall shield
- 6000 msw (19,800 ft.) rated
- Ø13.3 mm (Ø.525 in.) nominal OD
- 100 mm (4.0 in.) bend radius



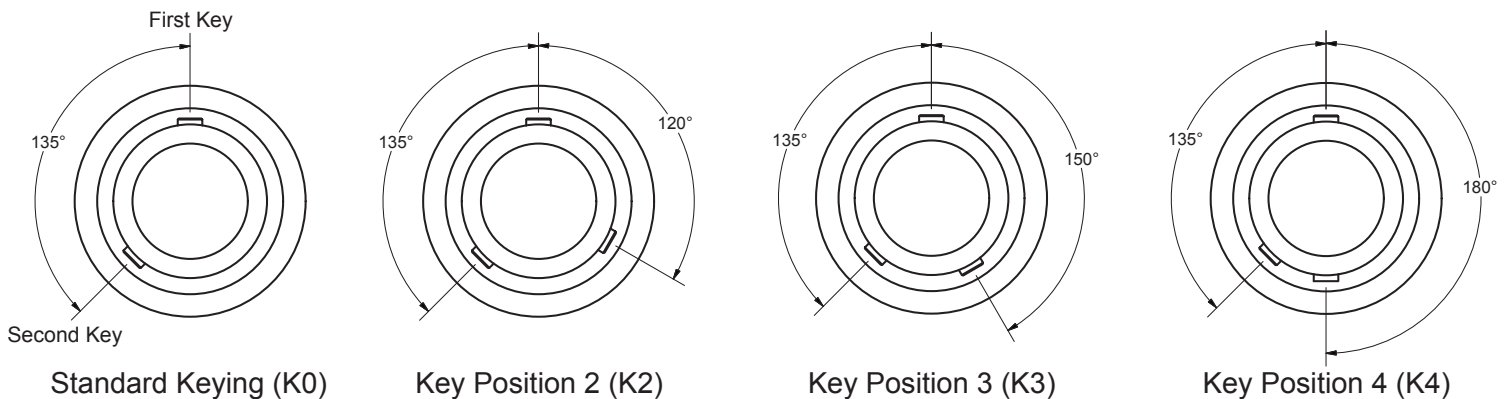
52A-314 RF Cable



As the BIRNS Millennium series is specifically engineered for challenging signal and power applications, keys for the series precisely and accurately orient connector mating and maintain that accuracy over the system's lifetime, while providing ease of use under harsh conditions. To that end, keys are machined as seamless integral elements of the connector shell*, of the same block of metal, with squared silhouettes for maximum strength, durability, and secure mating process.

For the ultimate in precision indexing, BIRNS Millennium connectors have dual keys and keyways. Users also have the option of a third key, providing purposeful incompatibility, when needed, to preclude inadvertent misconnection in the field. The optional third key can be specified in one of three positions, designated by part number suffixes K2, K3, or K4.

**Lesser-quality connectors use cheap press-fit keys.*



Note: Face of cable plug shown. Receptacles are mirror image.

Pro Tip: CPs with standard keys (K0) universally fit ALL receptacles (K0, K2, K3, K4). For suitable compatibility, always ensure that the CPs have the appropriate key options (K2, K3, K4).

CP to FR Compatibility				
	FR-K0	FR-K2	FR-K3	FR-K4
CP-K0	X	X	X	X
CP-K2		X		
CP-K3			X	
CP-K4				X

BIRNS Millennium receptacles typically incorporate pins, which are recessed into the shell to mitigate against mechanical damage and electrical shorts. In power-transfer situations it's preferred for the power source to use sockets instead of pins. For applications in which the Receptacle is the power source, BIRNS offers Reverse-Gender (RG) options. In RG configurations, sockets are in the Receptacle and pins are in the Cable Plug, providing additional safety in power-supply applications.



Left to Right: 3P-13-FR, 3P-13-CP, 3P-RG13-CPTI, 3P-RG13-FRTI. Note that RG and non-RG versions are not intermateable.

These connectivity solutions provide flexibility and enhanced safety and security options for subsea system designers who need the Receptacle to be the power source. The integration of sockets versus pins into the RG Receptacle enhances safety and further protects the system against mechanical damage or electrical shorts in specific applications, e.g., on ROV power supply units.

Reverse-Gender receptacles fit the same mounting profiles as non-RG receptacles, and provide the same depth rating and electrical performance characteristics. Also, RG inserts are backwards-compatible into existing receptacles, so system designers can change existing connectors to an RG configuration by simply replacing the inserts.

Part Number Explanation

RG and non-RG connectors follow the same part numbering system but RG pin configurations include the "RG" letters which are integrated into the part number. For example, for the 3P-13 and 3P-RG13 pin configurations, the part numbers are as follows:

3P-13-FR = pins in FR (not RG)

3P-13-CP = sockets in CP (not RG)

3P-RG13-FR = sockets in FR (Reverse-Gender)

3P-RG13-CP = pins in CP (Reverse-Gender)

See "Part Numbering-Receptacles (non-optical)", Page 21, "Part Numbering-Molded Cable Assemblies", Page 28, and "Part Numbering-Oil-Filled Cable Assemblies", Page 45.

Replacement insert part numbers for both RG and non-RG specify the contact gender (pins or sockets). For example, for the 3P-13 and 3P-RG13 pin configurations, replacement insert part numbers are as follows:

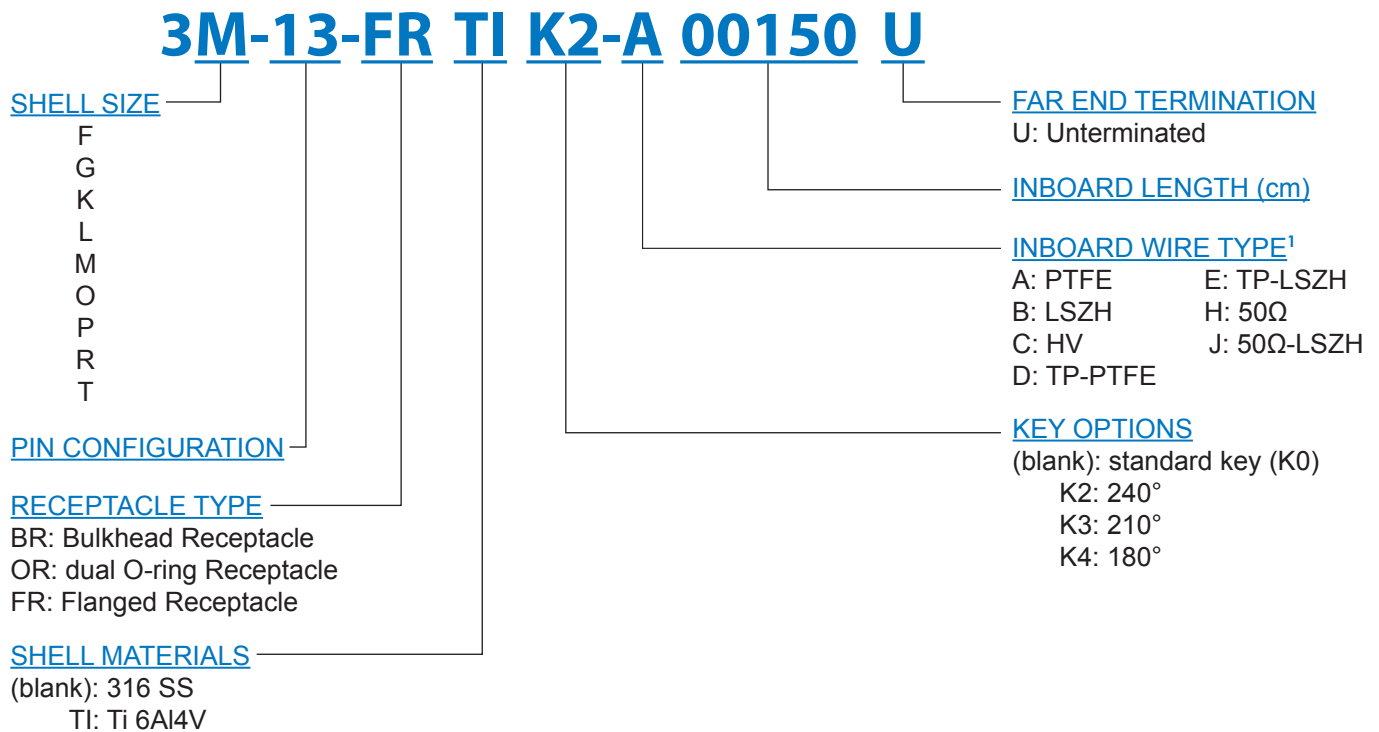
3P-RIP-13 = Receptacle Insert with Pins (not RG)

3P-RIS-13 = Receptacle Insert with Sockets
(Reverse-Gender)

3P-PIS-13 = Plug Insert with Sockets (not RG)

3P-PIP-13 = Plug Insert with Pins (Reverse-Gender)

See "Part Numbering-Inserts", Page xxx.



Receptacle Kit/Assembly Part Numbering Guide²

1. Select a non-optical³ pin configuration from the chart.
2. On the Pin Configuration chart, note the shell size (e.g. 3M) and configuration label (e.g. 3M-13)
3. Select receptacle type (BR, OR, FR) [For locking nuts, see Nuts & Tools Page 58]
4. Select shell material (SS, TI)
5. Select a Key Option if desired (K2, K3, K4)

Steps 1-5 are for the receptacle kit without assembly or inboard termination. For a complete terminated assembly:

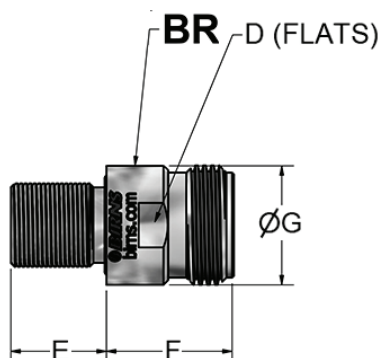
6. Select the inboard wire type letter
7. Select the desired termination length in centimetres
8. Select the far-end termination

1. PTFE wire is required for oil-filled cannisters; LSZH is required for PVHO (Pressure Vessels for Human Occupancy).

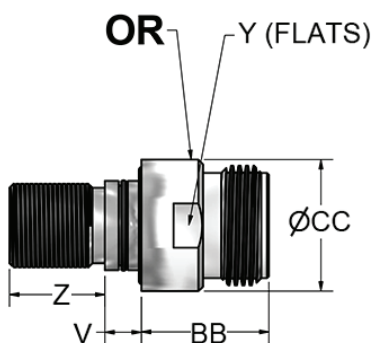
2. Contact BIRNS for the correct replacement of legacy or obsolete part numbers.

3. This is the designator of electrical and electro-coax configurations. For optical receptacles, see "Part Numbering, Optical Receptacles".

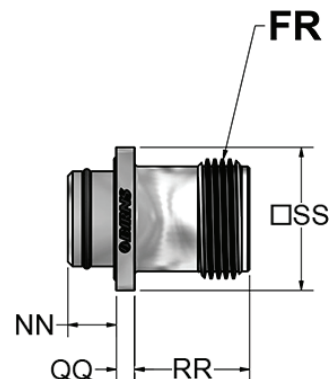
Dimensions



Bulkhead Receptacle



dual O-ring Receptacle



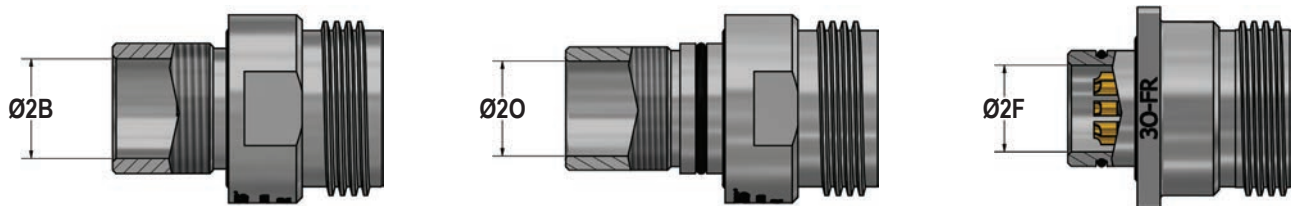
Flanged Receptacle

Receptacle Dimensions (mm)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
D	BR Wrench Flats	19	22	25	29	35	38	41	51	57
E	BR Thread Length	19	25	25	25	25	25	25	32	25
F	BR Body Height	22	25	34	34	29	34	34	40	34
G	BR Body Diameter	21	25	29	32	38	41	44	57	64
V	OR Shaft Seal Depth	8	10	10	10	10	10	10	9	10
Y	OR Wrench Flats	19	22	25	33	35	38	41	49	57
Z	OR Thread Length	25	25	29	25	25	25	25	32	26
BB	OR Body Height	22	25	36	34	28	34	34	35	34
CC	OR Body Diameter	24	25	29	35	38	41	44	56	64
NN	FR Shaft Seal Depth	16	13	13	13	13	15	13	13	13
QQ	FR Flange Thickness	5	5	8	5	4	5	8	6	8
RR	FR Body Height	17	21	29	30	28	30	29	31	31
SS	FR Flange Dimension	25	29	32	38	38	44	60	57	67

Receptacle Dimensions (inch)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
D	BR Wrench Flats	0.75	0.88	1.00	1.13	1.38	1.50	1.62	2.00	2.25
E	BR Thread Length	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.25	1.00
F	BR Body Height	0.87	1.00	1.34	1.34	1.13	1.33	1.34	1.57	1.34
G	BR Body Diameter	0.82	1.00	1.13	1.25	1.50	1.63	1.75	2.25	2.50
V	OR Shaft Seal Depth	0.31	0.39	0.38	0.38	0.38	0.39	0.38	0.37	0.38
Y	OR Wrench Flats	0.75	0.88	1.00	1.31	1.38	1.50	1.62	1.92	2.25
Z	OR Thread Length	1.00	1.00	1.13	1.00	1.00	1.00	1.00	1.25	1.03
BB	OR Body Height	0.87	1.00	1.40	1.34	1.12	1.32	1.34	1.39	1.34
CC	OR Body Diameter	0.93	1.00	1.13	1.38	1.50	1.63	1.75	2.19	2.50
NN	FR Shaft Seal Depth	0.62	0.50	0.50	0.50	0.50	0.60	0.50	0.50	0.50
QQ	FR Flange Thickness	0.19	0.19	0.30	0.20	0.15	0.20	0.30	0.25	0.30
RR	FR Body Height	0.68	0.81	1.15	1.20	1.10	1.20	1.16	1.22	1.24
SS	FR Flange Dimension	1.00	1.13	1.25	1.50	1.50	1.75	2.36	2.25	2.62

Internal Wire Clearance

In high-density applications, and especially when using twisted pairs or quads, it is important to ensure sufficient internal clearance for wire bundles. Below are wire bundle clearance dimensions for BIRNS Millennium receptacles.



Receptacle Internal Wire Clearance Dimensions (mm)									
Item	Description	3G	3K	3L	3M	3O	3P	3R	3T
2B	BR Wire Clearance	11	14	17	19	22	27	31	44
2O	OR Wire Clearance	13	13	17	19	21	26	32	44
2F	FR Wire Clearance	10	14	19	19	19	27	31	41

Receptacle Internal Wire Clearance Dimensions (inch)									
Item	Description	3G	3K	3L	3M	3O	3P	3R	3T
2B	BR Wire Clearance	0.438	0.560	0.680	0.750	0.860	1.060	1.201	1.750
2O	OR Wire Clearance	0.500	0.500	0.680	0.750	0.820	1.010	1.250	1.750
2F	FR Wire Clearance	0.410	0.560	0.750	0.750	0.748	1.050	1.202	1.600

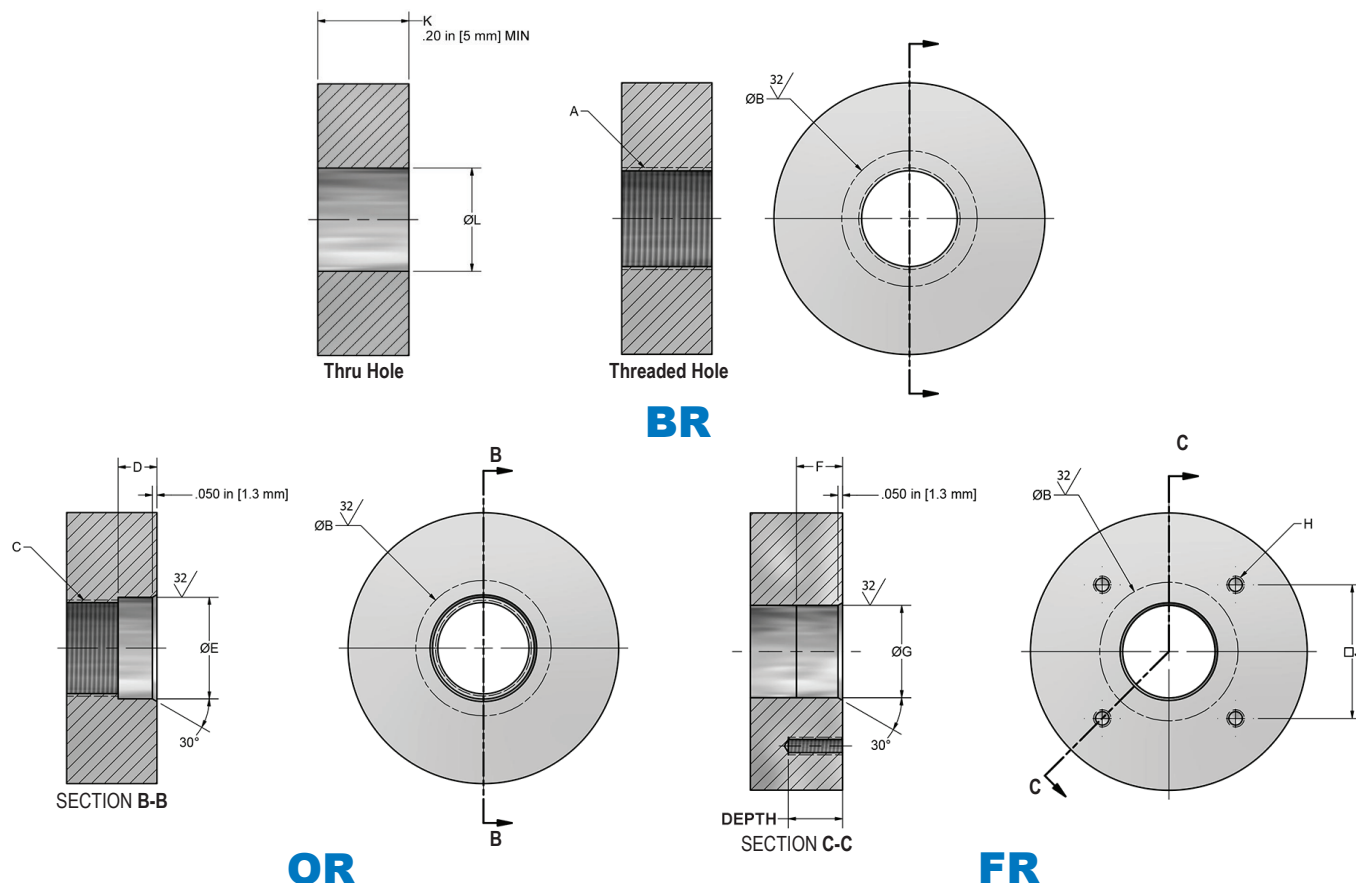
Receptacle Mass

Receptacle Mass (g)									
Type	Material	3G	3K	3L	3M	3O	3P	3R	3T
BR	Stainless Steel	75	127	146	183	207	257	450	455
BR	Titanium	42	70	81	102	117	143	250	253
OR	Stainless Steel	79	146	184	199	221	281	387	490
OR	Titanium	44	81	103	111	123	157	216	272
FR	Stainless Steel	76	131	150	154	199	402	339	541
FR	Titanium	42	74	83	88	109	223	189	301

Receptacle Mass (oz.)									
Type	Material	3G	3K	3L	3M	3O	3P	3R	3T
BR	Stainless Steel	3	4	5	6	7	9	16	16
BR	Titanium	1	2	3	4	4	5	9	9
OR	Stainless Steel	3	5	7	7	8	10	14	17
OR	Titanium	2	3	4	4	4	6	8	10
FR	Stainless Steel	3	5	5	5	7	14	12	19
FR	Titanium	1	3	3	3	4	8	7	11

Mounting

These are our recommended mounting methods for BIRNS Millennium receptacles. See Nuts & Tools Page 58.



BIRNS Millennium Receptacle Mounting Dimensions (mm)									
Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
A BR Mounting Thread	1/2-20 UNF-2B	5/8-24 UNEF-2B	3/4-20 UNEF-2B	7/8-20 UNEF-2B	1-20 UNEF-2B	1 1/8-16 UN-2B	1 1/4-16 UN-2B	1 1/2-16 UN-2B	2-16 UN-2B
B O-Ring Face Seal	24.1	28.7	30.5	36.8	36.8	40.6	49.5	54.1	62.2
C OR Mounting Thread	1/2-20 UNF-2B	9/16-20 UN-2B	11/16-20 UNEF-2B	7/8-20 UNEF-2B	1-20 UNEF-2B	1 1/16-20 UNEF-2B	1 1/4-16 UN-2B	1 1/2-16 UN-2B	2-16 UN-2B
D OR Shaft Seal Depth	9.7	10.9	10.9	10.2	10.2	10.9	10.7	10.9	10.2
E OR Shaft Seal Diameter (+.05/-00)	14.27	15.88	19.05	23.80	25.40	28.58	31.75	41.28	50.80
F FR Shaft Seal Depth	12.7	12.7	12.7	12.7	12.7	15.2	12.7	12.7	12.7
G FR Shaft Seal Diameter (+.05/-00)	12.70	17.45	19.05	25.40	25.40	25.40	38.10	38.10	50.80
H FR Mounting Screw Size	M3 x 0.5	M3 x 0.5	M3.5 x 0.6	M3.5 x 0.6	M4 x 0.7	M5 x 0.8	M5 x 0.8	M6 x 1	M6 x 1
J FR Mounting Screw Pattern	19.81	23.01	25.91	30.18	30.12	36.73	46.99	44.91	52.98
K BR Vessel Thickness, MAX	6	8	9	9	9	9	10	16	9
L BR Thru Hole Diameter	13.2	16.3	19.6	22.6	25.9	29.0	32.3	38.6	51.3

BIRNS Millennium Receptacle Mounting Dimensions (in)									
Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
A BR Mounting Thread	1/2-20 UNF-2B	5/8-24 UNEF-2B	3/4-20 UNEF-2B	7/8-20 UNEF-2B	1-20 UNEF-2B	1 1/8-16 UN-2B	1 1/4-16 UN-2B	1 1/2-16 UN-2B	2-16 UN-2B
B O-Ring Face Seal	0.95	1.13	1.20	1.45	1.45	1.60	1.95	2.13	2.45
C OR Mounting Thread	1/2-20 UNF-2B	9/16-20 UN-2B	11/16-20 UNEF-2B	7/8-20 UNEF-2B	1-20 UNEF-2B	1 1/16-20 UNEF-2B	1 1/4-16 UN-2B	1 1/2-16 UN-2B	2-16 UN-2B
D OR Shaft Seal Depth	0.38	0.43	0.43	0.40	0.40	0.43	0.42	0.43	0.40
E OR Shaft Seal Diameter (+.002/-000)	0.562	0.625	0.750	0.937	1.000	1.125	1.250	1.625	2.000
F FR Shaft Seal Depth	0.50	0.50	0.50	0.50	0.50	0.60	0.50	0.50	0.50
G FR Shaft Seal Diameter (+.002/-000)	0.500	0.687	0.750	1.000	1.000	1.000	1.500	1.500	2.000
H FR Mounting Screw Size	#4	#4	#6	#6	#8	#10	#10	1/4	1/4
J FR Mounting Screw Pattern	0.780	0.906	1.020	1.188	1.186	1.446	1.850	1.768	2.086
K BR Vessel Thickness, MAX	0.25	0.30	0.35	0.35	0.35	0.35	0.38	0.64	0.35
L BR Thru Hole Diameter	0.52	0.64	0.77	0.89	1.02	1.14	1.27	1.52	2.02

DEPTH: An appropriate threaded hole depth is one that provides a minimum thread engagement equal to at least twice the diameter of the screw to be used. Many factors affect the choice of hole depth, such as the materials of the screw and the substrate (housing, bulkhead, or hull) and the thread quality. BIRNS is not able to predict or control these variables. Thus, the customer is responsible to design an appropriate mounting system, including the selection of screw hole depth.

FR Mounting Screw Torque

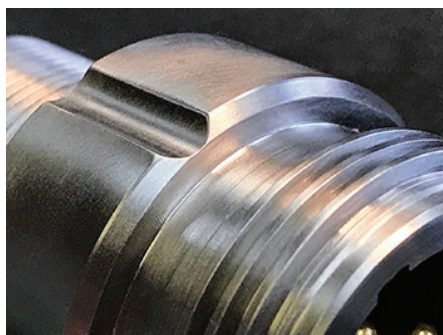
FR	Screw Size	Torque (Nm)		
		SS	Ti (Gr. 2)	Ti (Gr. 5)
3F	M3	0.7	0.7	1.7
3G	M3	0.7	0.7	1.7
3K	M3.5	1.0	1.0	2.6
3L	M3.5	1.0	1.0	2.6
3M	M4	1.6	1.6	3.8
3O	M5	3.1	3.2	7.8
3P	M5	3.1	3.2	7.8
3R	M6	5.3	5.4	13.2
3T	M6	5.3	5.4	13.2

FR	Screw Size	Torque (in-lbs)		
		SS	Ti (Gr. 2)	Ti (Gr. 5)
3F	#4	4	4	11
3G	#4	4	4	11
3K	#6	8	8	20
3L	#6	8	8	20
3M	#8	15	15	36
3O	#10	20	21	51
3P	#10	20	21	51
3R	1/4	49	50	123
3T	1/4	49	50	123

These are the recommended screw sizes and torque values for installation of FR mounting screws. Please refer to the value in the correct column for your screw material.

These values are considered appropriate for well-lubricated threads in good condition and assumes that the threaded length is sufficiently long for the materials. However, they are ultimately merely approximate guideline suggestions. Many variables affect the torque value, such as screw material quality, screw length, thread class, cleanliness and lubrication, all of which are impossible for BIRNS to predict or control. Thus, the customer is ultimately responsible to ensure proper installation including the selection of appropriate torque values.

Anti-Rotation Dowel Slot



Slot allows for use of anti-rotation dowel.

Many BR and OR receptacles feature anti-rotation dowel slots. These provide a locking feature in thick-wall applications which preclude the use of Nut/Washer sets. Below are the receptacles which incorporate an anti-rotation dowel slot.

Receptacle Anti-Rotation Dowel Slot								
Description	3G	3K	3L	3M	3O	3P	3R	3T
BR Dowel Slot	Yes	No	No	Yes	Yes	No	Yes	No
OR Dowel Slot	Yes	No	Yes	Yes	Yes	No	Yes	No

Connector Serialization



Shells are individually serialized.

In accordance with its comprehensive Quality Management System, BIRNS individually and permanently serializes all connector shells, allowing quality traceability back to the shell's original manufacturing material certificates and dimensional inspection reports. Serialization marking is performed by means of laser etching.

Materials

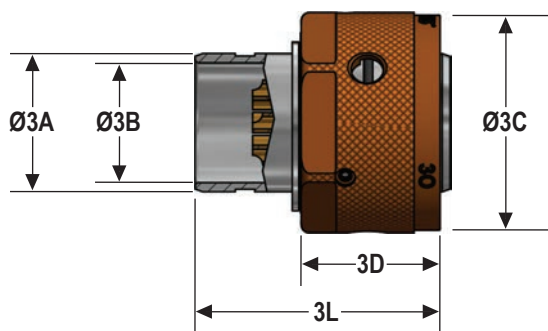
BIRNS Millennium Cable Plugs are available in three material options: CP, CPTI, and CPTIA, each available with any Key Option (K0, K2, K3, or K4). Inserts, backshells, cables, and overmolds are all compatible and interchangeable.



Cable Plug Materials			
	CP	CPTI	CPTIA
Shell:	316 Stainless Steel	Titanium 6Al-4V	Titanium 6Al-4V
Coupling Ring:	C54400 Phosphor Bronze	Black Delrin	Titanium 6Al-4V
Hardware:	316 Stainless Steel	Titanium 6Al-4V	Titanium 6Al-4V

Pro tip: for oil-filled cable assemblies, select a backshell made of the same material as the Cable Plug shell.

Dimensions



BIRNS Millennium Cable Plugs are dimensionally equivalent irrespective of different materials and/or Key Options.

Cable Plug Dimensions (mm)								
Type	3G	3K	3L	3M	3O	3P	3R	3T
Ø3A	15.9	19.1	22.2	24.0	27.0	31.8	41.3	47.6
Ø3B	13.0	17.0	18.8	20.3	23.4	29.1	36.8	42.9
Ø3C	26.9	33.5	36.6	39.6	42.9	49.3	57.2	66.7
3D	21.6	26.7	26.7	26.7	27.2	26.7	26.7	26.7
3L	41.0	47.5	47.4	47.4	47.9	47.4	50.6	48.2

Cable Plug Dimensions (in)								
Dim	3G	3K	3L	3M	3O	3P	3R	3T
Ø3A	0.625	0.750	0.875	0.944	1.062	1.250	1.625	1.875
Ø3B	0.510	0.670	0.740	0.800	0.920	1.145	1.450	1.688
Ø3C	1.060	1.320	1.440	1.560	1.690	1.940	2.250	2.625
3D	0.850	1.050	1.050	1.050	1.070	1.050	1.050	1.050
3L	1.616	1.871	1.866	1.866	1.886	1.868	1.993	1.898

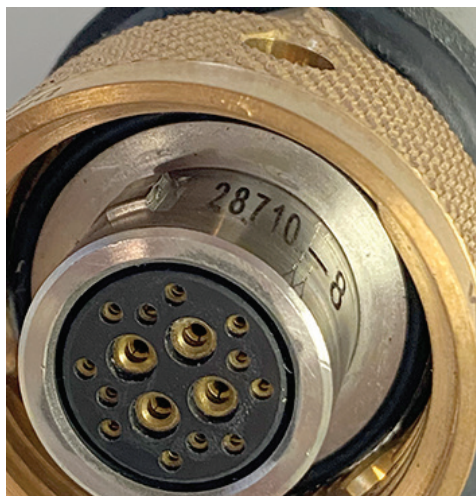
Mass

BIRNS Millennium Cable Plug masses are detailed in the following tables. These figures do not include the mass of any cable or wire, solder, insulating tubing, or potting or overmolding materials. Due to the different insert masses as a result of various contact quantities and sizes, these mass figures include a representative insert.

MASS (g)								
Item	3G	3K	3L	3M	3O	3P	3R	3T
CP:	78	126	164	184	230	277	392	505
CPTI:	32	50	69	80	107	135	199	262
CPTIA:	46	73	95	107	137	171	247	318

MASS (oz.)								
Item	3G	3K	3L	3M	3O	3P	3R	3T
CP:	2.8	4.4	5.8	6.5	8.1	9.8	13.8	17.8
CPTI:	1.1	1.8	2.4	2.8	3.8	4.8	7.0	9.2
CPTIA:	1.6	2.6	3.4	3.8	4.8	6.0	8.7	11.2

Connector Serialization



In accordance with its comprehensive Quality Management System, BIRNS individually and permanently serializes all connector shells, allowing quality traceability back to the shell's original manufacturing material certificates and dimensional inspection reports. Serialization marking is performed by means of laser etching.

3M-13-CP TI K2-RA-A 00300 D

SHELL SIZE

F
G
K
L
M
O
P
R
T

PIN CONFIGURATION

SHELL TYPE

CP: Cable Plug
CR: Cable Receptacle

SHELL MATERIALS

(blank): 316 SS shell, Phosphor Bronze ring
TI: Ti shell, Delrin coupling ring
TIA: All titanium:Ti Shell, Ti ring

KEY OPTIONS

(blank): standard key (K0)
K2: 240°
K3: 210°
K4: 180°

FAR-END TERMINATION

U: Underterminated
D: Double-ended
E: one end CP, other CR
R: one end 180°, other 90°

CABLE LENGTH (cm)

CABLE TYPE

CABLE OVERMOULDING ANGLE

(blank): 180° (straight)
RA: 90°

CP Materials Table

CP Type	Shell	Hardware	Coupling Ring
CP:	SS	SS	Bronze
CPTI:	Ti	Ti	Delrin
CPTIA:	Ti	Ti	Ti



CP (right), CPTI (left), CPTIA (center).

Molded Cable Assemblies Part Numbering Guide¹

1. Select a pin configuration from the chart; note the shell size (e.g. 3M) and pin configuration label (e.g. 3M-13).
2. Select the connector type (CP, CR).
3. Select shell material (SS, TI, TIA)²
4. Select a Key Option if desired (K2, K3, K4)

Steps 1-4 are for the connector kit without termination or overmolding. For a complete molded assembly:

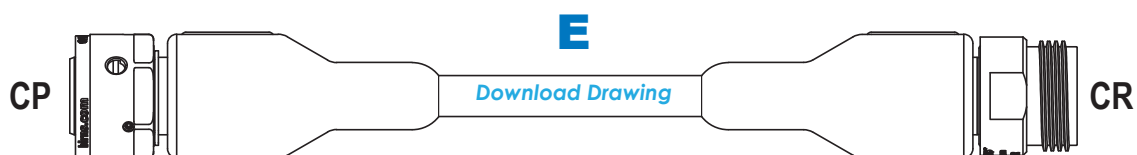
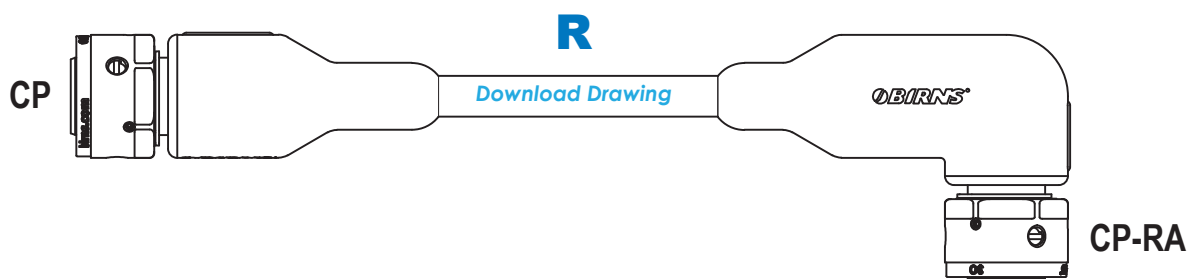
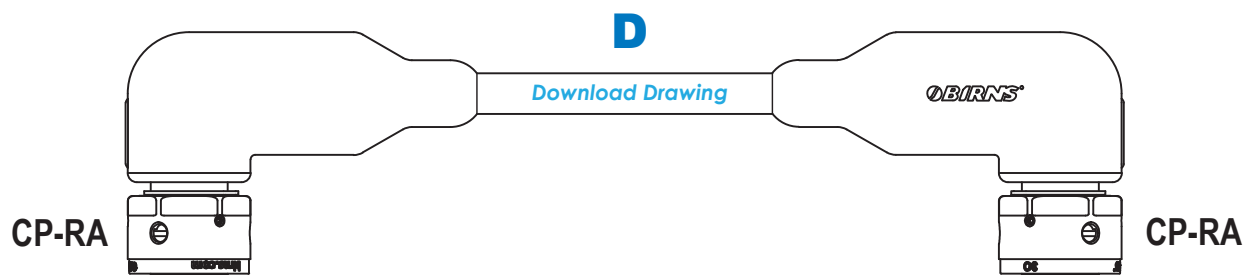
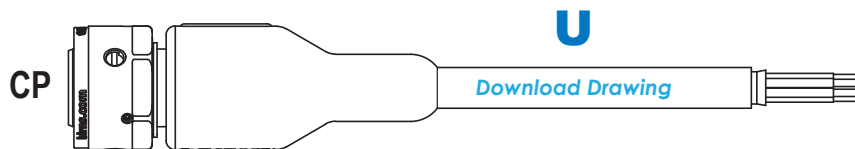
5. Select the overmold angle (180°, 90°)
6. Select the cable type
7. Select the length in centimetres
8. Select the far-end termination (U, D, R, E)

The part number does not include information such as wiring diagram, shield treatment, labeling, length tolerance, clocking, rotation, or overmolding material. Please ask for a BIRNS Configuration Drawing to define these details. See Molded Cable Assembly Configuration Guide, Page 30.

¹ Contact BIRNS for the correct replacement of legacy or obsolete part numbers.

² TI Cable Plugs have titanium shells and Delrin coupling rings. TIA Cable Plugs have titanium shells and titanium coupling rings. TI Cable Receptacles have titanium shells and are innately "TIA".

The following outlines represent BIRNS's standard cable assembly configurations, correlating to the "Far-End Termination" section of the part numbering system for molded cable assemblies (see Part Numbering, Molded Cable Assemblies, page 28). A fillable configuration drawing can be downloaded through the link on that configuration shown below.



The part number does not include information relating to the wiring diagram, shield treatment, labeling, length tolerance, clocking, rotation, or overmolding material. The BIRNS Configuration Drawing helps define these details. Configuration drawings can be downloaded through the links on the Molded Cable Assemblies page.

Wiring Diagram

A Wiring Diagram (or equivalent written instructions) is required to start any cable assembly work. Wiring Diagram options are:

1. Provide your own Wiring Diagram (preferred). Note the connector pin sizes: additional charges will apply if you specify to terminate wires of different size(s) to the connector pins.
2. Specify to "Wire pin to pin" ('straight through').
3. Use the default pre-established wiring diagram for that interconnect.

Shield Method

Some cables incorporate OAS (F/, S/, or SF/). Available Shield Method (treatment) options are:

1. **None:** no OAS exists in the cable
2. **Not Connected:** an OAS exists but is not terminated to anything (isolated or "floating")
3. **Jumper Wire to Shell:** a wire connects the OAS to the connector shell
4. **360-degree to Shell:** the OAS forms a Faraday cage around the shell
5. **Connected to Pin:** the OAS is terminated to a specific connector pin

PUR Material

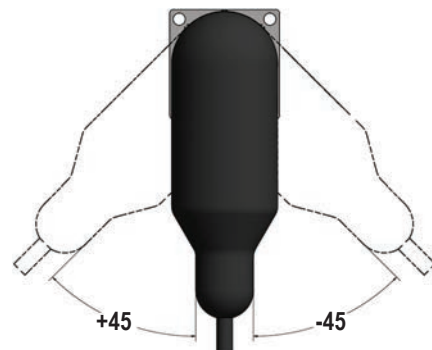
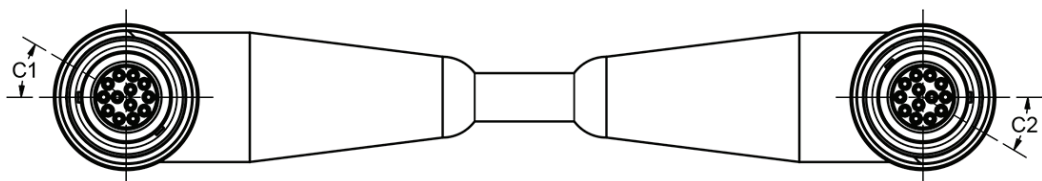
BIRNS offers three PUR materials as follows.

1. **Commercial-Grade:** standard default material.
2. **High-Reliability:** an excellent high-end PUR.
3. **PRO-020:** PUR material and molding and documentation procedures IAW S9320-AM-PRO-020. If this option is selected, affirmative instructions to apply a NCC IAW S9320-AM-PRO-030 will be required.

Note: cable overmolding is machined-based so costs of changing the PUR are high. Selection of HRL or PRO can significantly impact price and schedule.

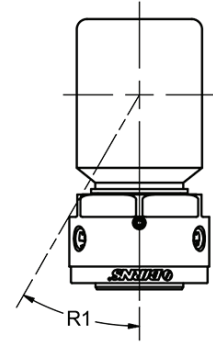
Clocking

"Clocking" is the angle between a right-angle connector's No. 1 key and the cable's long axis. The default position is 0°, and the tolerance is $\pm 15^\circ$. The angle is positive clockwise (maximum 180°), negative counterclockwise, and is specified per connector.



Rotation

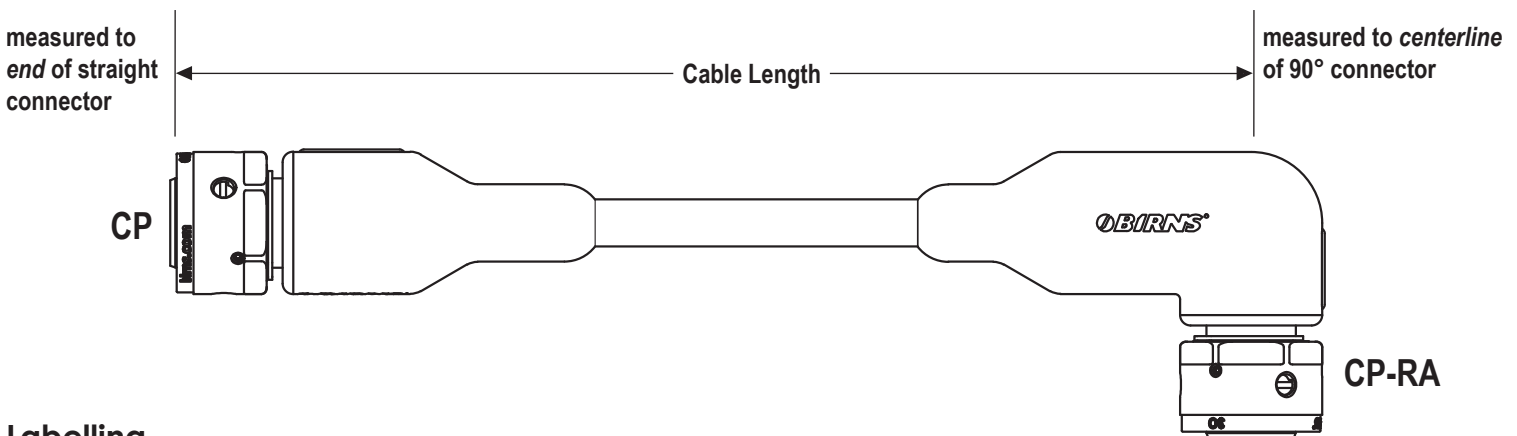
"Rotation" is the angle between the connector's alignment ridge and the cable. The default position is 0°, and the tolerance is $\pm 30^\circ$. The angle is positive clockwise (maximum 180°), negative counterclockwise, and is specified per connector.



Length Tolerance

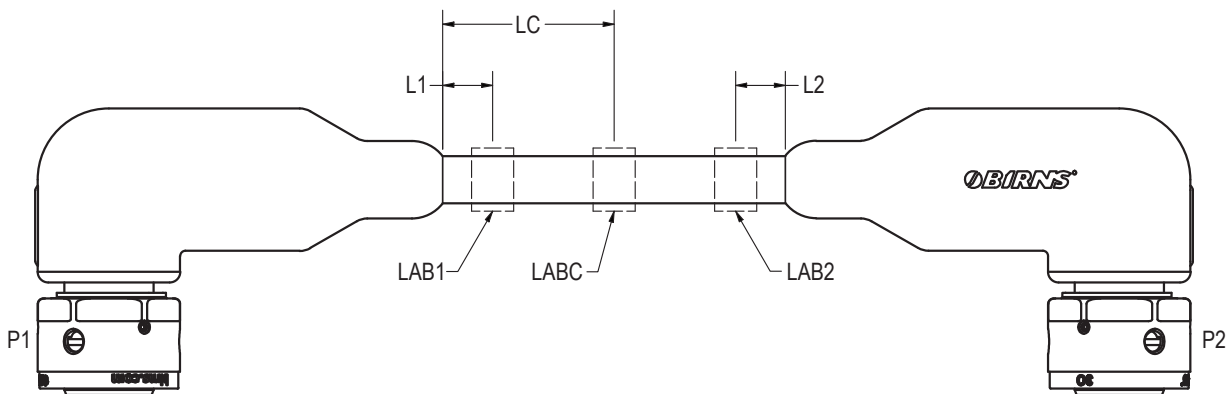
BIRNS manufactures cable assemblies with these standard overall length tolerances. Other tolerances can be specified (with possible price and/or schedule impact). Cable assembly length is measured from the *end* of a straight connector and the *centerline* of a 90° connector.

Cable Length Tolerances					
Tolerance		Length (cm)		Length (feet)	
+ (plus)	- (minus)	From	To	From	To
12%	0%	30	50	1	2
7%	0%	50	200	2	7
5%	0%	200	500	7	16
4%	0%	500	3,000	16	100
3%	0%	3,000	30,000	100	1,000



Labelling

Optional Marking/Labels can be applied in various locations. The most common locations are at the connector, in the cable center, and/or at the far end; these are LAB1, LABC, and LAB2, respectively.



Label Types

Various types of Marking/Labels are available as follows.

(Note: labels provide more data space than tags.)

1. **Bag & Tag Only:** no marking on the product; a printed label is on the packaging
2. **Label with Clear Heat-Shrink:** data is on white tubing and covered with clear tubing
3. **Wrap-Around Tag:** small plastic tags secured with cable ties
4. **K-Type Label (plastic ties):** Pre-printed "macaroni" rings on a carrier, secured with plastic cable ties
5. **K-Type Label (SS ties):** As above but with SS cable ties
6. **Stamped SS Tag:** marker plates (max. 17 characters) secured with SS cable ties

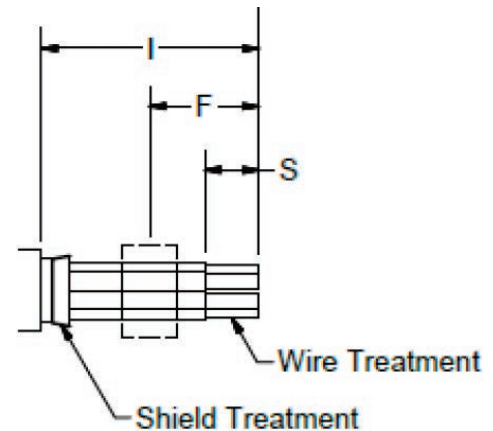


Label options available for all BIRNS cable assemblies.

Type 'U' Cable Assemblies (one end unterminated)

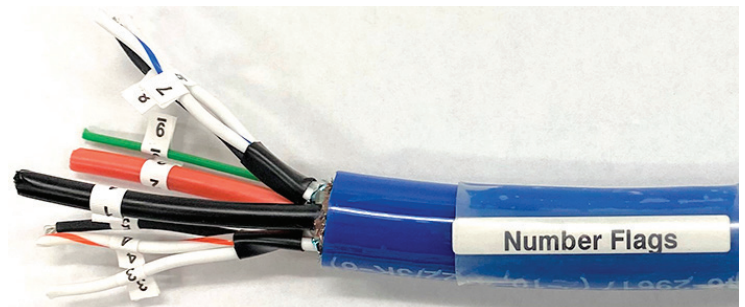
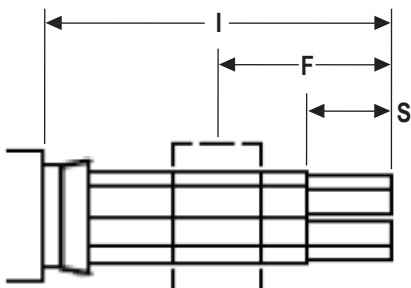
Jacket Strip and Insulation Strip

Cables with an unterminated end allow additional options. Among other things, customers can specify the desired length of cable jacket ('I') and insulation ('S') removal.



Number Flags

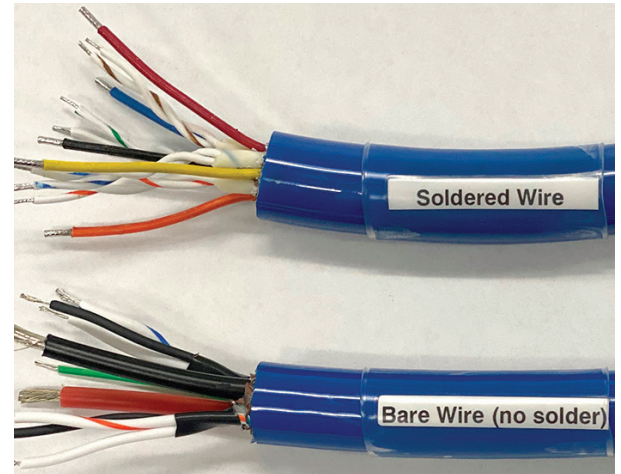
Optional number flags (one for each wire) are available and their location ('F') can be specified.



Wire Treatment

Stripped wires can be tinned, if desired. Options are:

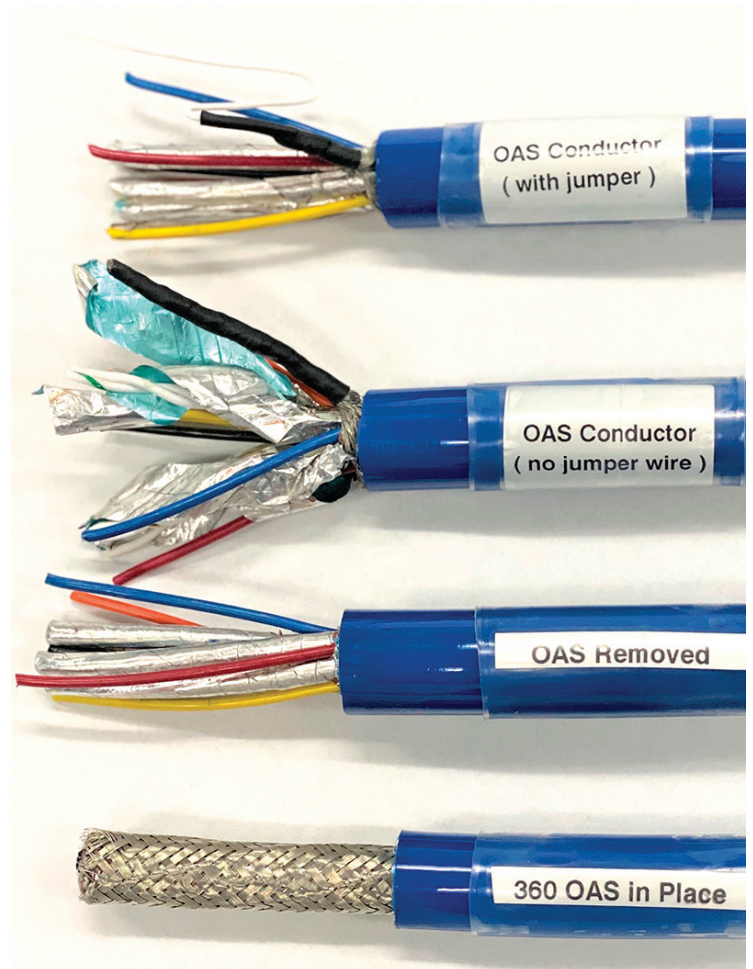
1. **Bare wire** (no tinning)
2. **Lead-based solder**
3. **Tin-based solder** (RoHS)



Shield (OAS) Treatment

Jacket removal regularly exposes an OAS. Shield treatment options are:

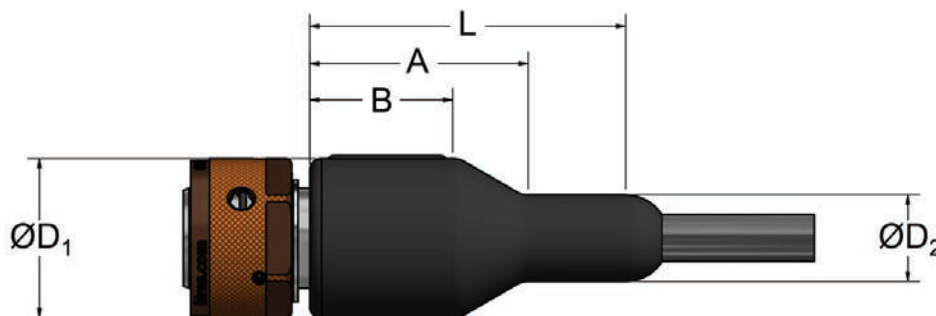
1. **Attach Jumper:** attach a conductor to the OAS so that it can be terminated into a system
2. **Twist into Conductor:** manipulate the OAS into a conductor without using a jumper wire
3. **Remove Exposed Shield:** cut it short to be approximately level with the jacket end
4. **Maintain 360:** leave the OAS in place (this could interfere with wire stripping and/or flagging)



Shield treatment options available for BIRNS cable assemblies with F, S, or SF shields (screens).

Next-Gen

BIRNS has developed enhanced overmold designs to optimize cable strain relief, size, and depth capacity. Some dimensions may be different from legacy designs.



Pro Tip: if desired, select legacy overmolds may still be available on special order (see Legacy Overmolds, Page 37)—please contact the BIRNS Sales Team for details.

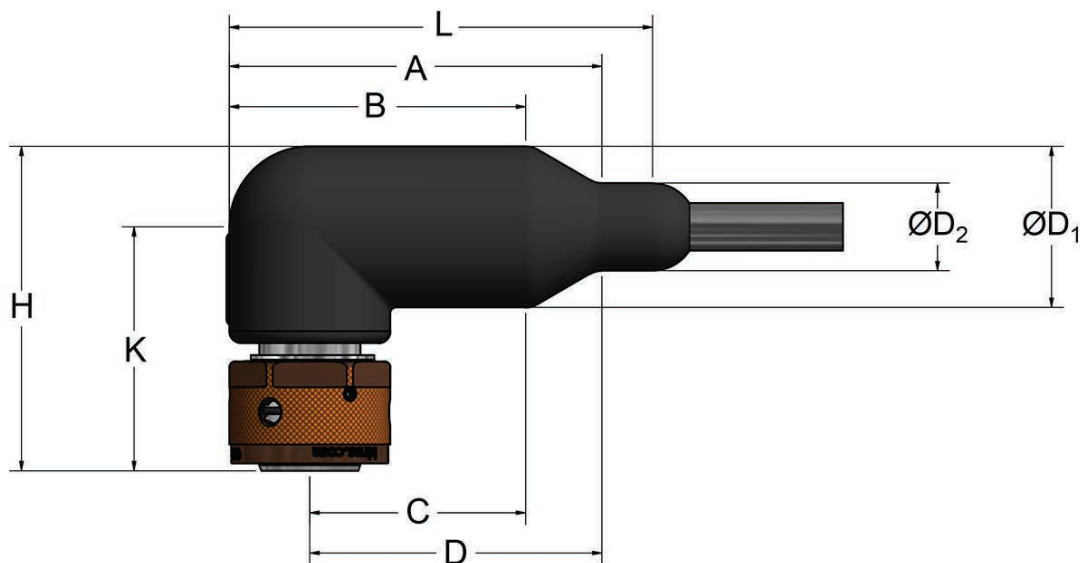
Note the maximum cable diameter limitations in the tables below. Special terminations, such as for 10GbE and HV, require longer molds. Optical and EO assemblies use special molds (see Optical Cable Assemblies, Page xx).

POM-ST Molds - mm							
Size	Mold	D ₁	D ₂	L	A	B	Cable Max OD (≤Ømm)
3G	3G-POM-ST.9	27	13	93	83	67	8
3K	3K-POM-ST.8	34	17	86	60	42	12
	3K-POM-ST.9	34	34	91	91	91	27
3L	3L-POM-ST.8	37	19	86	60	41	14
3M	3M-POM-ST.8	40	20	86	60	40	15
	3M-POM-ST.9	40	40	92	92	92	33
3O	3O-POM-ST.8	43	23	85	59	39	18
	3O-POM-ST.12	43	27	123	103	86	22
	3O-POM-ST.16	48	41	160	148	138	36
3P	3P-POM-ST.12	49	29	125	99	78	24
	3P-POM-ST.13	49	49	132	132	132	43
3R	3R-POM-ST.12	57	37	124	98	77	32
3T	3T-POM-ST.12	67	43	124	98	74	38
	3T-POM-ST.19	67	43	198	164	147	38
	3T-POM-ST.21	70	43	213	186	160	38

POM-ST Molds - inch							
Size	Mold	D ₁	D ₂	L	A	B	Cable Max OD (≤Øin.)
3G	3G-POM-ST.9	1.06	0.51	3.66	3.25	2.64	0.31
3K	3K-POM-ST.8	1.32	0.67	3.39	2.36	1.66	0.47
	3K-POM-ST.9	1.32	1.32	3.6	3.6	3.6	1.07
3L	3L-POM-ST.8	1.44	0.74	3.39	2.36	1.62	0.55
3M	3M-POM-ST.8	1.56	0.8	3.4	2.37	1.57	0.59
	3M-POM-ST.9	1.56	1.56	3.61	3.61	3.61	1.31
3O	3O-POM-ST.8	1.69	0.92	3.35	2.32	1.51	0.71
	3O-POM-ST.12	1.69	1.06	4.85	4.07	3.39	0.87
	3O-POM-ST.16	1.88	1.6	6.31	5.82	5.44	1.42
3P	3P-POM-ST.12	1.94	1.15	4.93	3.89	3.07	0.94
	3P-POM-ST.13	1.94	1.94	5.18	5.18	5.18	1.69
3R	3R-POM-ST.12	2.25	1.45	4.9	3.87	3.07	1.26
3T	3T-POM-ST.12	2.63	1.69	4.9	3.87	2.92	1.5
	3T-POM-ST.19	2.63	1.69	7.78	6.47	5.8	1.5
	3T-POM-ST.21	2.75	1.69	8.4	7.34	6.31	1.5



Next-Gen overmolds provide an alignment ridge for positional tactile feedback (useful when working in tight locations without line of sight). Unless specified otherwise, the alignment ridge aligns with the First Key. For alternate alignments, see “Rotation” in the Molded Cable Assembly Configuration Guide, Page 30.



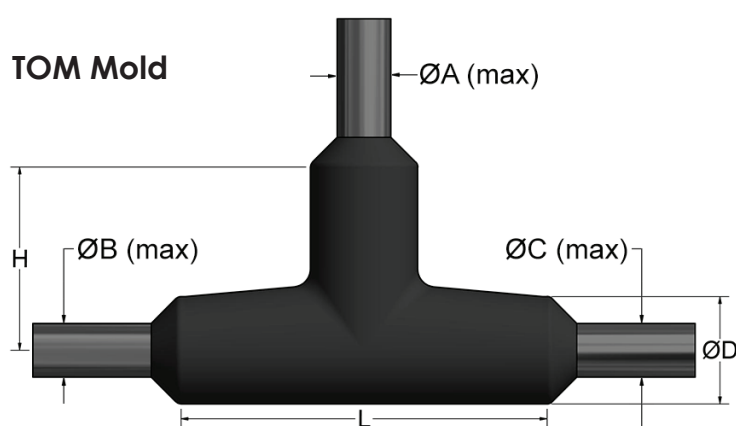
POM-RA Molds - mm											
Size	Mold	D ₁	D ₂	L	A	B	C	D	H	K	Cable Max OD (≤Ømm)
3G	3G-POM-RA.9	27	13	105	91	76	62	78	70	57	8
3K	3K-POM-RA.9	34	17	108	95	77	60	78	78	61	12
	3K-POM-RA.10	34	34	120	120	120	103	103	78	61	28
3L	3L-POM-RA.9	37	19	110	96	77	59	78	83	65	14
3M	3M-POM-RA.9	40	20	111	98	78	58	78	86	66	15
	3M-POM-RA.10	40	40	123	123	123	103	103	86	66	35
3O	3O-POM-RA.9	43	23	113	99	79	58	78	86	65	18
	3O-POM-RA.10	43	41	124	117	114	93	96	86	65	36
3P	3P-POM-RA.13	49	29	154	141	120	95	116	100	75	24
	3P-POM-RA.14	49	49	166	166	166	141	141	100	75	44
3R	3R-POM-RA.13	57	37	158	145	124	95	116	109	80	32
3T	3T-POM-RA.13	67	43	163	149	125	92	116	115	82	38

POM-RA Molds - inch											
Size	Mold	D ₁	D ₂	L	A	B	C	D	H	K	Cable Max OD (≤Øin.)
3G	3G-POM-RA.9	1.06	0.51	4.13	3.6	2.99	2.46	3.07	2.76	2.23	0.31
3K	3K-POM-RA.9	1.32	0.67	4.26	3.73	3.03	2.37	3.07	3.07	2.41	0.47
	3K-POM-RA.10	1.32	1.32	4.72	4.72	4.72	4.06	4.06	3.07	2.41	1.12
3L	3L-POM-RA.9	1.44	0.74	4.32	3.79	3.05	2.33	3.07	3.28	2.56	0.54
3M	3M-POM-RA.9	1.56	0.8	4.38	3.85	3.06	2.27	3.07	3.38	2.6	0.6
	3M-POM-RA.10	1.56	1.56	4.84	4.84	4.84	4.06	4.06	3.38	2.6	1.36
3O	3O-POM-RA.9	1.69	0.92	4.45	3.91	3.11	2.27	3.07	3.4	2.56	0.71
	3O-POM-RA.10	1.69	1.6	4.9	4.62	4.49	3.65	3.78	3.4	2.56	1.4
3P	3P-POM-RA.13	1.94	1.15	6.07	5.54	4.72	3.75	4.57	3.92	2.95	0.95
	3P-POM-RA.14	1.94	1.94	6.53	6.53	6.53	5.56	5.56	3.92	2.95	1.74
3R	3R-POM-RA.13	2.25	1.45	6.23	5.69	4.87	3.74	4.57	4.28	3.16	1.25
3T	3T-POM-RA.13	2.63	1.69	6.41	5.88	4.93	3.62	4.57	4.53	3.23	1.5

Complex molded cable assemblies sometimes require breakouts, splits, and splices, so in addition to everyday connector overmolds, BIRNS also makes the following standardized joints.

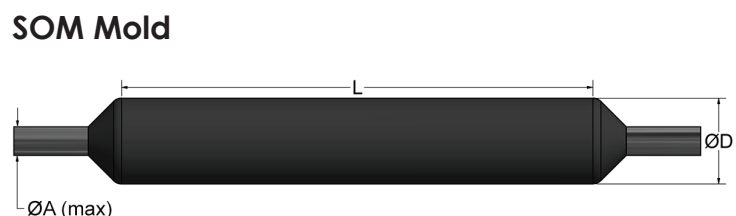
Type	Description	ID Method
TOM	T-junction	D-TOM-L.H
YOM	Y-junction	YOM-L.W
SOM	Splice	D-SOM-L

The mold number indicates the mold Type (prefixed by the diameter, if applicable), length, and height/width in approximate centimetres. Actual dimensions are detailed in the tables below. Note the maximum cable OD limitations in each table. Special terminations, such as for 10GbE and HV, may require longer molds; check with your BIRNS Sales Executive for details.



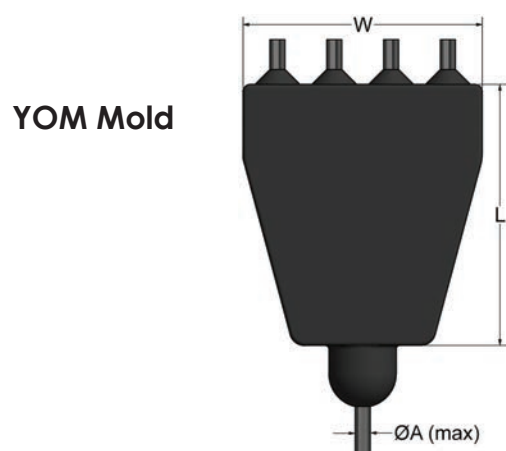
TOM Molds-mm						
Mold	L	H	ØD	Max Cable Max OD, A	Max Cable Max OD, B	Max Cable Max OD, C
4-TOM-13.6	127	64	38	Ø29	Ø29	Ø29

TOM Molds-in						
Mold	L	H	ØD	Max Cable Max OD, A	Max Cable Max OD, B	Max Cable Max OD, C
4-TOM-13.6	5	2.5	1.5	1.13	1.13	1.13



SOM Molds-mm			
Mold	L	D	Max Cable OD, A
2-SOM-10	101	19	Ø13

SOM Molds-in			
Mold	L	D	Max Cable Max OD, C
2-SOM-10	4	0.75	Ø.50

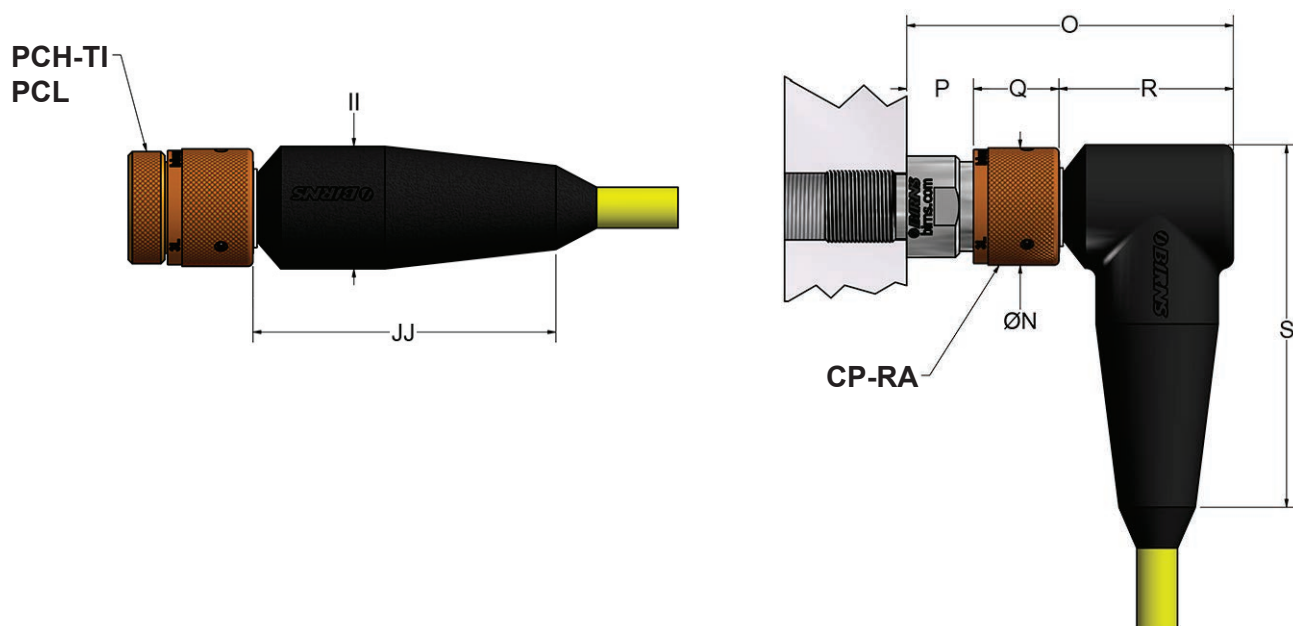


YOM Molds-mm			
Mold	L	W	Max Cable OD, A
YOM-11.10	111	101	Ø22

YOM Molds-in			
Mold	L	W	Max Cable Max OD, C
YOM-11.10	4.38	4	Ø.88

Legacy

BIRNS has transitioned to enhanced Next-Gen overmold designs to optimize cable strain relief, size, and depth capacity (see Next-Gen Overmolds ST, and Next-Gen Overmolds RA, on previous pages). Select legacy overmolds may still be available, on special order, in accordance with the legacy mold dimensions shown below. Please contact the BIRNS Sales Team if legacy products are desired.

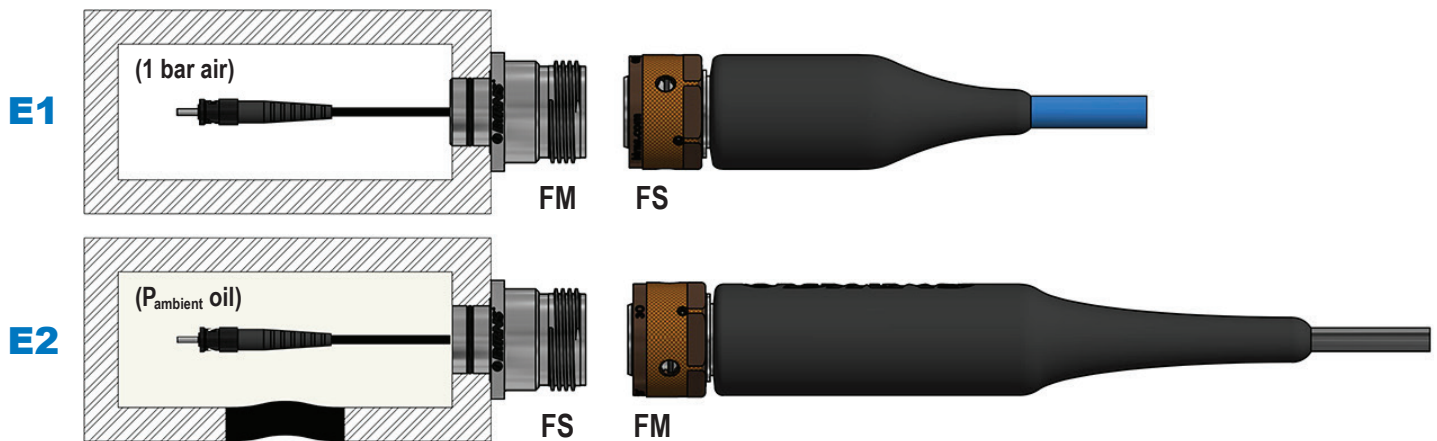


Legacy Mold Dimensions (mm)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
O	BR/CP-RA Combined Height	N/A	65	87	85	88	93	79	94	89
P	CP to Face Distance, on BR	11	17	23	21	15	20	12	27	15
Q	Coupling Ring Length	19	20	27	27	27	27	27	27	26
R	RA Overmold Height	N/A	29	38	38	46	46	40	40	48
S	RA Overmold Length	N/A	57	96	96	114	114	114	114	147
II	Straight Overmold Diameter	19	28	38	38	38	41	46	51	64
JJ	Straight Overmold Length	27	56	86	95	86	113	114	133	146

Legacy Mold Dimensions (inch)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
O	BR/CP-RA Combined Height	N/A	2.56	3.43	3.36	3.48	3.66	3.12	3.69	3.52
P	CP to Face Distance, on BR	0.45	0.65	0.89	0.82	0.61	0.79	0.48	1.05	0.59
Q	Coupling Ring Length	0.75	0.78	1.05	1.05	1.05	1.05	1.05	1.05	1.03
R	RA Overmold Height	N/A	1.13	1.49	1.49	1.82	1.82	1.59	1.59	1.90
S	RA Overmold Length	N/A	2.24	3.78	3.78	4.50	4.50	4.49	4.49	5.79
II	Straight Overmold Diameter	0.75	1.11	1.50	1.50	1.50	1.63	1.82	2.02	2.50
JJ	Straight Overmold Length	1.05	2.20	3.39	3.75	3.39	4.43	4.50	5.25	5.75

Optical connectors require Moveable (FM) and Stationary (FS) ferrules. The FM needs a dry 1-bar chamber behind it, so is typically in the Receptacle (BR, OR, FR, CR) [illustration E1]. When the Receptacle is subject to *reverse* pressure, e.g. mounted on an oil-filled pressure-compensated canister [E2], the FS is in the Receptacle and the FM is in the CP.

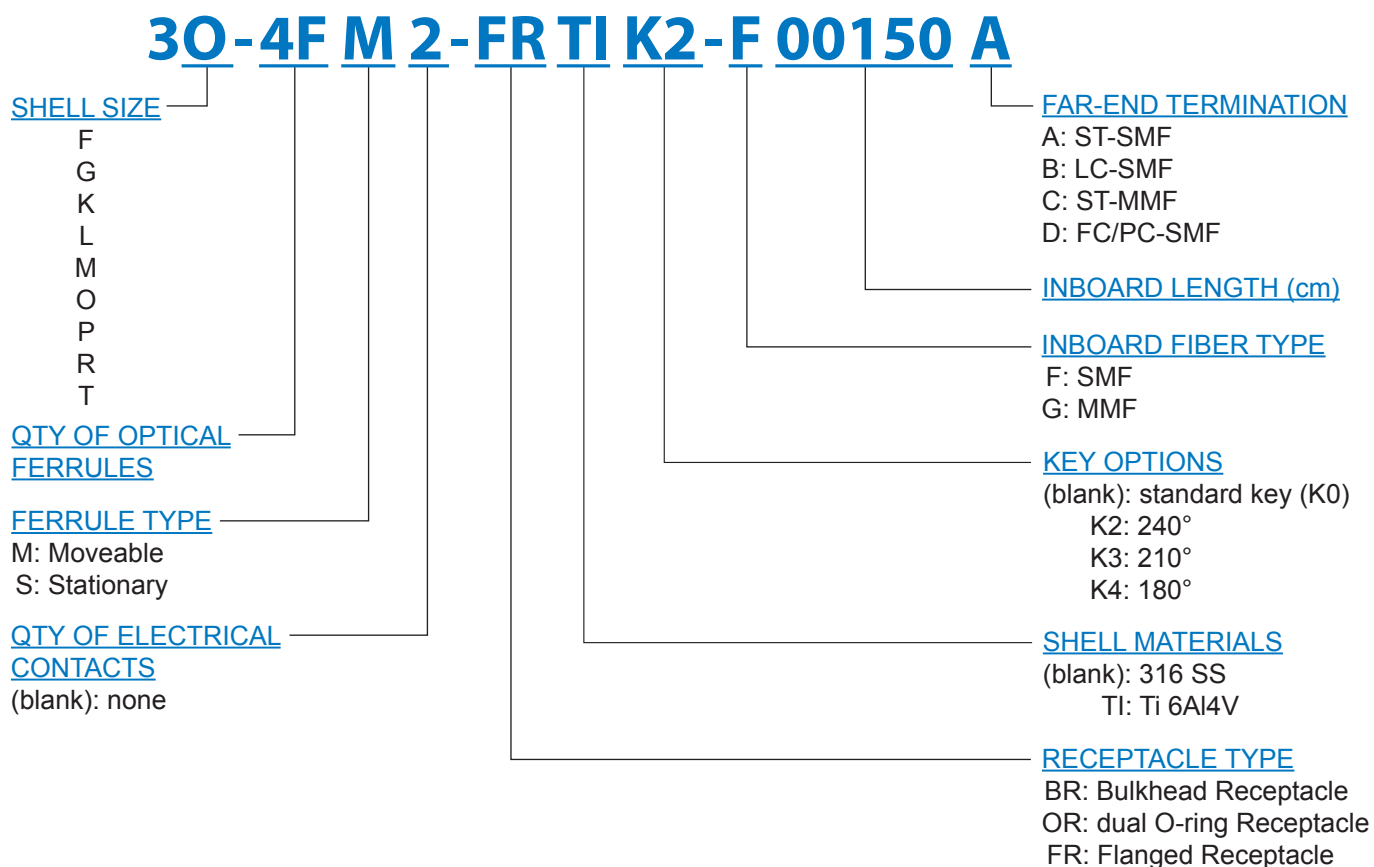
The part number reflects FM or FS. For example, the 3O-4F2 is the general designation of the 3O configuration with 4 ferrules and 2 copper contacts, but the part number of the *connector* begins with 3O-4FM2 (or 3M-4FS2) to designate Moveable or Stationary ferrules. (Not all Optical or EO connectors are available for reverse pressure. Ask your BIRNS Sales Executive for details.)



BIRNS Millennium optical connectors incorporate UPC (Ultra-Physical Contact) ferrules¹. BIRNS can provide customers' choice of SM or MM fibers. The fiber type is designated in the receptacle assembly part number (see Part Number-Optical/EO Receptacles, Page 28). BIRNS's standard fiber for SM inboard termination is premium grade high-modulus coated Corning Ø9.3/125/250/900µm diameter optical fibers. Maximum fiber attenuation is 1.0 dB/km @1310nm and .75 dB/km @1550nm.

Pro Tip: always ensure that your SMF or MMF termination selections are consistent throughout the interconnect system.

¹. At present BIRNS does not offer connectors with APC (Angled Physical Contact) ferrules.



Receptacle Kit/Assembly Part Numbering Guide¹

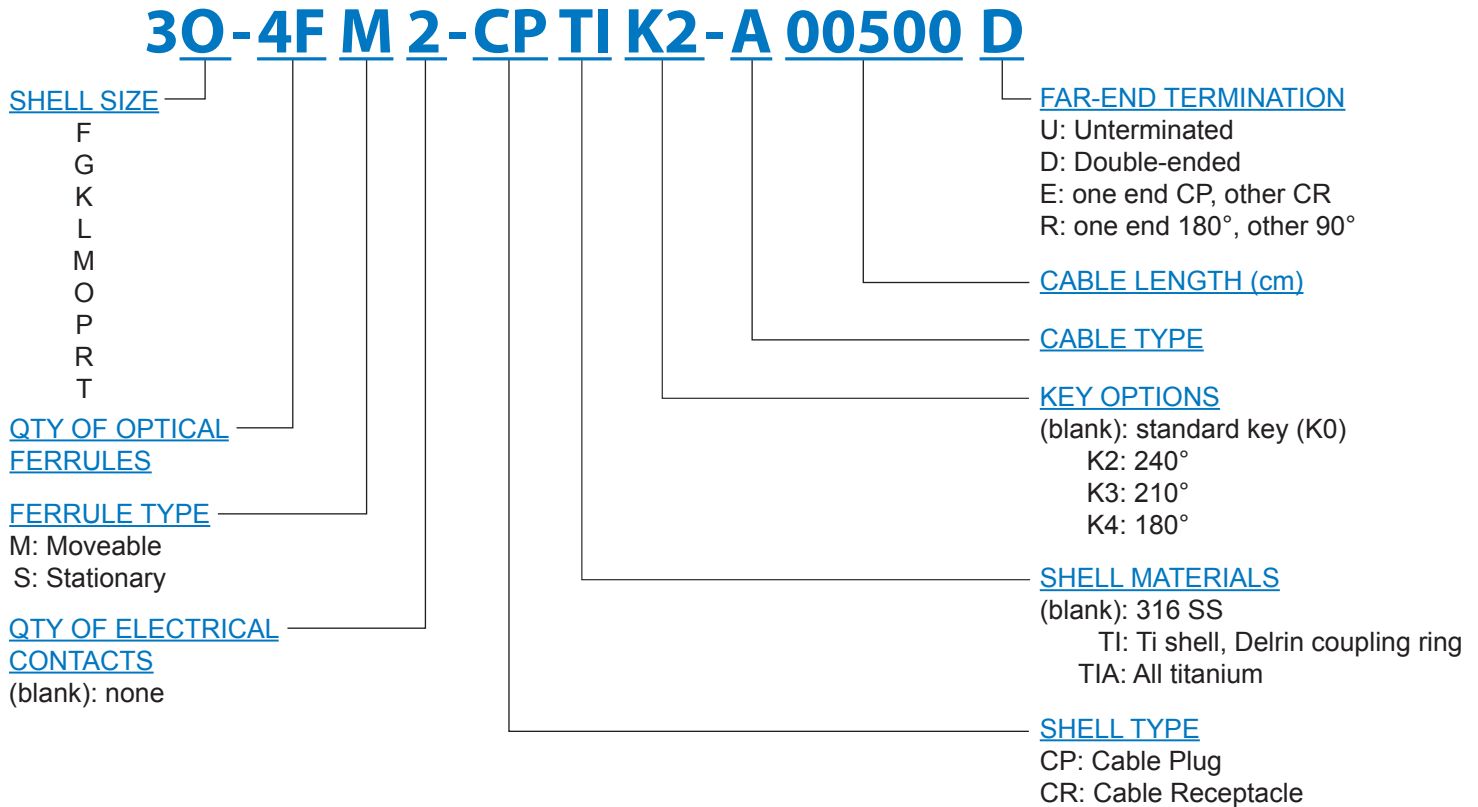
1. Select an optical or EO pin configuration from the chart.
2. On the Pin Configuration chart, note the shell size (e.g. 30) and configuration label (e.g. 30-4F2).
3. Select Moveable (FM) or Stationary (FS) ferrules.
 - a. Choose Moveable (FM) ferrules if your receptacle will be mounted into a device with a dry, 1-bar chamber inboard [see illustration E1].
 - b. Choose Stationary (FS) ferrules if your receptacle will be subjected to reverse pressure (for example, if it will be mounted in an oil-filled pressure-compensated canister [E2].
 - c. Add the letter 'M' or 'S' after the 'F' in the receptacle part number.
4. Select receptacle type (BR, OR, FR).
 - a. For optional locking nuts, see Nuts & Tools, Page 58.
5. Select shell material (SS, TI).
6. Select a Key Option if desired (K2, K3, K4).

Steps 1-6 are for the receptacle kit without assembly or inboard termination². For a complete terminated assembly:

7. Select the inboard fiber type (F: SMF, G: MMF)
8. Select the desired termination length in centimetres
9. Select the far-end termination

¹. Contact BIRNS for the correct replacement of legacy or obsolete part numbers.

². Optical and electro-optical termination and assembly of deep-ocean connectors is not a trivial task and requires special expertise and tools. We suggest that it be done by BIRNS' expert team.



Optical / EO Cable Assemblies Part Numbering Guide¹

1. Select an optical or EO pin configuration from the chart; note the shell size (e.g. 30) and configuration label (e.g. 30-4F2).
2. Select Moveable (FM) or Stationary (FS) ferrules.
 - a. The cable assembly ferrule MUST BE the OPPOSITE of the receptacle ferrule.
 - i. If the receptacle ferrules are Moveable (FM), the cable assembly ferrules MUST BE Stationary (FS).
 - ii. If the receptacle ferrules are Stationary (FS), the cable assembly ferrules MUST BE Moveable (FM).
 - b. Add the letter 'M' or 'S' after the 'F' in the cable assembly part number.
3. Select the cable connector type (CP, CR).
4. Select shell material (SS, TI, TIA).²
5. Select a Key Option if desired (K2, K3, K4).

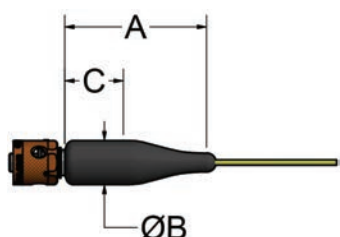
Steps 1-5 are for the connector kit without assembly or inboard termination³. For a complete terminated assembly:

6. Select the cable type.
7. Select the desired termination length in centimetres
8. Select the far-end termination (U, D, R, E).

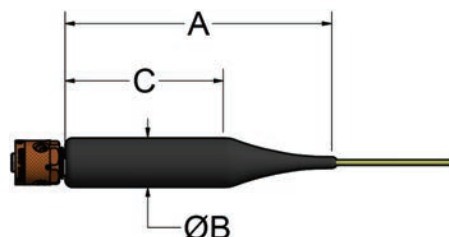
The part number does not include information such as wiring diagram, shield treatment, labeling, length tolerance, clocking, rotation, or overmolding material. Please ask for a BIRNS Configuration Drawing to define these details.

¹. Contact BIRNS for the correct replacement of legacy or obsolete part numbers.
². TI Cable Plugs have titanium shells and Delrin coupling rings. TIA Cable Plugs have titanium shells and titanium coupling rings. TI Cable Receptacles have titanium shells and are innately "TIA".
³. Optical and electro-optical termination and assembly of deep-ocean connectors is not a trivial task and requires special expertise and tools. We recommend that it be done by BIRNS' expert team.

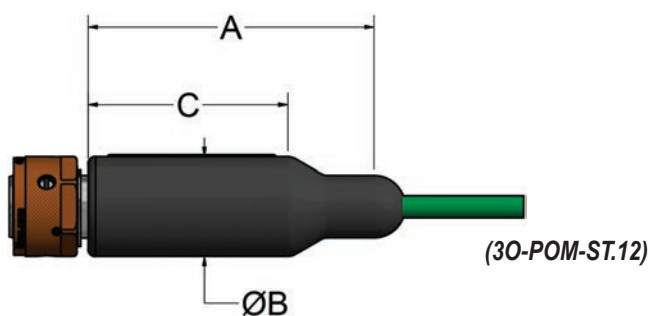
BIRNS optical and EO CPs use special cable assembly molds. Optical fibers require face-to-face mating of two ferrule assemblies: one spring-loaded Moveable Ferrule ("FM") and one Stationary Ferrule ("FS"). Moveable ferrules require a dry, one-atmosphere (1 bar) inboard chamber for proper operation, so are usually in the Receptacle. For use with oil-filled pressure-balanced chambers, BIRNS provides select optical and EO connectors with the Moveable Ferrule in the CP.



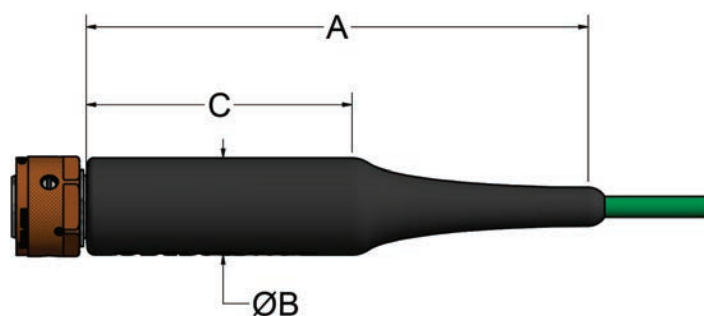
3F-FS-CP



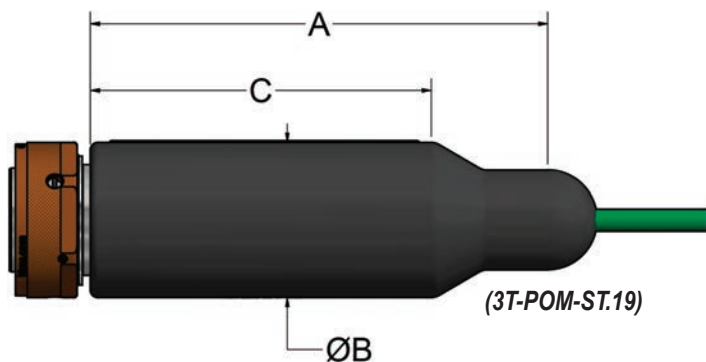
3F-FM-CP



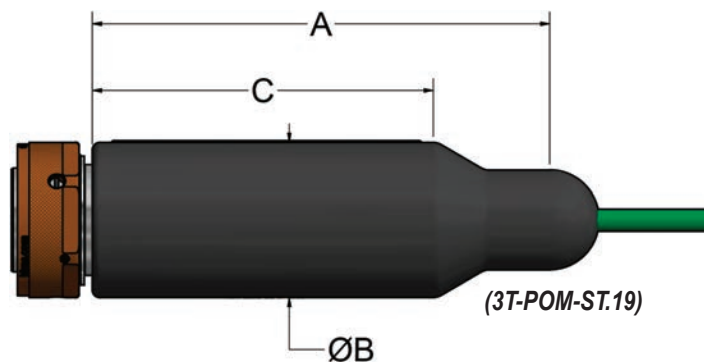
3O-FS-CP



3O-FM-CP



3T-FS-CP



3T-FM-CP

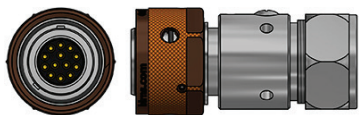
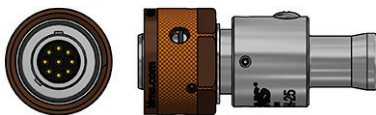

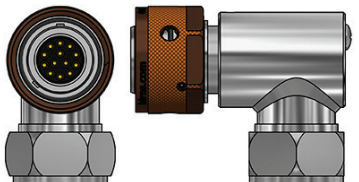
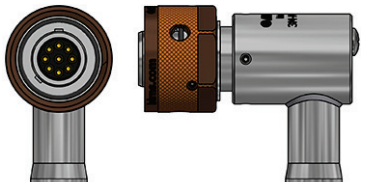
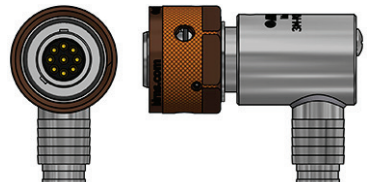
Optical/EO Cable Assembly Molds - mm			
Size	A	ØB	C
3F-FS-CP	61	19	25
3F-FM-CP	115	21	69
3O-FS-CP	123	43	86
3O-FM-CP	217	42	115
3T-FS-CP	198	67	147
3T-FM-CP	198	67	147

Optical/EO Cable Assembly Molds - inch			
Size	A	ØB	C
3F-FS-CP	2.4	0.75	1
3F-FM-CP	4.52	0.84	2.71
3O-FS-CP	4.85	1.69	3.4
3O-FM-CP	8.53	1.64	4.52
3T-FS-CP	7.78	2.63	5.8
3T-FM-CP	7.78	2.63	5.8

Oil-filled cable assemblies constitute conductive lines inside a hose containing an inert fluid. For some applications, oil-filled cable assemblies provide significant advantages: design flexibility, in-field serviceability, and inherent pressure balancing. However, successful use of oil-filled assemblies requires special consideration of design elements, for example that all conductors used in oil-filled cable assemblies must be sheathed or insulated with materials, such as PTFE, which withstand long-term oil immersion.

BIRNS Millennium connectors can be used in oil-filled cable assemblies¹ with a backshell (adapter) to affix the hose to the connector. Select types are available for multiple hose sizes. We offer three backshell designs:

- OF:** swaged hydraulic Fitting (accepts overall braided shield)
- OH:** Hose clamp
- OB:** Barb stem (accepts overall braided shield)

	OF	OH	OB
<i>Benefit 1:</i>	Superb tube sealing and retention	Minimal weight and size	Lightweight
<i>Benefit 2:</i>	Allows for OAS attachment	Very simple to use	Allows for OAS attachment
<i>Material:</i>	SS	SS or TI	SS
Straight:			
90°:			

1. When used with oil-filled cable assemblies, connectors may require special sealing caps. See Caps (Page 37) for details.

Backshell part numbers are listed on the next page. The choice of OF, OH, or OB backshell style, along with that of the hose size, is designated in the connector part number. (See Part Numbering - Oil-Filled Cable Assemblies, Page 45.)

It's important to ensure sufficient internal clearance for the wire bundle. First ascertain the maximum diameter of the wire bundle. Then, select a hose size with sufficient ID. (See the "Hose Size" table on the next page.) Finally, verify that the backshell, too, has enough internal clearance.

Pro Tip: remember to include any braided OAS in the wire-bundle diameter.

Each backshell style has unique internal geometry and wire clearance. The minimum clearance ID is listed for each backshell in the tables on the next page. When multiple hose size backshells are available for any CP shell size, the recommended size is highlighted in yellow: it is larger and thus provides greater internal wire clearance.

Pro Tip: use the backshell minimum ID to verify sufficient wire-bundle clearance. This ID will often be the constraint throughout the cable assembly.

Hose Size		
OD	ID (inch)	ID (mm)
0.50	0.25	6
0.75	0.50	13
1.00	0.75	19
1.25	1.00	25
1.50	1.25	32

CP Shell ID (min.)		
CP	ID (inch)	ID (mm)
3G-CP	0.44	11
3K-CP	0.56	14
3L-CP	0.65	17
3M-CP	0.69	18
3O-CP	0.85	22
3P-CP	1.04	26
3R-CP	1.36	34
3T-CP	1.54	39

OF backshells (Fitting), straight				
CP	Hose OD (in.)	Backshell	ID Min. (in.)	ID Min. (mm)
3G	0.50	3G-POF13	0.19	5
	0.75	3G-POF19	0.41	10
3K	0.75	3K-POF19	0.44	11
	1.00	3K-POF25	0.62	16
3L	0.75	3L-POF19	0.44	11
	1.00	3L-POF25	0.62	16
3M	0.50	3M-POF13	0.19	5
	0.75	3M-POF19	0.44	11
	1.00	3M-POF25	0.62	16
3O	0.75	3O-POF19	0.44	11
	1.00	3O-POF25	0.69	17
3P	0.75	3P-POF19	0.44	11
	1.00	3P-POF25	0.69	17

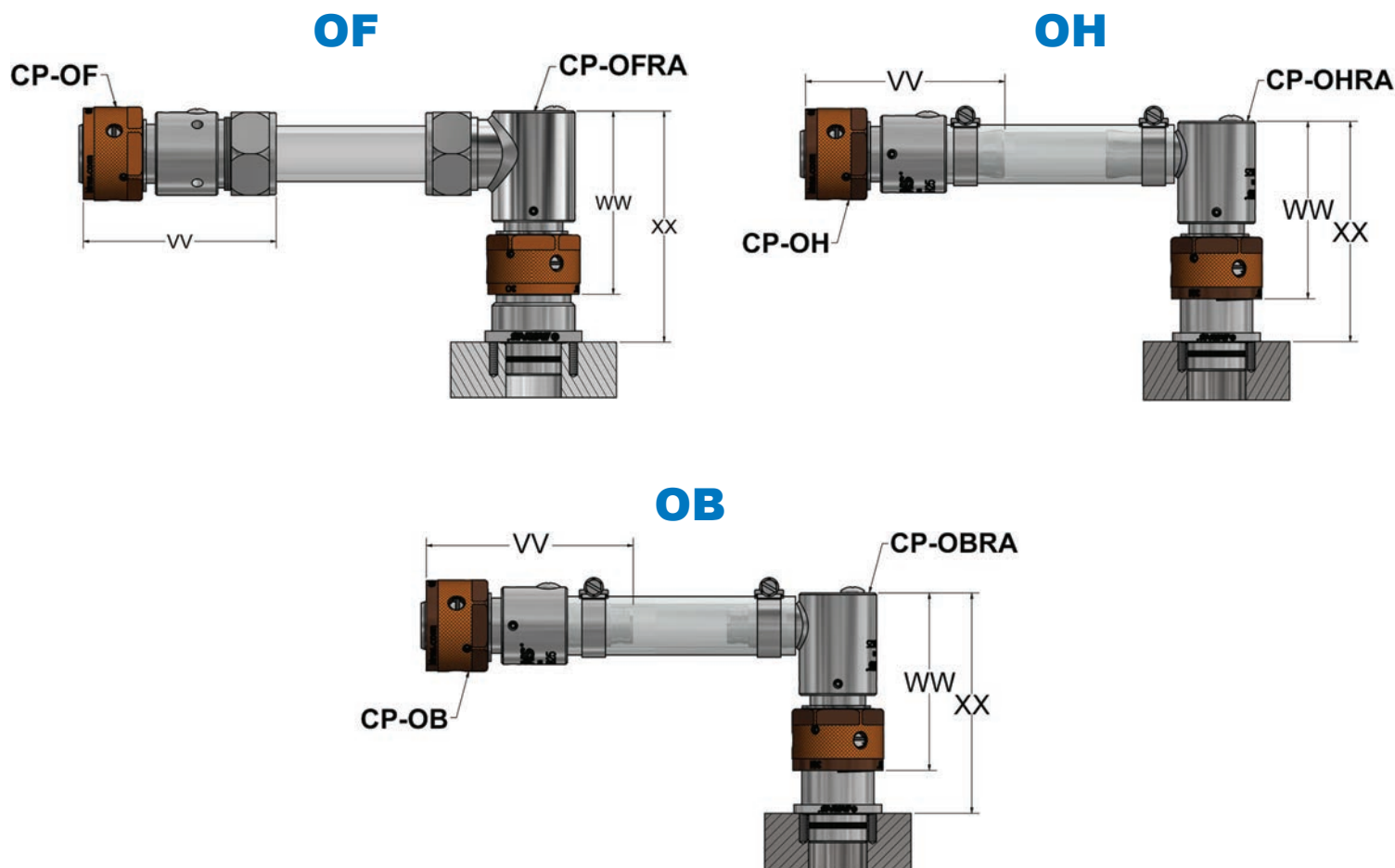
OFRA backshells (Fitting), Right Angle				
CP	Hose OD (in.)	Backshell	ID Min. (in.)	ID Min. (mm)
3G	0.50	3G-POFRA13	0.19	5
	0.75	3G-POFRA19	0.44	11
3K	0.75	3K-POFRA19	0.44	11
	1.00	3K-POFRA25	0.69	17
3L	0.75	3L-POFRA19	0.44	11
3M	0.75	3M-POFRA19	0.44	11
	1.00	3M-POFRA25	0.69	17
3O	0.75	3O-POFRA19	0.44	11
	1.00	3O-POFRA25	0.69	17
3P	1.00	3P-POFRA25	0.69	17

OH backshells (Hose clamp), straight					
CP	Hose OD (in.)	Backshell (SS)	Backshell (TI)	ID Min. (in.)	ID Min. (mm)
3G	0.75	3G-POH19	3G-POHTI19	0.36	9
3K	0.75	3K-POH19	3K-POHTI19	0.36	9
	1.00	3K-POH25	3K-POHTI25	0.60	15
3L	0.75	3L-POH19	3L-POHTI19	0.36	9
	1.00	3L-POH25	3L-POHTI25	0.60	15
3M	0.75	3M-POH19	3M-POHTI19	0.36	9
	1.00	3M-POH25	3M-POHTI25	0.60	15
3O	1.00	3O-POH25	3O-POHTI25	0.60	15
	1.25	3O-POH32	3O-POHTI32	0.84	21
3P	1.00	3P-POH25	3P-POHTI25	0.60	15
	1.25	3P-POH32	3P-POHTI32	0.84	21
3R	1.25	3R-POH32	3R-POHTI32	0.84	21
	1.50	3R-POH38	3R-POHTI38	1.05	27
3T	1.25	3T-POH32	3T-POHTI32	0.84	21
	1.50	3T-POH38	3T-POHTI38	1.05	27

OHRA backshells (Hose clamp), Right-Angle					
CP	Hose OD (in.)	Backshell (SS)	Backshell (TI)	ID Min. (in.)	ID Min. (mm)
3G	0.75	3G-POHRA19	3G-POHRATI19	0.36	9
3K	0.75	3K-POHRA19	3K-POHRATI19	0.36	9
	1.00	3K-POHRA25	3K-POHRATI25	0.60	15
3L	0.75	3L-POHRA19	3L-POHRATI19	0.36	9
	1.00	3L-POHRA25	3L-POHRATI25	0.60	15
3M	0.75	3M-POHRA19	3M-POHRATI19	0.36	9
	1.00	3M-POHRA25	3M-POHRATI25	0.60	15
3O	1.00	3O-POHRA25	3O-POHRATI25	0.60	15
	1.25	3O-POHRA32	3O-POHRATI32	0.84	21
3P	1.00	3P-POHRA25	3P-POHRATI25	0.60	15
	1.25	3P-POHRA32	3P-POHRATI32	0.84	21
3R	1.25	3R-POHRA32	3R-POHRATI32	0.84	21
	1.50	3R-POHRA38	3R-POHRATI38	1.05	27
3T	1.25	3T-POHRA32	3T-POHRATI32	0.84	21
	1.50	3T-POHRA38	3T-POHRATI38	1.05	27

OB backshells (Barb), straight				
CP	Hose OD (in.)	Backshell (SS)	ID Min. (in.)	ID Min. (mm)
3G	0.75	3G-POB19	0.28	7
3K	1.00	3K-POB25	0.53	13
3L	1.00	3L-POB25	0.53	13
3M	1.00	3M-POB25	0.53	13
3O	1.00	3O-POB25	0.53	13
	1.25	3O-POB32	0.78	20
3P	1.25	3P-POB32	0.78	20
3R	1.25	3R-POB32	0.78	20
	1.50	3R-POB38	1.03	26
3T	1.50	3T-POB38	1.03	26

OBRA backshells (Barb), Right-Angle				
CP	Hose OD (in.)	Backshell (SS)	ID Min. (in.)	ID Min. (mm)
3G	0.75	3G-POBRA19	0.28	7
3K	1.00	3K-POBRA25	0.53	13
3L	1.00	3L-POBRA25	0.53	13
3M	1.00	3M-POBRA25	0.53	13
3O	1.00	3O-POBRA25	0.53	13
	1.25	3O-POBRA32	0.78	20
3P	1.25	3P-POBRA32	0.78	20
3R	1.25	3R-POBRA32	0.78	20
	1.50	3R-POBRA38	1.03	26
3T	1.50	3T-POBRA38	1.03	26



Oil-filled Connector Dimensions (mm)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
VV-OF	CP-OF overall length	N/A	74	90	89	83	89	89	N/A	N/A
VV-OH	CP-OH overall length	N/A	78	87	87	87	87	87	90	88
VV-OB	CP-OB overall length	N/A	81	90	90	90	90	90	93	91
WW-OF	CP-OFRA height	N/A	68	91	77	91	84	84	N/A	N/A
WW-OH	CP-OHRA height	N/A	69	77	77	77	84	84	99	98
WW-OB	CP-OBRA height	N/A	69	77	77	77	84	84	99	98
XX-OF	FR/CP-OFRA height	N/A	79	115	100	110	106	108	N/A	N/A
XX-OH	FR/CP-OHRA height	N/A	83	101	100	96	106	108	123	120
XX-OB	FR/CP-OBRA height	N/A	83	101	100	96	106	108	123	120

Oil-filled Connector Dimensions (inch)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
VV-OF	CP-OF overall length	N/A	2.92	3.55	3.52	3.26	3.50	3.50	N/A	N/A
VV-OH	CP-OH overall length	N/A	3.08	3.42	3.41	3.41	3.43	3.41	3.54	3.47
VV-OB	CP-OB overall length	N/A	3.20	3.55	3.54	3.54	3.56	3.54	3.66	3.60
WW-OF	CP-OFRA height	N/A	2.66	3.60	3.04	3.60	3.31	3.29	N/A	N/A
WW-OH	CP-OHRA height	N/A	2.70	3.05	3.04	3.04	3.31	3.29	3.91	3.85
WW-OB	CP-OBRA height	N/A	2.70	3.05	3.04	3.04	3.31	3.29	3.91	3.85
XX-OF	FR/CP-OFRA height	N/A	3.10	4.52	3.92	4.32	4.17	4.24	N/A	N/A
XX-OH	FR/CP-OHRA height	N/A	3.28	3.97	3.92	3.77	4.17	4.24	4.86	4.74
XX-OB	FR/CP-OBRA height	N/A	3.28	3.97	3.92	3.77	4.17	4.24	4.86	4.74

3M-13-CP TI K2-OH RA 25-A 00300 D

SHELL SIZE

F
G
K
L
M
O
P
R
T

PIN CONFIGURATION

SHELL TYPE

CP: Cable Plug
CR: Cable Receptacle

SHELL MATERIALS

(blank): 316 SS
TI: Ti shell, Delrin coupling ring
TIA: All titanium

KEY OPTIONS

(blank): standard key (K0)
K2: 240°
K3: 210°
K4: 180°

FAR-END TERMINATION

U: Unterminated
D: Double-ended
E: one end CP, other CR
R: one end 180°, other 90°

ASSEMBLY LENGTH (cm)

HOSE TYPE

A: Tygon Beverage
B: Tygon Fuel
X: None

HOSE SIZE

13: 1/2" OD
19: 3/4" OD
25: 1" OD
32: 1 1/4" OD
38: 1 1/2" OD

HOSE ANGLE

(blank): 180° (straight)
RA: 90°

HOSE ATTACHMENT

OF: swaged Fitting (SS only)
OH: Hose clamp
OB: Barb (SS only)

Oil-Filled Cable Assemblies Part Numbering Guide¹

1. Select a pin configuration from the chart. Note the shell size (e.g. 3M) and pin configuration label (e.g. 3M-13).
2. Select the connector type (CP, CR)
3. Select shell material (SS, TI, TIA)² (see CP Materials Table, Page 18)
4. Select a Key Option if desired (K2, K3, K4)
5. Select the Hose Attachment style (OF, OH, OB)³
6. Select hose Angle (180°, 90°)
7. Select hose outer diameter⁴

Steps 1-7 are for the connector kit without termination or assembly. For a complete cable assembly:

8. Select the hose type
9. Select the length in centimetres
10. Select the far-end termination (U, D, R, E) (see OF Cable Assemblies, Page 47)

The part number does not include information such as wiring diagram, shield treatment, labeling, length tolerance, back-potting, clocking, rotation, or oil-fill material. Please ask for a BIRNS Configuration Drawing to define these details.

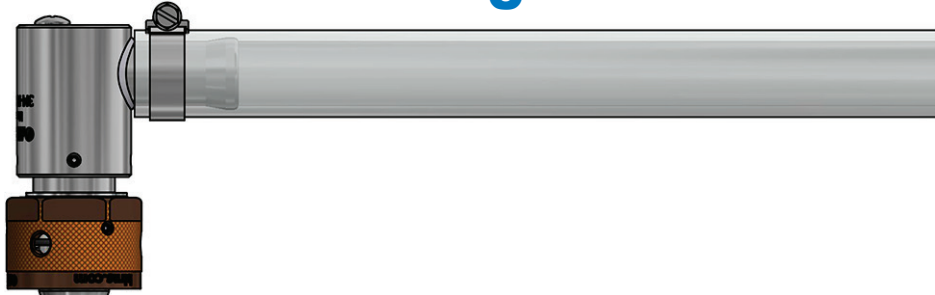
¹ Contact BIRNS for the correct replacement of legacy or obsolete part numbers.
² TI Cable Plugs have titanium shells and Delrin coupling rings. TIA Cable Plugs have titanium shells and titanium coupling rings. TI Cable Receptacles have titanium shells and are innately "TIA".
³ The backshell material is the same as the connector shell material (eg a SS connector will have a SS backshell). OF (Swaged Fitting) and OB backshells are available in SS only.
⁴ For adequate internal wire space, some shell sizes cannot be used with all hose sizes. All hoses have 1/8" (~3.2mm) wall thickness.

CP-OH,
CP-OB



U

CP-OHRA,
CP-OBRA



U

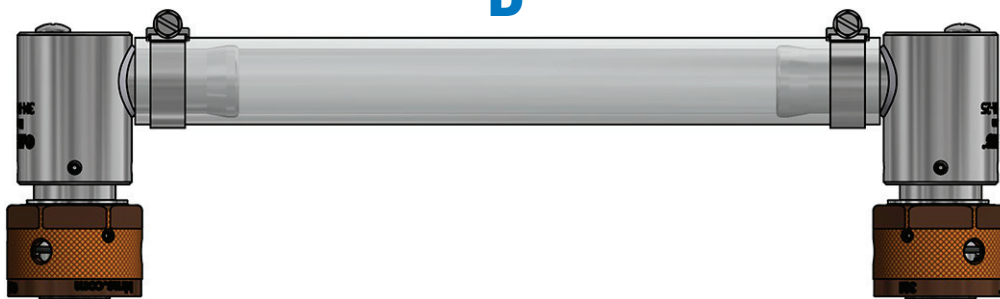
CP-OH,
CP-OB



D

CP-OH,
CP-OB

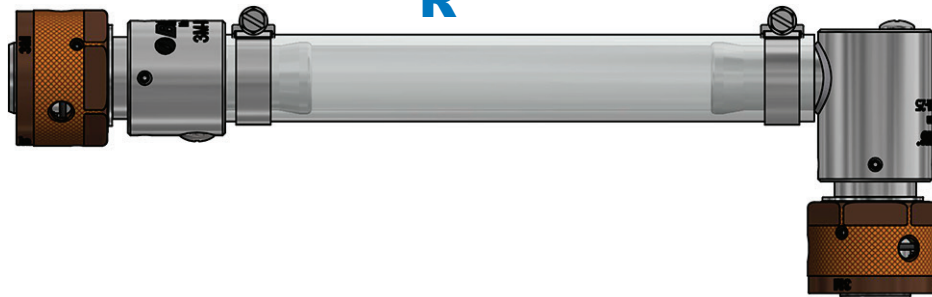
CP-OHRA,
CP-OBRA



D

CP-OHRA,
CP-OBRA

CP-OH,
CP-OB



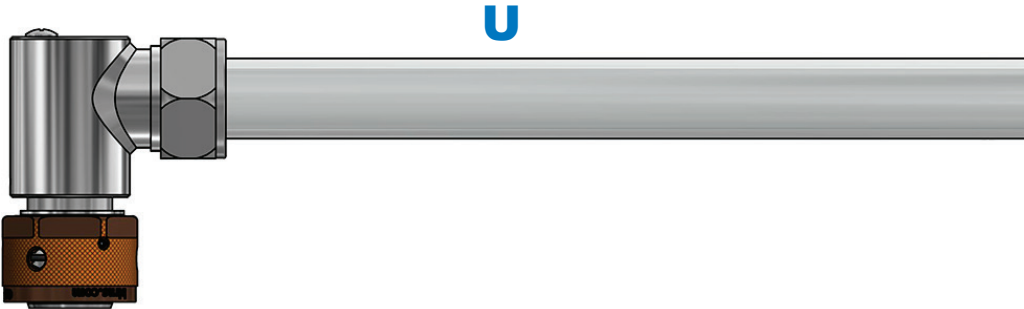
R

CP-OHRA,
CP-OBRA

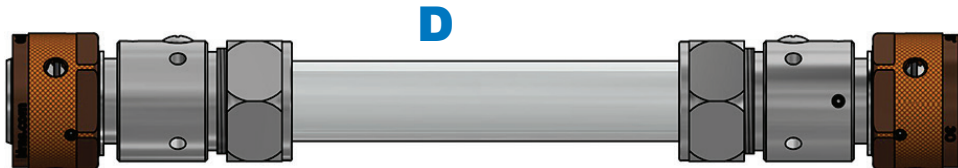
CP-OF



CP-OFRA

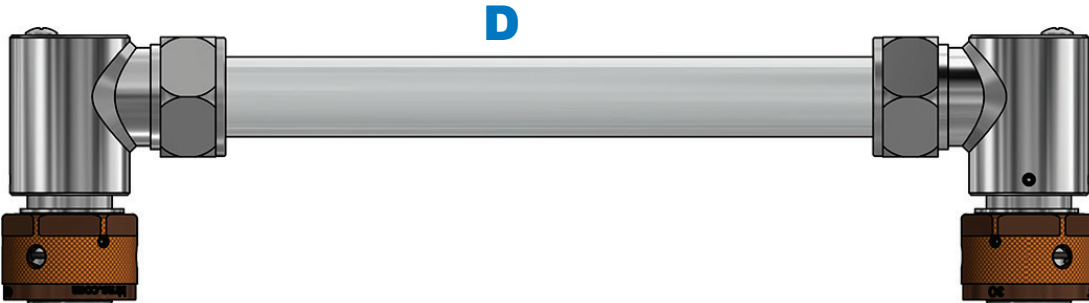


CP-OF



CP-OF

CP-OFRA



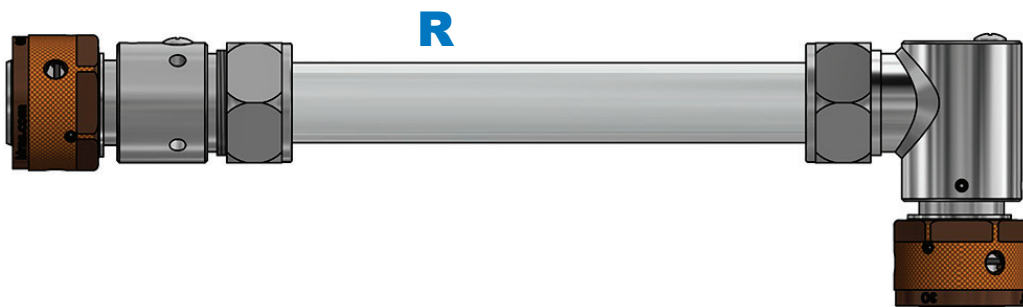
CP-OFRA

CP-OF



CR-OF

CP-OF



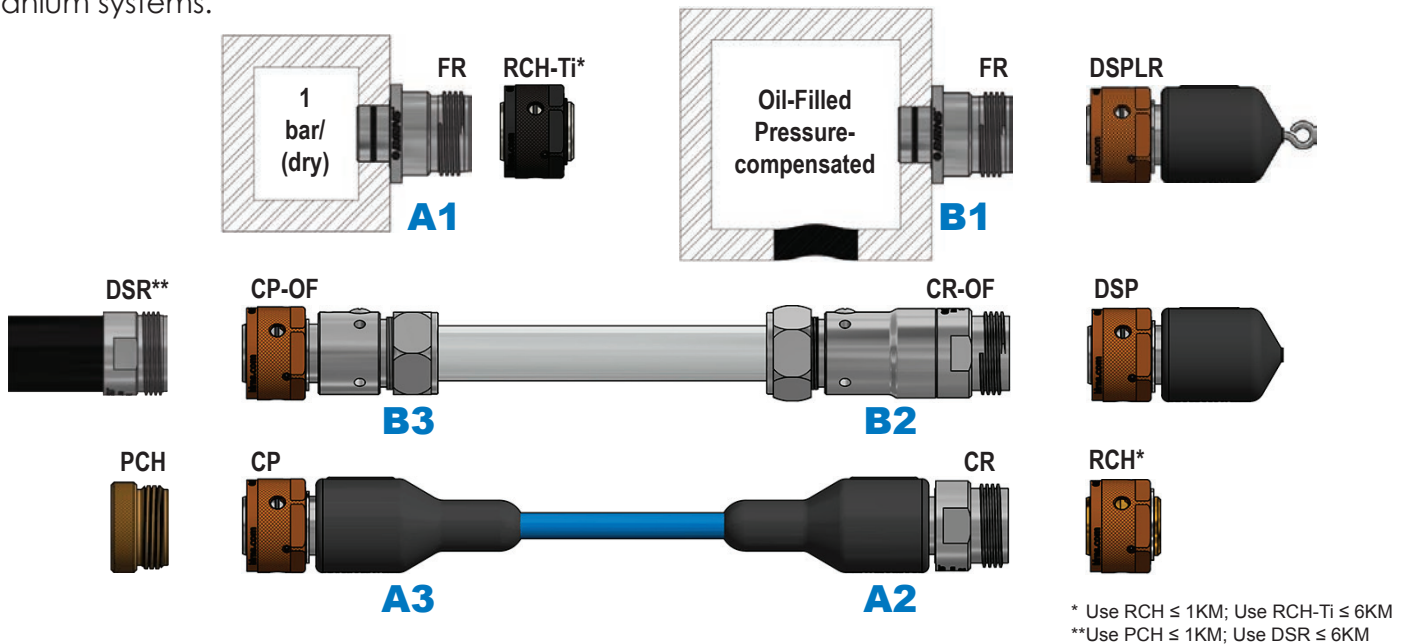
CP-OFRA

Caps

BIRNS sealing caps securely protect unmated BIRNS Millennium connectors. Caps are available for 100 bar and 600 bar, and for standard ("face") and reverse ("rear") pressure.

BIRNS Millennium receptacles withstand high face pressure (illustrations A1 & A2) and use RCH and RCH-TI. When the Receptacle is subjected to rear pressure, as part of an oil-filled cable (CR-OF) or on an oil-filled pressure-compensated canister (B1 & B2), it must be capped with the DSP (Dummy Sealing Plug). The DSP is specific to the receptacle's pin configuration: a 3L-25-CR-OF uses a 3L-25-DSP, a 3L-7-FR uses a 3L-7-DSP, etc. The DSP is optionally available with a 316 stainless steel Lanyard Ring [Ø6mm (Ø1/4") eye ID].

BIRNS Millennium cable plugs use PCH for face pressure (A3). In an oil-filled cable assembly (B3), the CP-OF withstands 100 bar while capped with a PCH; for higher pressures, the CP-OF must be capped with a DSR (Dummy Sealing Receptacle). Titanium PCH (PCH-TI) are available in select sizes for all-titanium systems.



Caps (Protective and Sealing/Pressure-Proof)				
Pressure Direction	Receptacle Caps		Plug Caps	
Face Pressure :	RCL	splash-proof	PCL	splash-proof
	RCH	≤ 1000m	PCH	≤ 6000m
	RCH-TI, RCH-TIA	≤ 6000m	PCH-TI	≤ 6000m
Rear Pressure :	DSP	≤ 6000m	PCH	≤ 1000m
			DSR	≤ 6000m

Dummy Sealing Connectors

3M-13-DSP

Shell Size

Contacts

DSP: Dummy Sealing Plug
DSR: Dummy Sealing Receptacle
DSPLR: Dummy Sealing Plug with Lanyard Ring

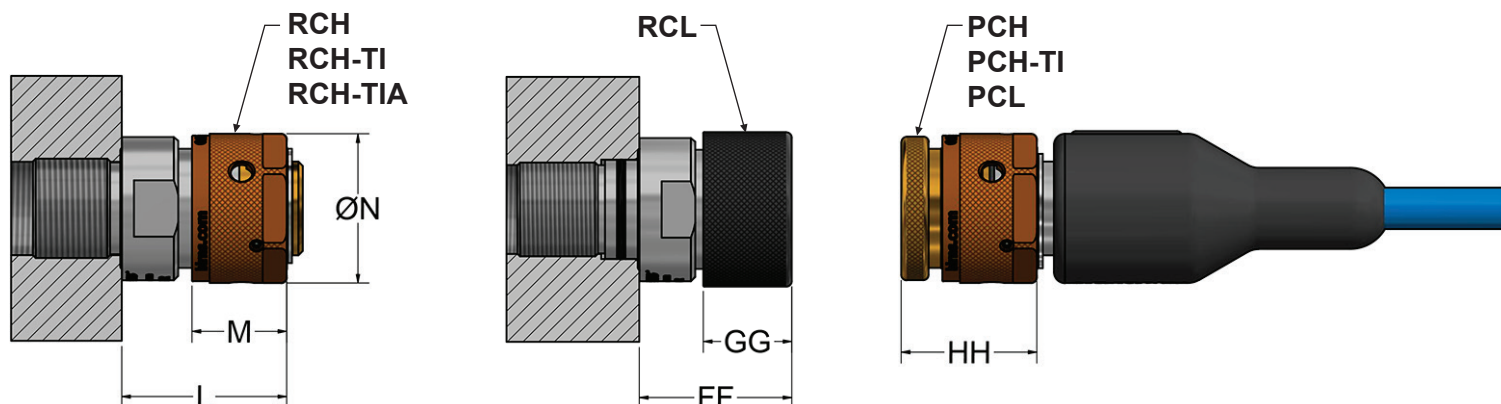
Pressure Caps

3M-RC H-TI

Shell Size

RC: Receptacle Cap
PC: Plug Cap

L: IP56
H: 1,000m
H-TI: 6,000m
H-TIA: 6,000m



Cap Dimensions (mm)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
L	BR/RCH Combined Height	34	41	52	52	46	52	52	58	52
M	RCH Height	22	27	31	31	32	31	31	31	34
N	Coupling Ring Diameter	19	27	34	37	40	43	49	57	67
FF	OR/RCL Combined Height	27	30	42	43	39	44	45	45	44
GG	RCL Height	15	15	25	25	25	25	27	27	27
HH	Coupling Ring/PCH Combined Length	27	31	39	39	39	39	41	45	44

Cap Dimensions (inch)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
L	BR/RCH Combined Height	1.33	1.63	2.06	2.05	1.83	2.05	2.06	2.29	2.04
M	RCH Height	0.88	1.05	1.24	1.23	1.25	1.24	1.23	1.24	1.35
N	Coupling Ring Diameter	0.75	1.06	1.32	1.44	1.56	1.69	1.94	2.25	2.63
FF	OR/RCL Combined Height	1.07	1.20	1.67	1.71	1.55	1.72	1.79	1.79	1.72
GG	RCL Height	0.60	0.60	1.00	1.00	1.00	1.00	1.05	1.05	1.06
HH	Coupling Ring/PCH Combined Length	1.07	1.23	1.52	1.53	1.53	1.53	1.63	1.78	1.74

Receptacle Cap Materials			
Cap Type	Shell	Hardware	Coupling Ring
RCL:	Delrin	N/A	Delrin
RCH:	Brass	SS	Bronze
RCHTI:	Ti	Ti	Delrin
RCHTIA:	Ti	Ti	Ti

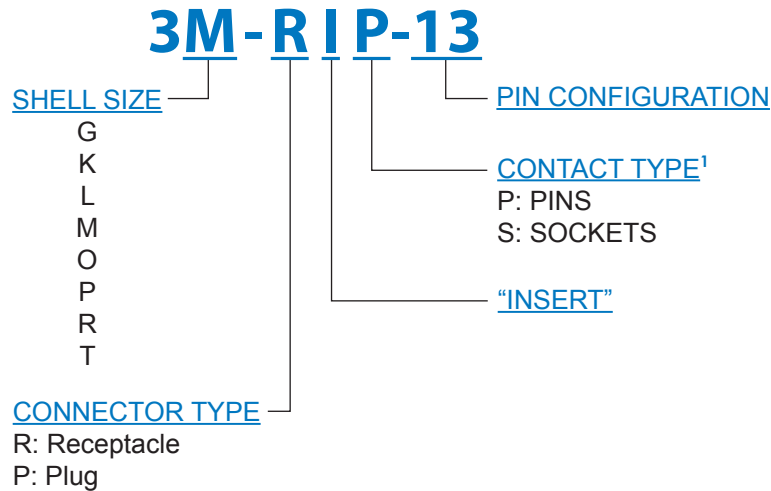
Plug Cap Materials	
Cap Type	Material
PCL:	Delrin
PCH:	Brass
PCHTI:	Ti

Cap Mass (g)									
Item	3F	3G	3K	3L	3M	3O	3P	3R	3T
RCL	5	7	16	20	25	31	43	49	63
RCH	30	72	125	159	176	222	272	368	508
RCH-TI	10	23	41	55	62	83	104	141	205
RCH-TIA	15	36	63	80	89	113	139	187	260
PCL	4	8	17	20	26	25	44	62	90
PCH	22	51	101	116	151	146	258	370	535
PCH-TI	12	27	53	61	79	77	135	194	280
DSP	N/A	101	161	208	234	299	349	485	645
DSP-LR	N/A	104	165	211	237	302	352	488	649
DSR	N/A	106	178	209	259	302	408	628	703
DSR-LR	N/A	109	182	212	262	305	411	632	706

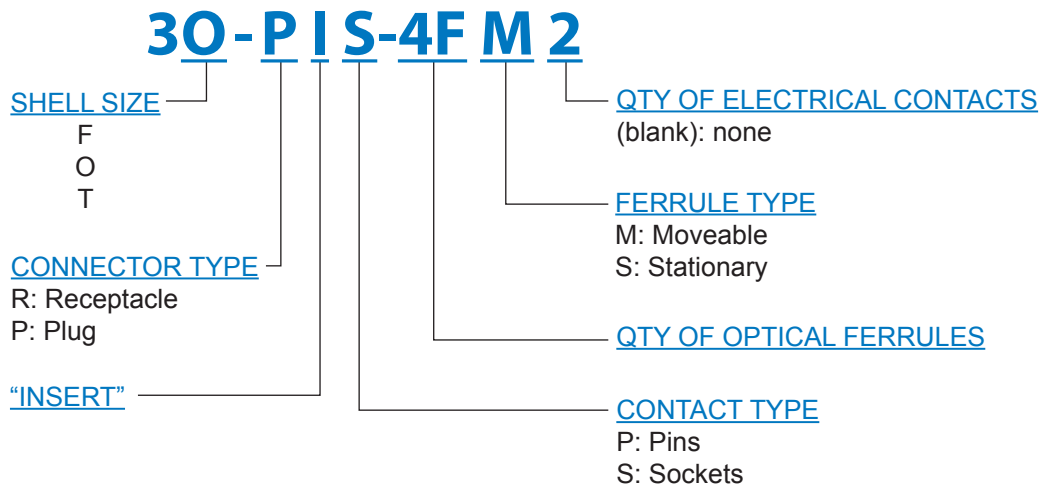
Cap Mass (oz)									
Item	3F	3G	3K	3L	3M	3O	3P	3R	3T
RCL	0.2	0.2	0.6	0.7	0.9	1.1	1.5	1.7	2.2
RCH	1.1	2.5	4.4	5.6	6.2	7.8	9.6	13.0	17.9
RCH-TI	0.3	0.8	1.4	1.9	2.2	2.9	3.7	5.0	7.2
RCH-TIA	0.5	1.3	2.2	2.8	3.1	4.0	4.9	6.6	9.2
PCL	0.1	0.3	0.6	0.7	0.9	0.9	1.5	2.2	3.2
PCH	0.8	1.8	3.5	4.1	5.3	5.1	9.1	13.0	18.9
PCH-TI	0.4	1.0	1.9	2.1	2.8	2.7	4.8	6.8	9.9
DSP	N/A	3.6	5.7	7.3	8.3	10.5	12.3	17.1	22.8
DSP-LR	N/A	3.7	5.8	7.4	8.4	10.6	12.4	17.2	22.9
DSR	N/A	3.7	6.3	7.4	9.1	10.6	14.4	22.2	24.8
DSR-LR	N/A	3.9	6.4	7.5	9.2	10.8	14.5	22.3	24.9

An insert is included with every connector kit (and/or assembly). If spares are needed, part numbering of the inserts is as follows.

Non-Optical



Optical/EO



1. Receptacles always have pins and plugs always have sockets, except for RG (Reverse Gender) configurations. Standard inserts are RIP and PIS for the Receptacle and Plug, respectively. In RG configurations, sockets are in the Receptacle and pins are in the Cable Plug; Inserts for the Receptacle and Plug are RIS and PIP, respectively.

Materials	
Item	Material
SS Shells:	316 SS, Passivated per ASTM A967
TI Shells:	Ti 6Al4V, Grade 5, Passivated per ASTM B600
Coupling Rings: (CP, RCH):	C54400 Phosphor Bronze, ASTM B139, Hard temper H04
Coupling Rings: (CPTI, RCH-TI):	Acetyl Resin, Delrin
Coupling Rings: (CPTIA, RCH-TIA):	Titanium, Grade 2, Anodized per AMS 2487 & PTFE-impregnated
SS Hardware:	300-series SS, Passivated
TI Hardware:	Titanium, Grade 2 (CP)
Pins:	C36000 Copper Alloy, 50μ Au/50μ Ni
Sockets:	C17300H BeCu, heat-treated, 50μ Au/50μ Ni
Inserts:	GRE (glass-reinforced epoxy)
Optical Ferrules, Alignment Sleeves:	Zirconia ceramic
O-rings (standard):	NBR (standard)

Titanium galling¹ ("seizing") is common. Galling is adhesive wear, particularly in high-ductility metals, caused by transfer of material between surfaces during transverse motion. To prevent galling, BIRNS titanium coupling rings are anodized per AMS 2487 in a 12.4 pH alkaline bath and then impregnated with PTFE for superb friction reduction and galling resistance.

Pressure Resistance (bar)				
Type	Electric	RF: 1C, 1V	RF: 1B	EO
Open-face:	600	140	140	600
Mated (molded):	600	600	600	600
Mated (oil-filled):	600	N/A	N/A	N/A

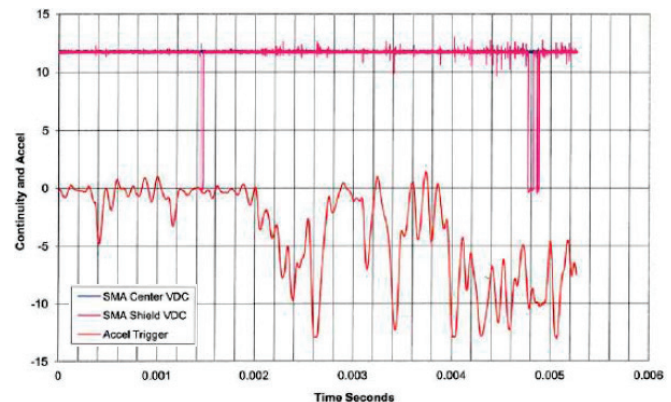
Note: select items have been tested and qualified to 625 bar open-face and 750 bar mated.

Temperature/Thermal Performance		Qualification Test Results
Temperature Range:	-34°C to +121°C	(expectation based on materials, not tests)
Operating Temperature:	-40°C to +65°C	Operational Performance maintained over the range
Non-Operating Temperature:	-40°C to +71°C	No damage/operational performance degradation over the range
Thermal Shock hot:	+65°C hot air to +20°C warm air	Operational Performance maintained over the range
Thermal Shock cold:	-54°C cold air to 0°C cold water	Operational Performance maintained over the range

Select EO sizes and configurations have been vibration-tested per MIL-STD-167-1A, Type 1, Table III, to 14 Hz.

TEST RESULTS				
Discontinuities (>1μs & >1.5dB)				
Vibration Step	Axis	Wavelength	Discontinuity?	Pass / Fail
Exploratory Vibration	X	1310nm	No	Pass
	Y	1310nm	No	Pass
	Z	1310nm	No	Pass
Variable Vibration	X	1310nm	No	Pass
	Y	1310nm	No	Pass
	Z	1310nm	No	Pass
Endurance Vibration	X	1310nm	No	Pass
	Y	1310nm	No	Pass
	Z	1310nm	No	Pass

Select EO sizes and configurations have been high-impact shock-tested per MIL-S-901D Grade A Class 1 Type C. Grade A items are essential to the ship's safety and continued combat capability; Class 1 items must pass shock tests without use of resilient mounting. The tests involve hitting the connector mounting plate in each of three axes (top, side, back) with a 400-lb (182kg) hammer dropped from 1, 3 and 5 feet (.3m, 1m, and 1.5m). This is a typical 5-foot (1.5m) drop test result:



1. Per ASTM G40: "Galling is a form of surface damage arising between sliding solids, distinguished by microscopic, usually localized, roughening and creation of protrusions (e.g.: lumps) above the original surface".

BIRNS Millennium electrical interconnect products are ideal for high performance subsea systems requiring power and fast data transfer, with available high-voltage (≤ 3.6 kV) and/or low-voltage (≤ 600 V) contacts. They provide excellent contact engagement per MIL-STD-39029D, with insulated solder pots to minimize EMI, noise and cross-talk. Sockets are heat-treated BeCu for longevity and superior electrical contact, and all contacts have 50 μ of hard gold plating for superior data transmission.

When multiple conductors are in proximity, each heats the others and decreases availability for cooling, so conductors' allowed current should be derated when conductors are bundled in a grouping or cable. NFPA 70 (NEC)¹ Tables B.310 define ampacity bundling-derating guidelines and ambient temperature adjustments.

BIRNS ampacity values are merely informational. The system's electrical designers are responsible to perform detailed engineering analyses of the many factors affecting ampacity.



Bundling Current Derating	
Conductors	% of Current Values
4-6	80
7-9	70
10-20	50
21-30	45
31-40	40
41 and above	35

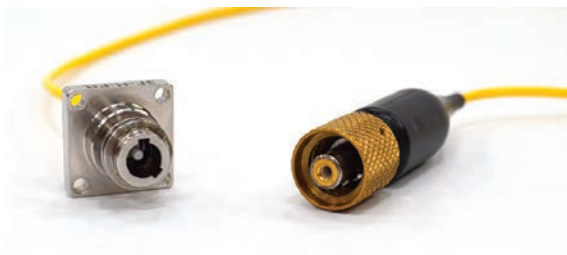
Actual measurements of AWG sizes can vary from manufacturer to manufacturer. BIRNS conductors are larger than some standard sizes for additional flexibility and safety.

(Industry Standard AWG)				BIRNS Connector Pins							
AWG	Ø (in.)	Ø (mm)	A (mm ²)	AWG	Ø (in.)	Ø (mm)	A (mm ²)	BIRNS:AWG ratio (%)	I (A)	Wire Ø Max (in.)	Wire Ø Max (mm)
22	0.025	0.65	0.33	22	0.030	0.76	0.46	140%	4	0.036	0.91
20	0.032	0.81	0.52	20	0.040	1.02	0.81	156%	6	0.040	1.02
16	0.051	1.29	1.31	16	0.063	1.60	2.01	154%	15	0.070	1.78
14	0.064	1.63	2.08	14	0.078	1.98	3.08	148%	25	0.093	2.36
10	0.102	2.59	5.26	10	0.125	3.18	7.92	150%	40	0.125	3.18

1. National Fire Protection Association 70, National Electric Code.

BIRNS Millennium optical and EO configurations deliver the ultimate in high-performance data transmission, with designs qualified in cold-water high pressure testing and proven in service. Configurations are available for both SM and MM fibers, as well as hybridized with electrical conductors for power and/or control.

- Insertion Loss¹
 - SM: .5dB max [typical: .1dB]
 - MM: 1dB max [typical: .25dB]
- Return Loss
 - 35 dB min



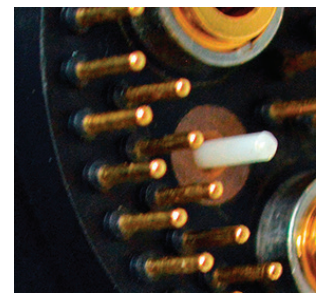
3F-1F-PAIR

The popular 3F-1F-FR (L) and mating 3F-1F-CP (R).



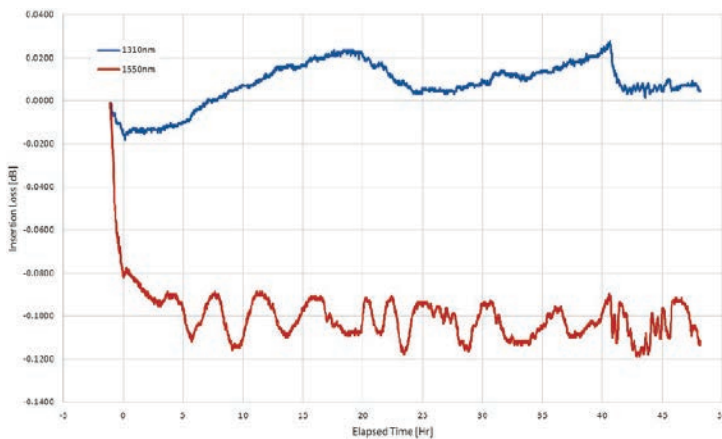
FERRULES

BIRNS makes ceramic zirconia ferrules in 2.5mm and 1.25mm styles.



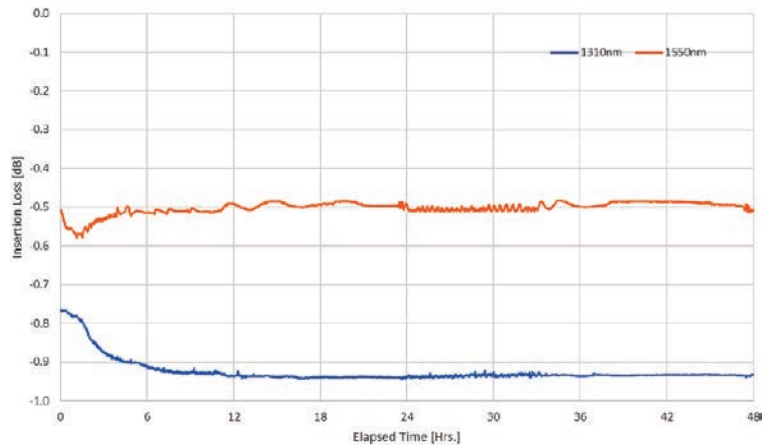
HYBRID

A 1.25mm ferrule in a hybridized high-density electro-opto-RF configuration.



3O-1F3

Insertion loss for the 3O-1F3 at 625 bar/1°C for 48 hours.
At both 1310nm and 1550nm, insertion loss ≤ -0.1 dB.
Return loss was ≥ 75 dB.



3F-1F

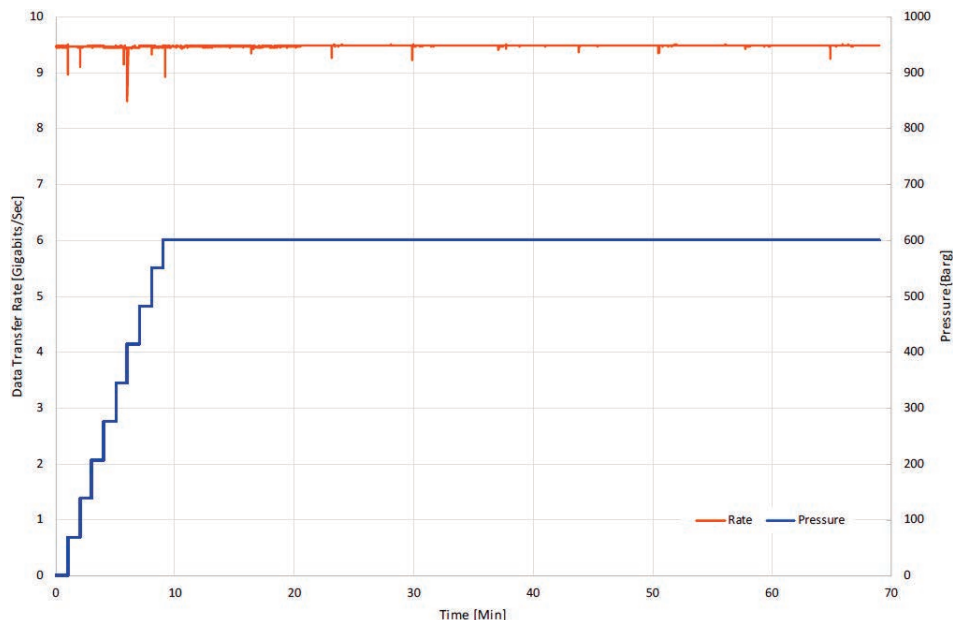
Insertion loss for the 3F-1F3 at 625 bar/1°C for 48 hours.

1. Tested in accordance with ANSI/TIA/EIA-455.

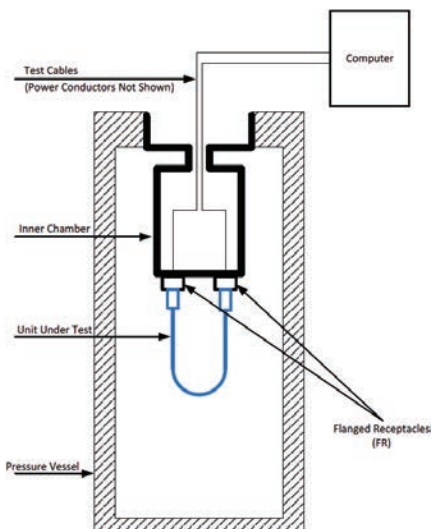
Gigabit Speed Data Transfer Capabilities: 9.4+/- 0.1 Gigabits per second (Gb/s)

We developed exclusive deep submergence cable constructed for Cat 8.2 use, and can now offer cable assemblies with data transfer rates of 9.4+/- 0.1 Gb/s. Performance testing proved that data consistently transmitted at this rate over the entire range of pressures from 0 to 8700 PSI/600 bar. The tested configuration is the BIRNS 3M-16. Several sizes and pin configurations are available with data transfer rates of up to 9.4+/- 0.1 Gb/s at 6000m: 3G-10 (Ethernet); 3M-13, 3M-16 and 3O-17 (Ethernet and Power).

Data Transfer Rate and Pressure

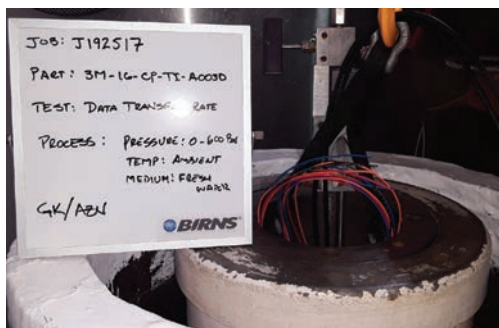


9.48 Gb/s over 20m (65 ft.) of cable with five inline mating pairs.



Setup for the Gigabit data transfer test under pressure requirements

Subsequent testing has shown consistent 9.48 Gb/s data transfer even over 20m (65 feet) of cable with five 3M-16 inline mating pairs.



The Unit Under Test after installation in the test chamber



The pressure system controls located outside Hydrostatic Pressure Testing facility I (The chiller was not used for this test.)

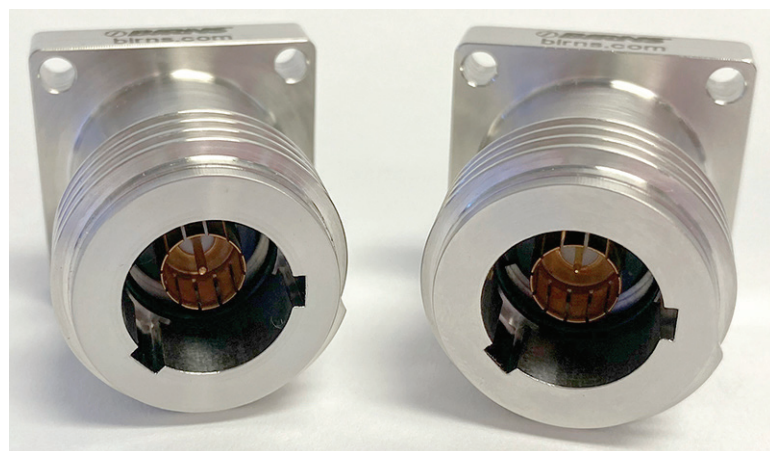


BIRNS produces high-performance RF connectors for 50Ω and 75Ω applications.

BIRNS Millennium pressure-rated, low-loss RF (coax) connectors are ideal for GPS-frequency systems up to SHF (centimetre wave) in IEEE bands S and C, and can be hybridized with electrical contacts and/or optical ferrules. BIRNS 1C and 1V assemblies offer low insertion loss even up to GPS frequencies, while BIRNS 1B units are capable of 18HGz and beyond.

BIRNS Millennium RF connectors are the most advanced and best-performing units on the market, with proprietary new RF technology providing low insertion loss, high frequency capability, open face pressure resistance, and 50Ω and 75Ω configurations. BIRNS exclusive RF contacts withstand open face pressure to depths of 1400m.

BIRNS recently launched the BIRNS “1V” series, featuring a compact 75Ω RF contact in a 50Ω footprint. The new 1V is ideal for HD/SD video with signal frequencies to 3GHz, for shortwave antennas, or for low-power RF needing minimal signal attenuation. And, due to its extraordinarily compact size, the 1V fits into many BIRNS coax pin configurations. BIRNS 1C (50Ω) and 1V (75Ω) contacts can be combined in the same connector, offering a range of flexible, powerful new options in a small space.



BIRNS 1C/50Ω (L) and 1V/75Ω (R) RF connectors.

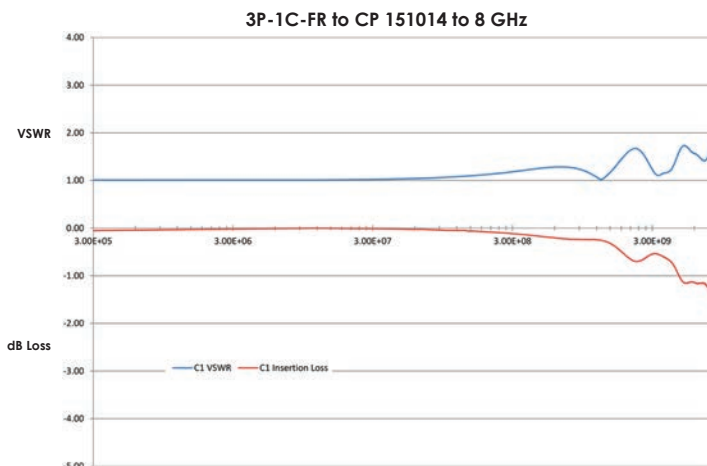
BIRNS 1C (50Ω)			BIRNS 1V (75Ω)		
Frequency (Hz)	Loss (dB)	VSWR	Frequency (Hz)	Loss (dB)	VSWR
1.0E+05	-0.01	1.00	1.0E+05	-0.01	1.65
5.0E+05	-0.01	1.00	5.0E+05	-0.01	1.65
1.0E+06	-0.01	1.00	1.0E+06	-0.01	1.65
5.0E+08	-0.18	1.27	5.0E+08	-0.16	1.25
1.0E+09	-0.24	1.20	1.0E+09	-0.15	1.31
1.5E+09	-0.32	1.17	1.5E+09	-0.11	1.53
2.0E+09	-0.61	1.59	2.0E+09	-0.34	1.47
2.5E+09	-0.68	1.60	2.5E+09	-0.01	1.59
3.0E+09	-0.54	1.23	3.0E+09	-0.21	1.83

Insertion Loss and VSWR performance data for the BIRNS 1C and 1V.

BIRNS also offers ultra-low-loss RF "1B" pressure-rated connectors for use to SHF band Ku (18GHz), developed and supplied exclusively for US military applications. BIRNS 1B connectors were previously qualified for US Navy applications and are presently undergoing additional US Navy saltwater performance qualification testing under conditions of cold (27°F/-3°C) and hot (100°F/38°C) hydrostatic pressure. BIRNS 1B connector solutions provide both strategic and tactical advantages by delivering synchronous, continuous mission-critical data from the submarine to the ship or tactical air cover without need to resurface.



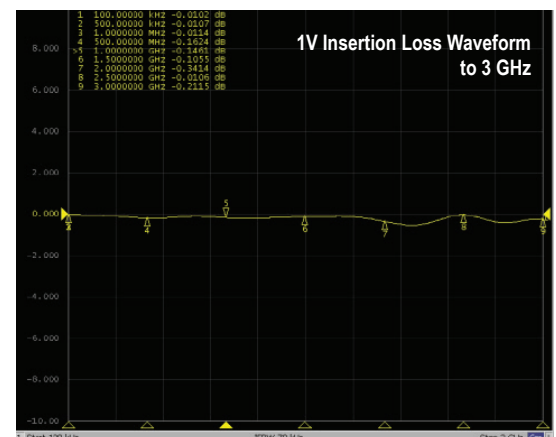
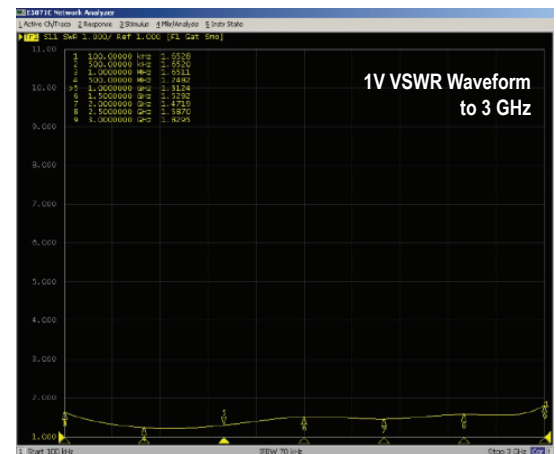
BIRNS RF contacts can be combined and/or hybridized with electrical and/or optical lines. Note the PRO-020 overmolding shown above.

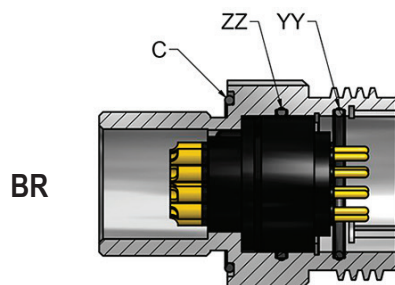


BIRNS 1C insertion loss and VSWR graph.

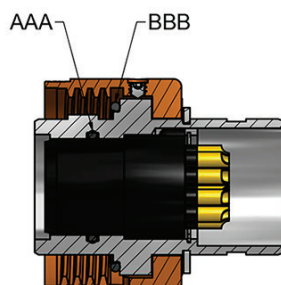


BIRNS 1B Ultra-low-loss pressure-rated RF connectors for the US Military.

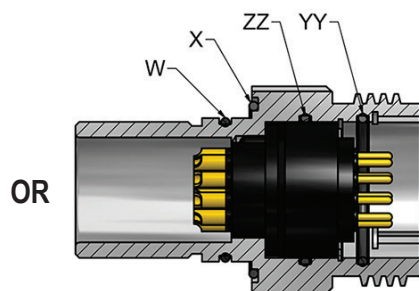




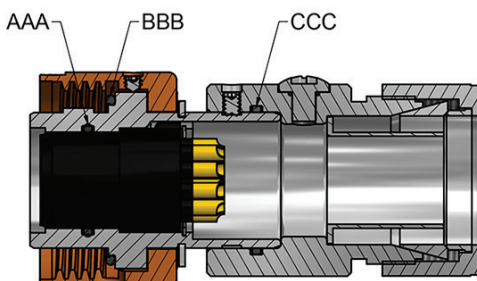
BR



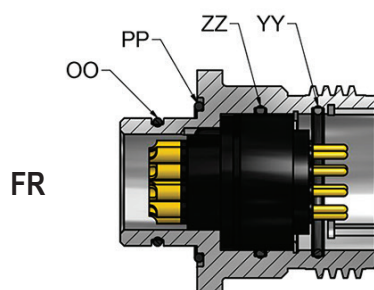
CP



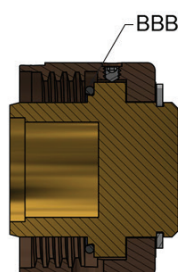
OR



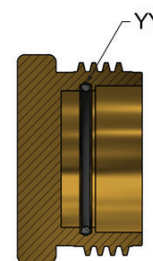
CP-OF, CP-OH, CP-OB,
CP-OFRA, CP-OHRA,
CP-OBRA



FR



RCH*
RCH-TI



PCH
PCH-TI

O-rings' standard material is NBR (Nitrile/Buna-N) compound N0674-70, 70±5 Type A Durometer hardness.

Millennium O-Ring Part Numbers

Callout	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
C	BR Face O-Ring	2-015 59A-059	2-017 59A-060	2-020 59A-026	2-021 59A-079	2-024 59A-101	2-026 59A-061	2-028 59A-132	2-031 59A-183	2-034 59A-127
W	OR Shaft Seal O-Ring	2-013 59A-058	2-014 59A-053	2-016 59A-025	2-019 59A-097	2-020 59A-026	2-022 59A-070	2-024 59A-101	2-029 59A-020	2-032 59A-180
X	OR Face Seal O-Ring	2-016 59A-025	2-017 59A-060	2-020 59A-026	2-022 59A-070	2-024 59A-101	2-026 59A-061	2-028 59A-132	2-132 59A-057	2-034 59A-127
OO	FR Shaft Seal O-Ring	2-012 59A-074	2-015 59A-059	2-016 59A-025	2-020 59A-026	2-020 59A-026	2-020 59A-026	2-028 59A-132	2-028 59A-132	2-032 59A-180
PP	FR Face Seal O-Ring	2-016 59A-025	2-019 59A-097	2-020 59A-026	2-024 59A-101	2-024 59A-101	2-024 59A-101	2-030 59A-169	2-031 59A-183	2-034 59A-127
YY	Mating Axial Seal O-Ring	2-011 59A-040	2-014 59A-053	2-016 59A-025	2-018 59A-093	2-019 59A-097	2-023 59A-092	2-025 59A-096	2-029 59A-020	2-031 59A-183
ZZ	Receptacle Insert Seal O-Ring	2-006 59A-065	2-014 59A-053	2-016 59A-025	2-018 59A-093	2-019 59A-097	2-023 59A-092	2-025 59A-096	2-029 59A-020	2-031 59A-183
AAA	Plug Insert Seal O-Ring	2-006 59A-065	2-012 59A-074	2-014 59A-053	2-015 59A-059	2-016 59A-025	2-018 59A-093	2-119 59A-172	2-026 59A-061	2-028 59A-132
BBB	Mating Face Seal O-Ring	2-012 59A-074	2-015 59A-059	2-018 59A-093	2-020 59A-026	2-023 59A-092	2-025 59A-096	2-028 59A-132	2-030 59A-169	2-033 59A-133
CCC	OF Adapter Seal O-Ring	2-013 59A-058	2-016 59A-025	2-018 59A-093	2-020 59A-026	2-021 59A-079	2-023 59A-092	2-026 59A-061	2-030 59A-169	N/A

*All sizes of the 6km RCH-TI incorporate an O-ring as shown. The 1km RCH do not include an O-ring (except for the 3O size, which uses the same O-ring as that in the 3O-RCH-TI).

BR and OR Nut/Washer Sets

Inboard Nut/Washer sets are recommended to secure BRs and ORs into the bulkhead and prevent loosening. Nut/Washer sets are made of Type 316 SS, designed specifically for use with BIRNS Millennium BRs and ORs, and now also feature new lock-wire holes for additional security in high-vibration applications.

Shell Size	BR Nut/Washer	OR Nut/Washer
3F	24I-120	24I-120
3G	24I-625	24I-562
3K	24I-075	24I-069
3L	24I-088	24I-088
3M	24I-102	24I-102
3O	24I-350	24I-113
3P	24I-125	24I-125
3R	24I-150	24I-150
3T	24I-200	24I-200

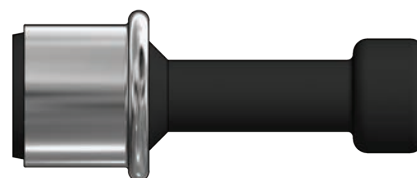


Nuts/Washer

O-ring Installation Tool

The CP face O-ring installation Tool is custom designed (and specifically sized for each CP) to allow fast and easy O-ring installation into the CP's quarter-dovetail groove without damage to the O-ring or connector.

CP O-ring Installation Tool	
CP Size	Tool No.
3F	3F-CP-OIT
3G	3G-CP-OIT
3K	3K-CP-OIT
3L	3L-CP-OIT
3M	3M-CP-OIT
3O	3O-CP-OIT
3P	3P-CP-OIT
3R	3R-CP-OIT
3T	3T-CP-OIT



O-ring Installation Tool

BIRNS Wrenches

BIRNS wrenches permit easy installation of BRs, ORs, and retention jam nuts; and facilitate loosening of tight coupling rings*.

P/N	Size (mm)	Size (Inch)	CP	BR	OR	Jam Nut
70A-069	17	11/16	3F			
70A-075	19	3/4		3F	3F	3F
70A-088	22	7/8		3G	3G	
70A-094	24	15/16	3G			
70A-100	25	1		3K	3K	3G, 3K
70A-113	29	1-1/8		3L		
70A-119	46	1-3/16	3K			
70A-125	32	1-1/4				3L, 3M
70A-131	33	1-5/16	3L		3L	
70A-138	35	1-3/8	3M	3M	3M	3O
70A-150	38	1-1/2	3O	3O	3O	3P
70A-163	41	1-5/8		3P	3P	
70A-175	44	1-3/4	3P			3R
70A-194	49	1-15/16			3R	
70A-200	51	2	3R	3R		
70A-225	57	2-1/4		3T	3T	
70A-238	60	2-3/8	3T			
70A-300	76	3				3T

*Wrenches should not be used to tighten coupling rings, only to loosen.



O-Ring Pick



P/N 70A-001

General

All installation and maintenance should be performed by qualified technicians.

The BIRNS Millennium series is a dry-mate connector system. It is not designed to be coupled or uncoupled while underwater or wet. Before mating or demating the connectors, always verify that the connectors are dry, and that the circuit is de-energized.

⚠ CAUTION

ENERGIZE HIGH-VOLTAGE SYSTEM CIRCUITS ONLY WHEN THE CONNECTORS ARE FULLY AND PROPERLY MATED!

Before Mounting and Coupling

Verify that mounting dimensions are correct and that all sealing surfaces have the correct surface finish and are clean. Lightly lubricate all O-rings with an appropriate grease (we recommend 52K-014 silicone lubricant, Dow Corning compound 111) to form a thin film.

NOTICE

Excessive grease will interfere with the seal.

Ensure that all contacts and internal connector areas are completely clean and FOD-free. Verify that no grease or FOD is present on any optical contacts. Clean as needed.

NOTICE

Use appropriate optical-contact cleaning materials and techniques.

Mounting

Install the receptacle into the bulkhead and secure appropriately. Place the cable assembly into position, avoiding bends which are smaller than the cable's rated bend radius (see Cable Stock, page 14), and secure it into place using appropriate clamping methods if seawater drag (water-current flow) is expected.

Coupling

Remove sealing caps from the connectors, and remove any protective optical caps and/or tack-free tape from optical ferrules and holes as needed. Gently insert the CP into the receptacle, rotate the CP until its keys enter the receptacle's keyways, and rotate the coupling ring to mate the connectors. Look through the coupling ring's drain holes to verify complete mating, and secure the locking set screws if desired. All unmated connectors should be protected with pressure-proof (high-pressure) caps prior to water immersion (see Caps, DSPs and DSRs, page 48).

Maintenance

After the connectors are fully and properly mated, very little maintenance is required. We recommend that the connectors be well rinsed with fresh water. If possible, after each deployment, to remove any sand, dirt, salt and marine growth. O-rings should be well cleaned and re-lubricated if the connectors are uncoupled. O-rings should be periodically replaced. When not in use, optical ferrules should be cleaned and protected with optical caps and/or tack-free tape.

APC: Angled Physical Contact	LSZH: Low Smoke Zero Halogen
ATM: Atmosphere	MMF: Multimode Fiber
AWG: American Wire Gauge	MM: Multimode
BR: Bulkhead Receptacle	NBR: Nitrile Butadiene Rubber (Buna-N)
CP: Cable Plug	NCC: Non-Conductive Coating
cm: Centimetres	OAS: Overall Shield
CR: Cable Receptacle	OR: Dual O-ring Receptacle
dB: Decibel	PBOF/PCOF: Pressure Balanced (or Compensated) Oil-Filled
DSP: Dummy Sealing Plug	PCH: Plug Cap, High pressure
DSR: Dummy Sealing Receptacle	PCL: Plug Cap, Low pressure
DWV: Dielectric Withstanding Voltage	PIS: Plug Insert, Sockets
EO: Electro-Optical	PP: Polypropylene
EOM: Electro-opto-mechanical	PTFE: Polytetrafluoroethylene (e.g. Teflon)
FC/PC: Ferrule Connector/Physical Contact (2.50mm ferrule, screw coupling)	PUR: Polyurethane
FTP: Foil-shielded Twisted Pair	RIP: Receptacle Insert, Pins
FM: Ferrule, Moveable	RCL: Receptacle Cap, Low pressure
FOD: Foreign Object Debris/Foreign Object Damage	RCH: Receptacle Cap, High pressure
FR: Flanged Receptacle	RF: Radio Frequency
FS: Ferrule, Stationary	SHF: Super High Frequency
GbE: Gigabit Ethernet	ST: Straight Tip (2.50mm ferrule, bayonet coupling)
GHz: Gigahertz	SMF: Singlemode Fiber
GIPS: Galvanized Improved Plow Steel	SM: Single Mode
GPS: Global Positioning System	SS: Stainless Steel
GRE: Glass-Reinforced Epoxy	TI: Titanium
HV: High Voltage ($\leq 3\text{kV}$)	TIA: All-Titanium
HZ: Hertz	TP: Twisted Pair
IR: Insulation Resistance	TSP: Twisted Shielded/Screened Pair
IAW: In Accordance With	UHF: Ultra High Frequency
LC: Lucent Connector (1.25mm ferrule, snap coupling)	UPC: Ultra-Physical Contact
	VSWR: Voltage Standing Wave Ratio

Technical/Warranty

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