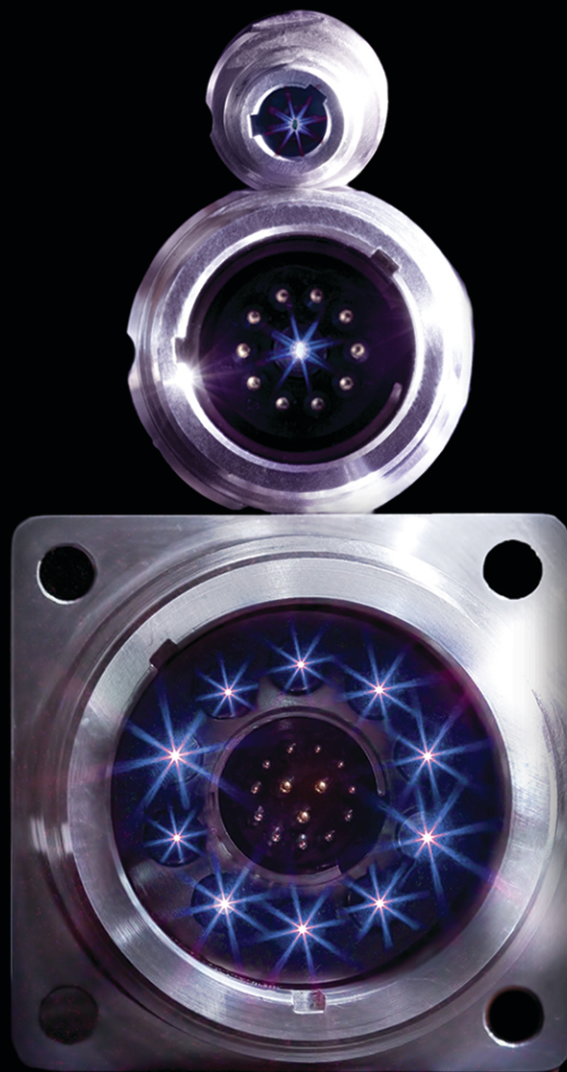


BIRNS Millennium™ Interconnect Solutions



*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.

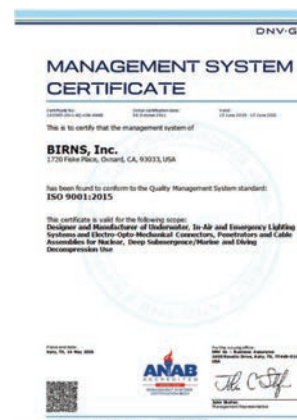
BIRNS' comprehensive Quality Management System is integrated throughout each process, from sales, design, and production to receiving, in-process and final inspection, through delivery and customer service. Our entire QMS is process-based and dedicated to evidence-based continual improvement, with consistent,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

BIRNS' QMS is certified to ISO 9001:2015 by DNV GL. Our 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 certified^[2] to both J-STD-001 and WHMA-A-620-A Class 3^[1], and we are 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] 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.

^[2] We have two full-time certified instructors in house, authorized to train and certify technicians.

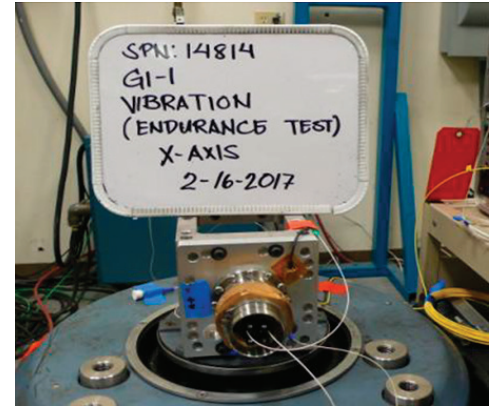
Introduction/General Features

The BIRNS Millennium series is a high performance, high density dry-mate connector range suitable for deep submergence applications to 6km depth. This series can be used with solid (molded) or oil-filled cables in straight or 90° configurations and is available in 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.

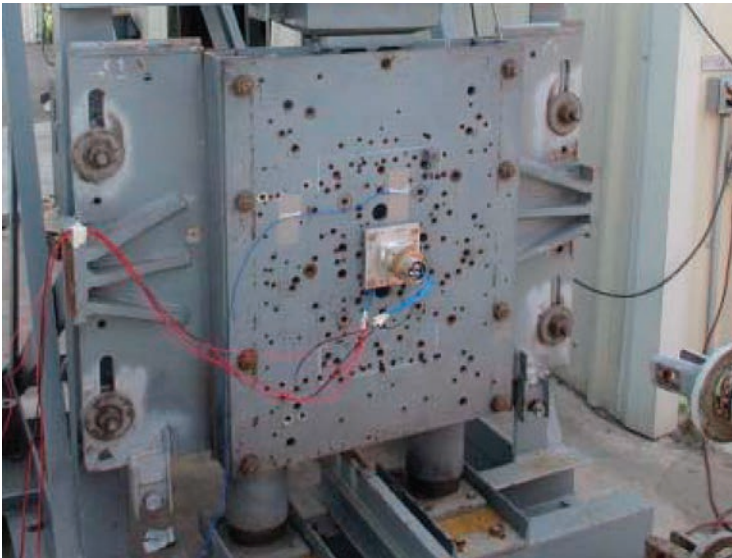
BIRNS Millennium connectors provide quantifiably superior performance characteristics: faster data transfer rates and greater signal bandwidth, lower optical insertion loss, greater depth capability, less RF loss and better VSWR. This has been achieved through meticulous and innovative engineering and 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 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.

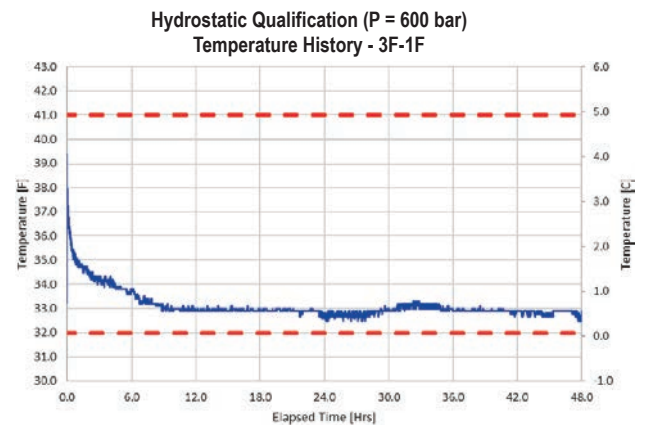
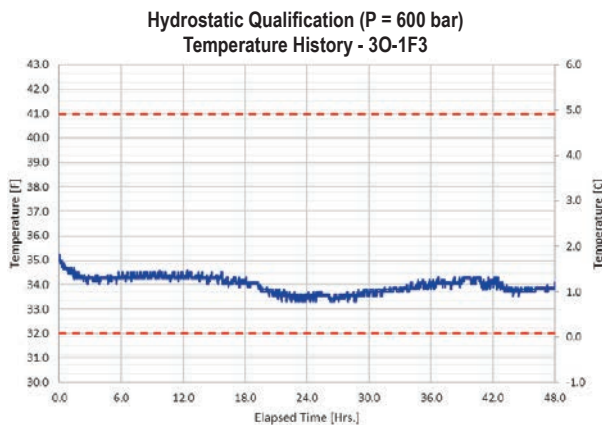
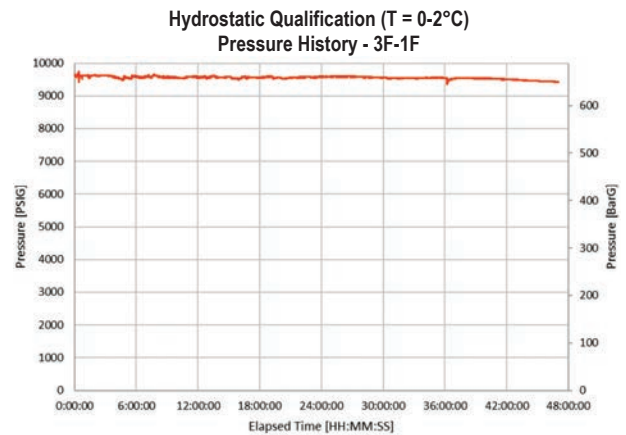
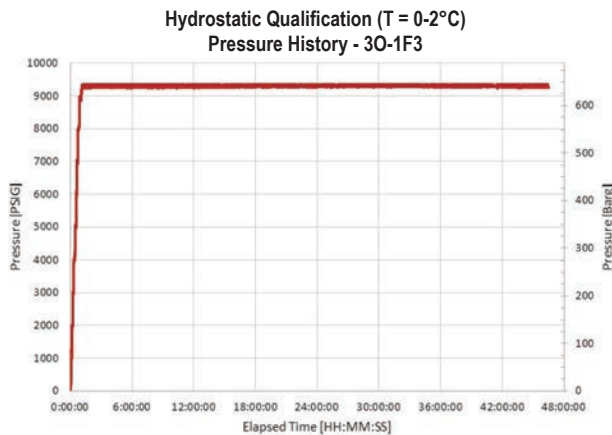


Operational signal transmission during shock testing of BIRNS connectors per MIL-S-901D Grade A Class I Type C, with impacts from the TOP/BACK (L) and SIDE (R).

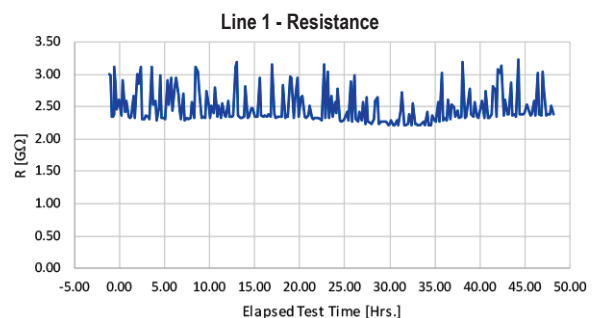
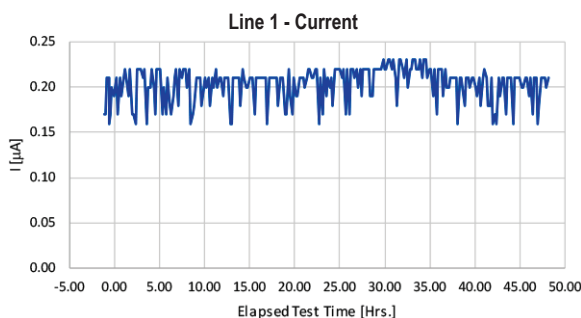
Qualification and verification of products' ability to reliably withstand high pressure is fundamental to BIRNS' product development. Connectors and cable assemblies are subjected to hydrostatic testing while mated and open-face. Sometimes high pressure is combined with low temperature to more accurately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



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



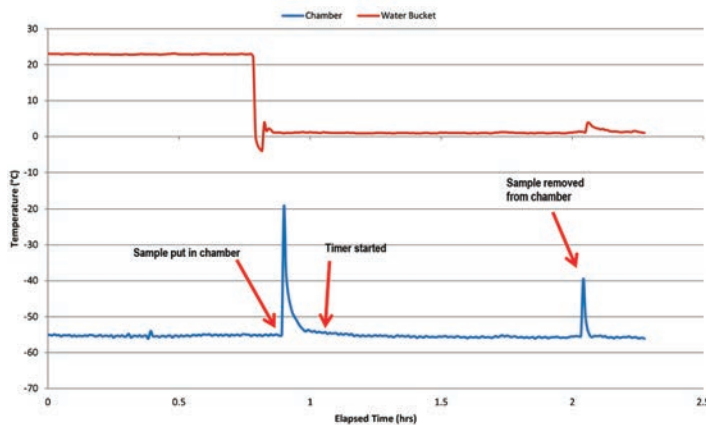
Extended (48-hour) continuous cold-water hydrostatic testing of the 3F-1F and 30-1F3, optical and electrical testing performed concurrently.



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 .



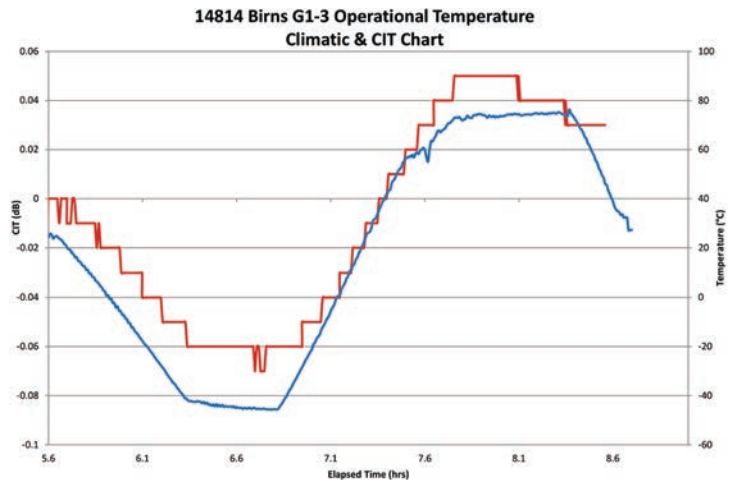
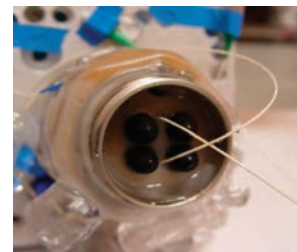
Inside the test chamber at $+65^{\circ}\text{C}$.



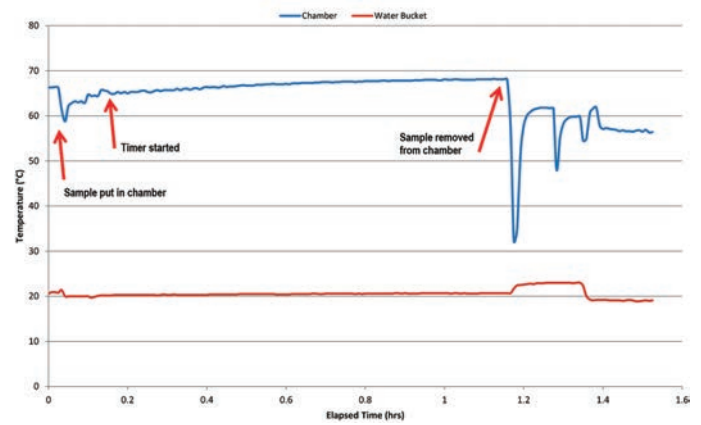
After over an hour at -55°C , the connector is plunged into 0°C ice water.



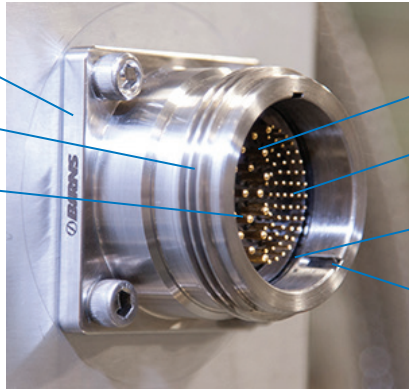
After the test is completed, the BIRNS connector is embedded in ice...but still transmits optical signal.



14814 Birns G1-4 Thermal Shock Hot Climatic Chart

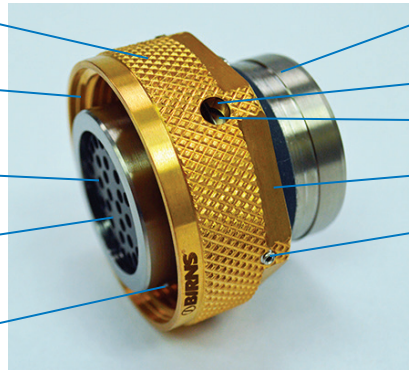


- Shells available in SS or TI
- Square Acme threads resist mechanical damage
- Open-face pressure resistance is standard



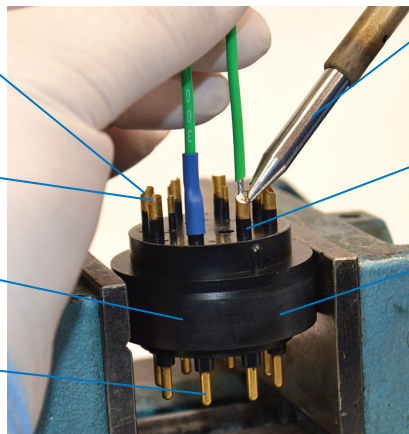
- Replaceable, interchangeable inserts
- Conductors: 22-, 20-, 16-, 14- and 10-AWG, optical fiber, and RF in same connector
- Dual redundant O-ring seals ensure long-term sealing reliability
- Three key options available for purposeful incompatibility

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

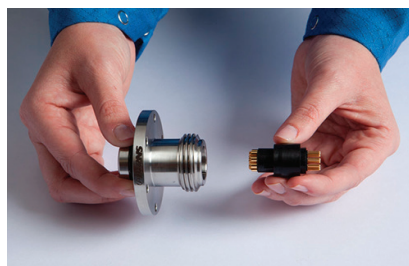


- Shells available in SS or TI (with Delrin or Ti coupling rings)
- Drain/view holes provide visual coupling verification
- Positive stops preclude over-tightening
- Coupling rings have hex flats for ease of loosening
- Locking set screws preclude vibration-loosening in service

- 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



Replaceable inserts

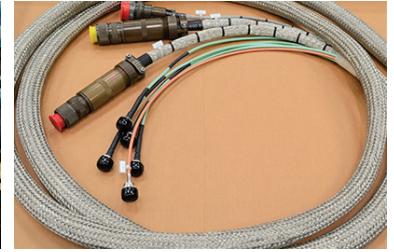
BIRNS performs multiple value-added services in the fabrication of Millennium cable assemblies—many of which are available on a subcontract basis.



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.



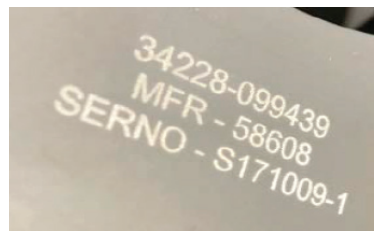
BIRNS' professional assembly, filling (on request) and testing of oil-filled cable assemblies provides turn-key solutions that reduce costs and optimize reliability.



BIRNS' team is expert at electrical^[1], 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. Two authorized 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.



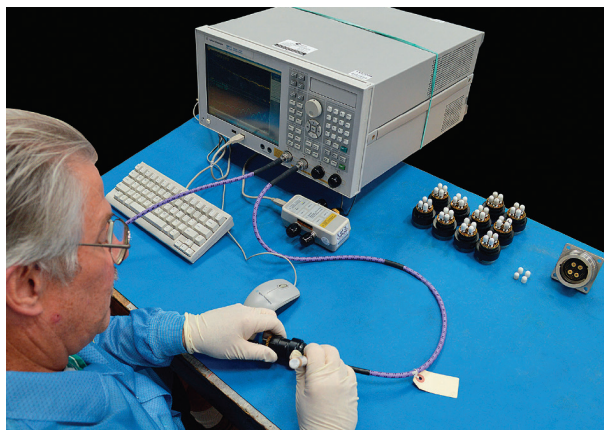
Low temperature/high pressure test capability simulates actual conditions at depth, with long-term continuous pressure testing in a controlled 2°C (±1°C) environment; programmable, automated multiple pressure cycles; real-time electrical and optical test data recording; and continuous digital output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



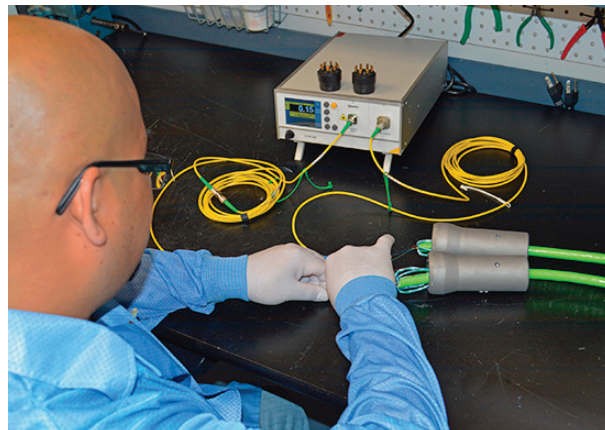
Final acceptance tests using a Kikusui TOS9213S DC DWV/IR Tester with high voltage scanners. This custom-made programmable system permits simultaneous testing of up to 16 electrical circuits at voltages up to 6kV, even while under hydrostatic pressure.



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 10.) 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 13.)

Pro Tip: when using OR or BR, remember Nut/Washer sets. See Nuts & Tools, Page 46.

Select the shell material, Key Options, and inboard termination as needed. See Part Numbering, Receptacles (non-optical), Page 15. For optical or electro-optical receptacles, see Part Numbering, Optical/EO Receptacles, Page 28.

Cable Assemblies

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

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 14.

2. Select MOLDED (solid) or OIL-FILLED cable. For MOLDED cable, see Part Numbering, Molded Cable Assemblies, Page 18, and specify cable type or part number. See Cable Stock, Page 11, and Molded Cable Assembly Configuration Guide, Page 20.

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

3. For OIL-FILLED cable, see Page 31, 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 7.
- Sealing caps: see Caps, DSPs & DSRs, Page 37.
- Nuts and Tools: see Nuts & Tools, Page 46.

LEGEND

●	50Ω	
⊗	Optical Fiber (OF) 1.25mm	
●	Optical Fiber (OF) 2.50mm	Ampacity
●	8 AWG (10mm ²)	40A
●	10 AWG (8mm ²)	33A
●	14 AWG (3mm ²)	15A
●	16 AWG (2mm ²)	12A
●	20 AWG (.8mm ²)	4A
●	22 AWG (.4mm ²)	2A

HV ≤ 3kV

3F ——— 3F-1F
1-OF

3G ——— 3G-3 3G-4 3G-10
3-16 4-20 10-22

3K ——— 3K-2 3K-3 3K-4 3K-5 3K-6 3K-7 3K-20 3K-1C
2-10 3-14 4-16HV 5-16 2-10 4-22 7-20 20-22 1-50Ω

3L ——— 3L-3 3L-4 3L-7 3L-8 3L-25
3-10 4-14 7-16 8-20 25-22

3M ——— 3M-4 3M-7 3M-9 3M-13 3M-14B 3M-14 3M-16 3M-31
4-10 7-14 9-16 5-16 8-22 3-16 11-20 14-20 4-16 12-22 31-22


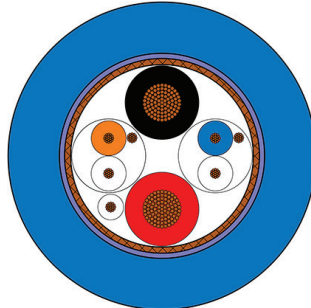



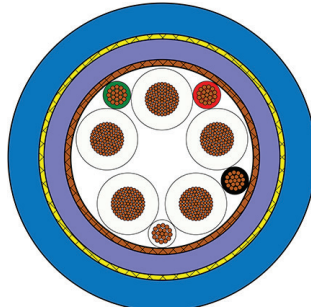


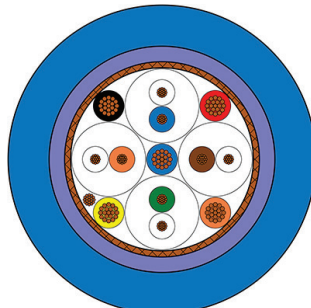

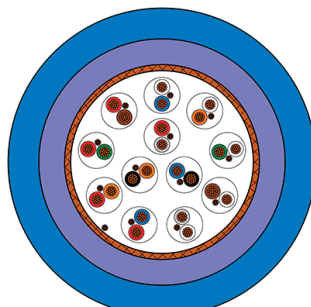
3O ——— 3O-4 3O-7 3O-8 3O-9 3O-9HV 3O-13 3O-17 3O-23 3O-46 3O-1F3 3O-2F2 3O-4F2
4-10HV 7-10 3-10 1-16 4-20 9-14 5-10HV 4-20 13-16 8-16 9-22 23-20 46-22 1 OF 3-16 2 OF 2-16 4 OF 2-16

3P ——— 3P-4 3P-13 3P-15 3P-25 3P-40 3P-83 3P-1C 3P-2C6
4-10HV 13-10 3-10 12-16 25-16 40-20 83-22 17-16 60-22 1-50Ω 2-50Ω 4-16 2-22

3R ——— 3R-12 3R-24 3R-36 3R-56 3R-77
12-10HV 24-14 36-16 56-20 17-16 60-22

3T ——— 3T-37 3T-52 3T-4C12 3T-4C24 3T-2F12 3T-12F8
37-16 52-16 4-50Ω 12-16 4-50Ω 12-16 12-20 2 OF 8-14HV 4-22 12 OF 8-16

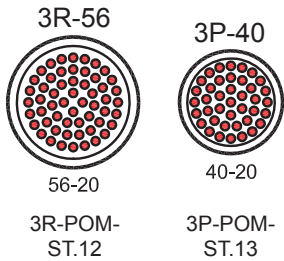
BIRNS is developing a series of exclusive, custom cables for select BIRNS Millennium pin configurations, in addition to the wide range of COTS cable already in our warehouse. Many of these cables are now in stock and available for immediate use in cable assemblies.

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>
<p>3O-23</p>  <p>23-20</p> <p>3O-POM-ST.12</p>	<p>Signal & Control</p> <ul style="list-style-type: none"> • 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 	 <p>52A-301 Electrical Cable</p>

Applicable Pin Configurations

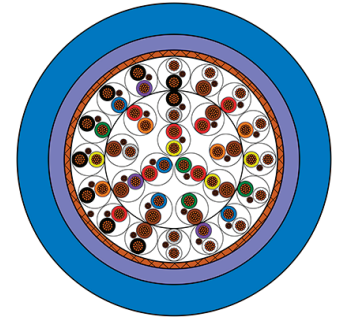
Cable Description

Cable Part No. & Illustration

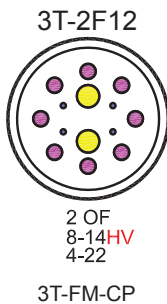


Signal & Control

- 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 (10.35 in.) bend radius

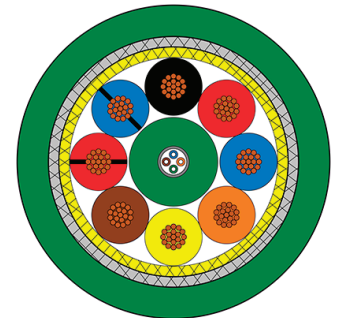


52A-302 Electrical Cable

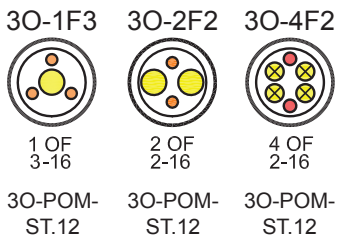


Optical & Power

- 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
- 155 mm (6.1 in.) bend radius

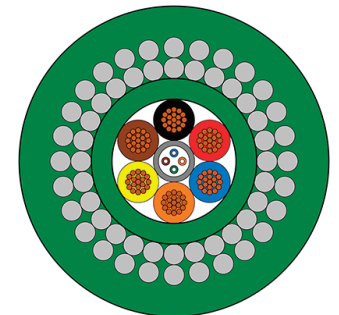


52A-277 EOM Cable

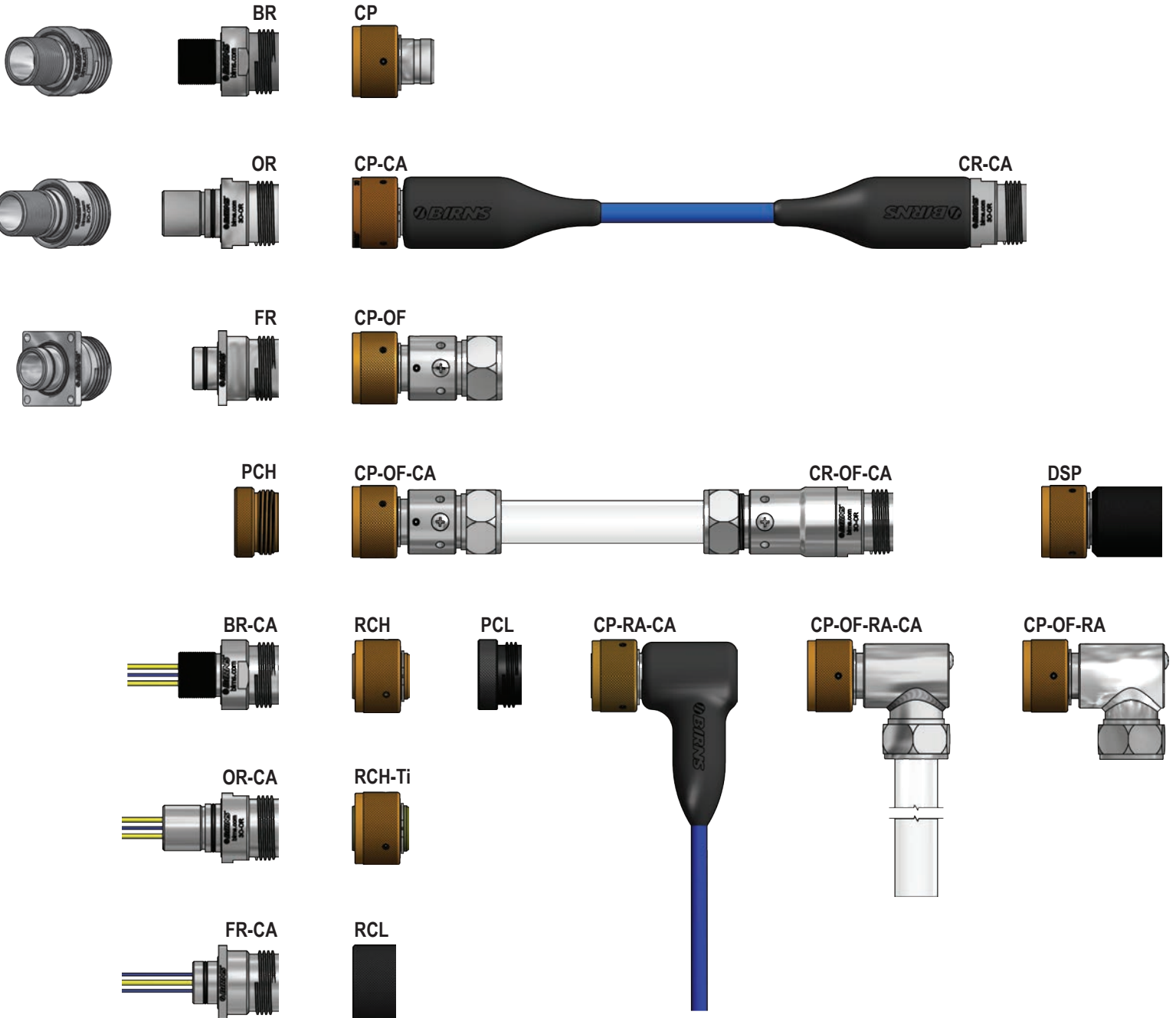


Optical & Power/Signal/Control

- 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



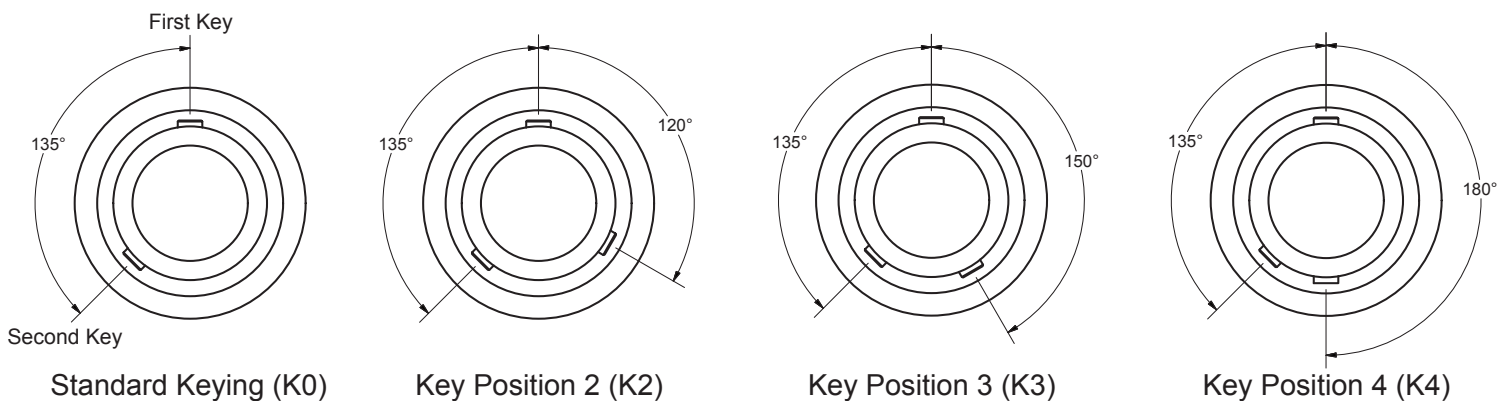
52A-304 EOM Cable



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.

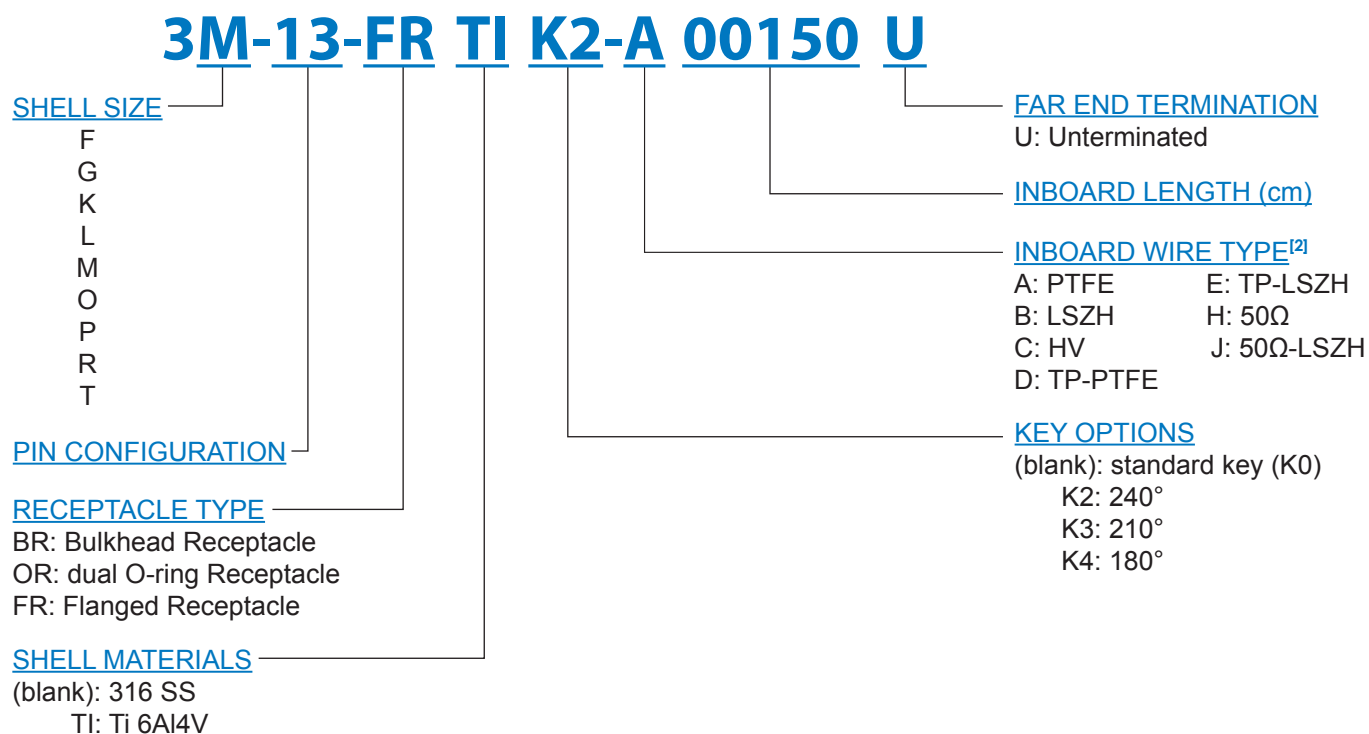
**Lesser-quality connectors use cheap press-fit keys.*



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



Receptacle Kit/Assembly Part Numbering Guide

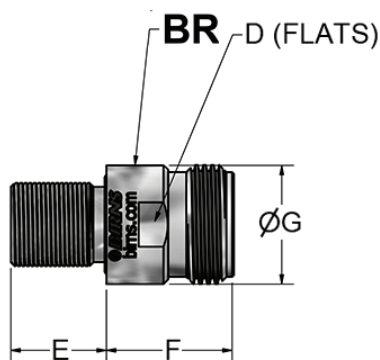
1. Select a non-optical^[1] pin configuration from the chart.
2. On the Pin Configuration chart, note the shell size (e.g. 3M) and configuration label (e.g. 3M-13)
3. Select receptacle type (BR, OR, FR) [For locking nuts, see Nuts & Tools Page 46]
4. Select shell material (SS, TI)
5. Select a Key Option if desired (K2, K3, K4)

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

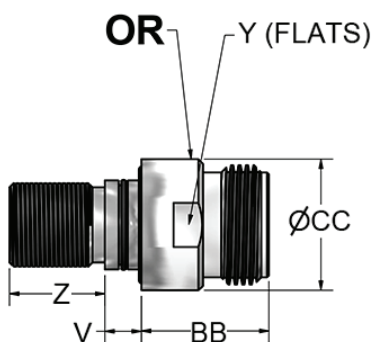
6. Select the inboard wire type letter
7. Select the desired termination length in centimetres
8. Select the far-end termination

^[1]This is the designator of electrical and electro-coax configurations. For optical receptacles, see "Part Numbering, Optical Receptacles".

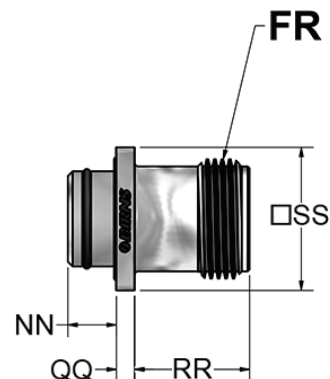
^[2]PTFE wire is required for oil-filled cannisters; LSZH is required for PVHO (Pressure Vessels for Human Occupancy).



Bulkhead Receptacle



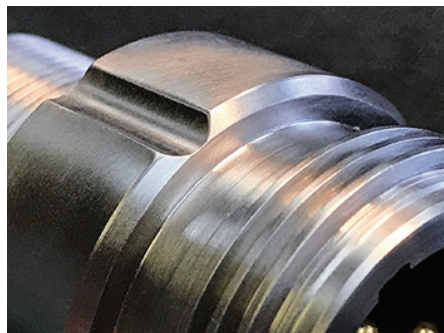
dual O-ring Receptacle



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	N/A
E	BR Thread Length	25	25	25	25	25	25	25	32	25
F	BR Body Height	22	25	36	34	29	34	34	40	34
G	BR Body Diameter	21	25	29	32	38	41	44	57	64
V	OR Shaft Seal Depth	10	11	11	10	10	11	11	11	10
Y	OR Wrench Flats	19	22	25	33	33	38	41	49	N/A
Z	OR Thread Length	25	25	29	25	25	25	25	32	26
BB	OR Body Height	22	25	36	34	28	34	33	47	35
CC	OR Body Diameter	24	25	35	35	38	41	44	56	64
NN	FR Shaft Seal Depth	13	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

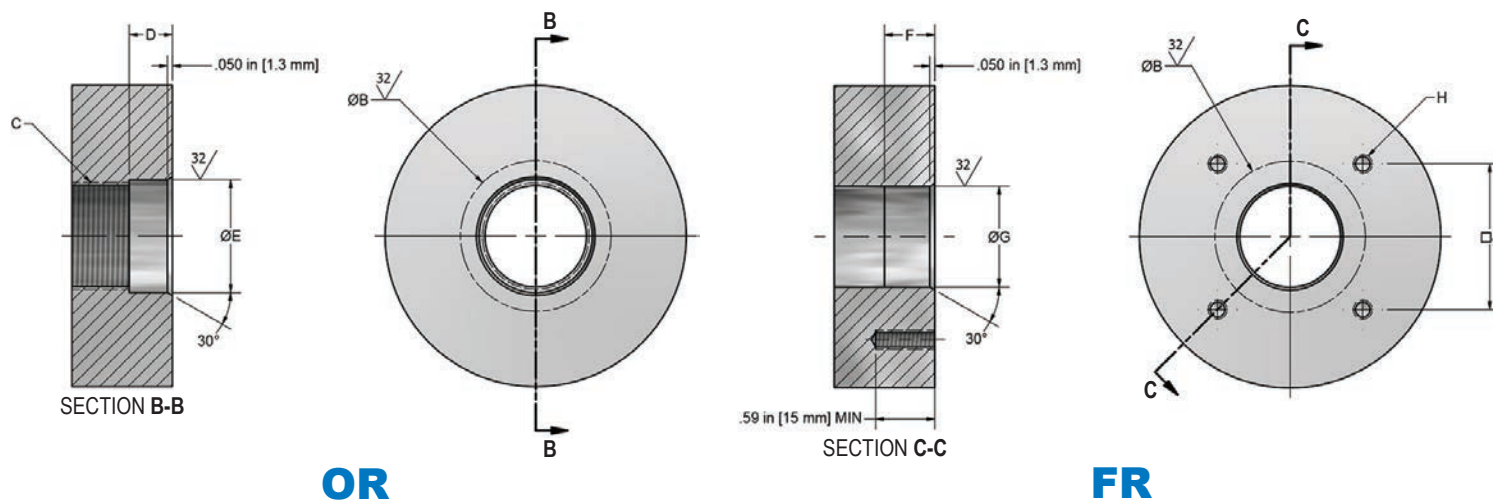
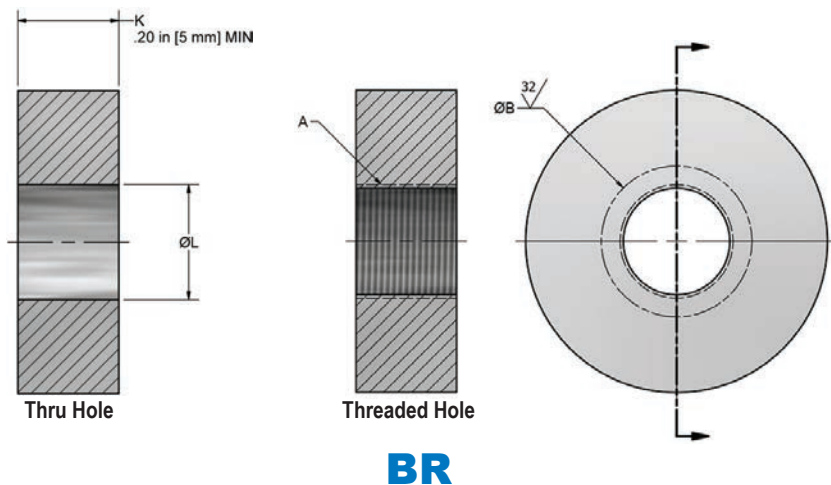
Receptacle Dimensions (inch)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
D	BR Wrench Flats	0.75	0.88	1.00	1.13	1.38	1.50	1.63	2.00	N/A
E	BR Thread Length	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.25	1.00
F	BR Body Height	0.88	1.00	1.40	1.34	1.13	1.33	1.34	1.57	1.34
G	BR Body Diameter	0.82	1.00	1.13	1.25	1.50	1.62	1.75	2.25	2.50
V	OR Shaft Seal Depth	0.38	0.43	0.43	0.40	0.40	0.43	0.42	0.43	0.40
Y	OR Wrench Flats	0.75	0.88	1.00	1.30	1.30	1.50	1.62	1.92	N/A
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	0.88	1.00	1.40	1.34	1.12	1.32	1.29	1.85	1.37
CC	OR Body Diameter	0.93	1.00	1.38	1.38	1.50	1.63	1.75	2.19	2.50
NN	FR Shaft Seal Depth	0.50	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



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

Receptacle Mounting Details

These are our recommended mounting methods for BIRNS Millennium receptacles. See Nuts & Tools Page 46.



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	18.80	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	0.740	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

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
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: Underminated
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

Molded Cable Assemblies Part Numbering Guide

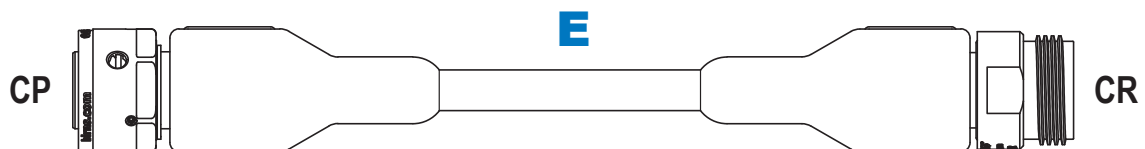
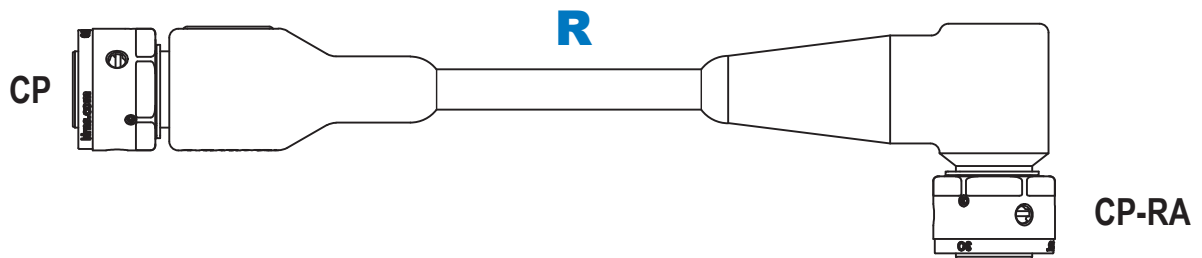
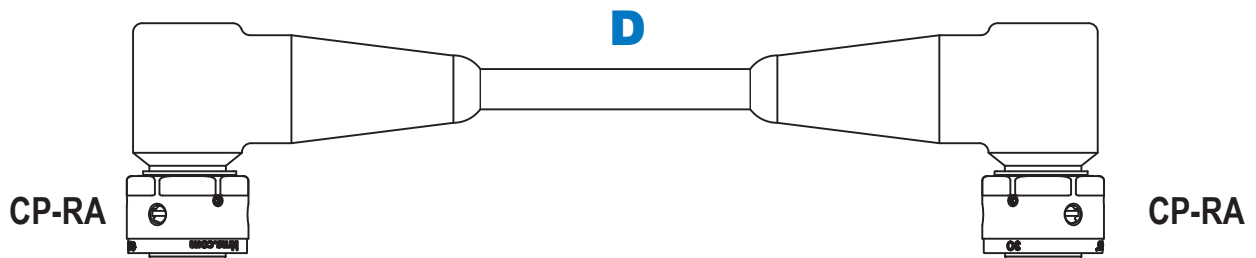
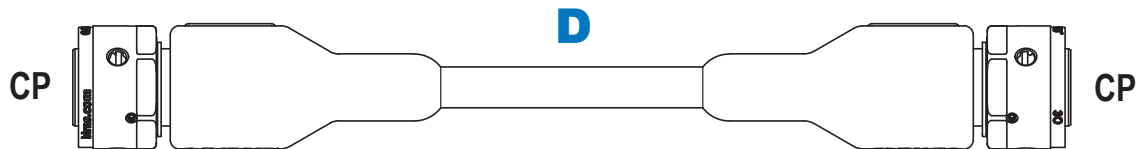
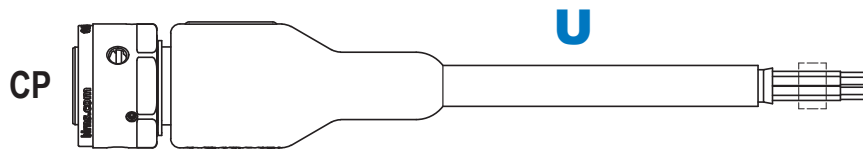
1. Select a pin configuration from the chart; note the shell size (e.g. 3M) and pin configuration label (e.g. 3M-13).
2. Select the connector type (CP, CR).
3. Select shell material (SS, TI, TIA)^[1]
4. Select a Key Option if desired (K2, K3, K4)

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 20.

^[1] 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 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.

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
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

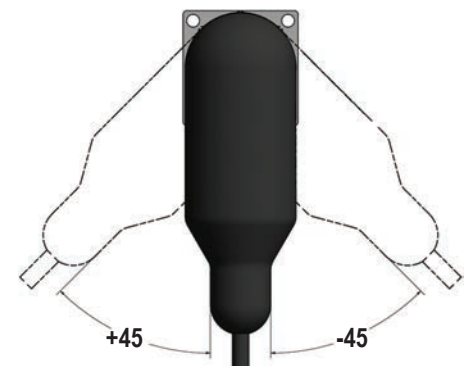
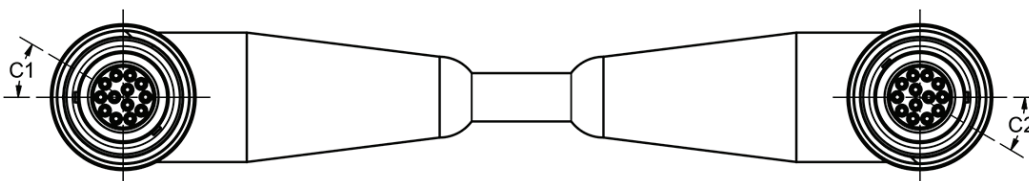
BIRNS offers three PUR materials as follows.

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.

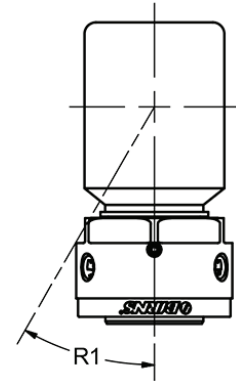
Clocking

"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.



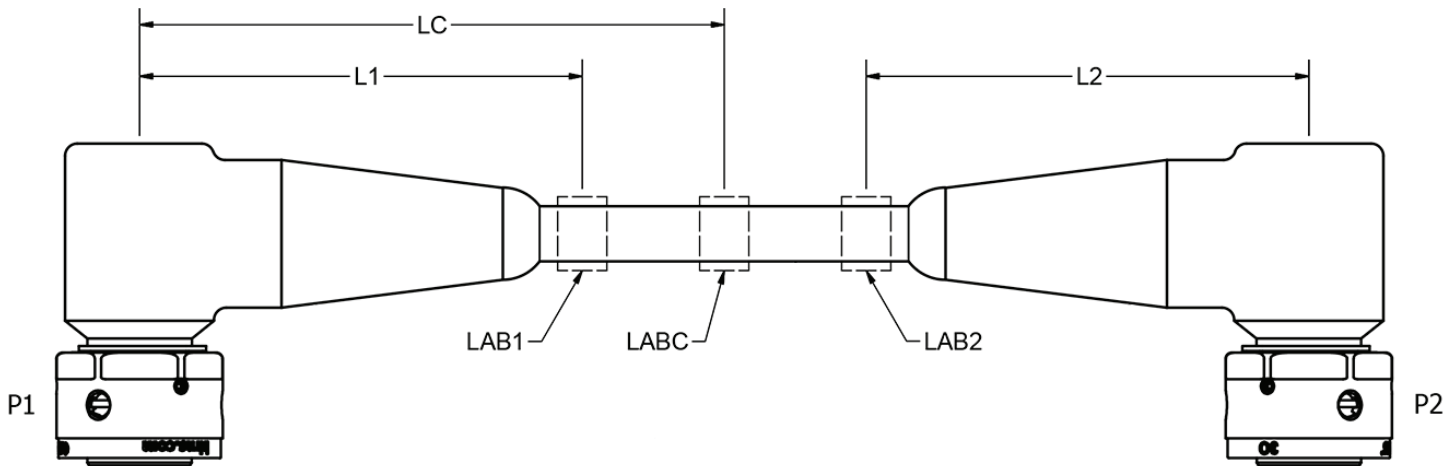
Length Tolerance

Cable assemblies have a standard length tolerance. A different tolerance, if preferred, can be specified. Note that this might impact pricing and, possibly, schedule.

Cable Length Tolerances	
Overall length	Tolerance
1 to 10 ft. (0.3 to 3.0m)	-0/+6 in. (-0/+15 cm)
11 to 25 ft. (3.4 to 7.6m)	-0/+1 ft. (-0/+30 cm)
26 to 50 ft. (7.9 to 15.2m)	-0/+3 ft. (-0/+1 m)
51 to 100 ft. (15.5 to 30.5m)	-0/+5 ft. (-0/+1.5 m)
Over 100 ft. (30.8m)	-0/+6 ft. (0/+2 m)

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. **White Ink-Stamp:** the product is marked with 80L-010 white epoxy ink IAW MIL-I-43553
3. **Heat-Shrink Label:** data is on white or yellow heat-shrink tubing
4. **Label with Clear Heat-Shrink:** data is on white tubing and covered with clear tubing
5. **Wrap-Around Tag:** small plastic tags secured with cable ties
6. **K-Type Label (plastic ties):** Pre-printed "macaroni" rings on a carrier, secured with plastic cable ties
7. **K-Type Label (SS ties):** As above but with SS cable ties
8. **Stamped SS Tag:** marker plates (max. 17 characters) secured with SS cable ties

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.

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)

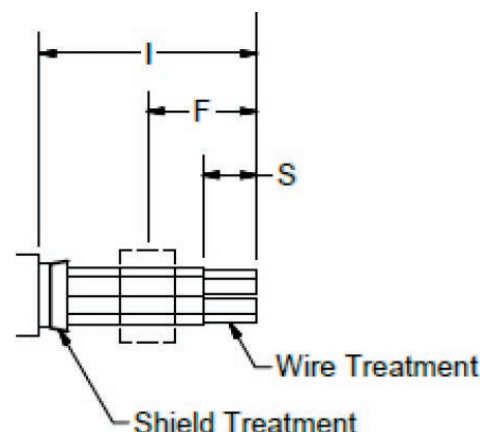
Number Flags

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

Shield (OAS) Treatment

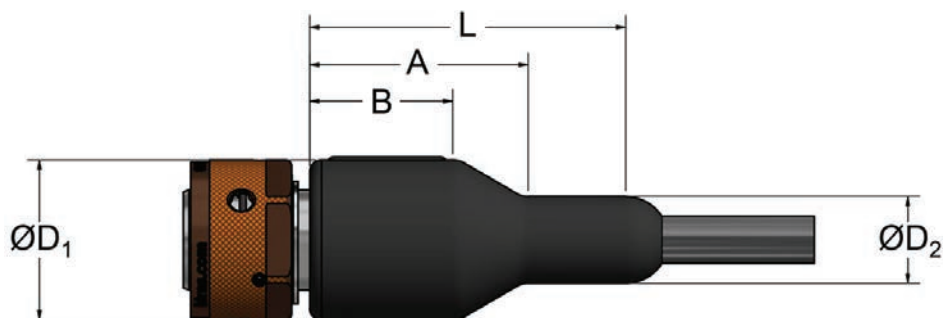
Jacket removal regularly exposes an OAS. Shield treatment options are:

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



Next-Gen

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



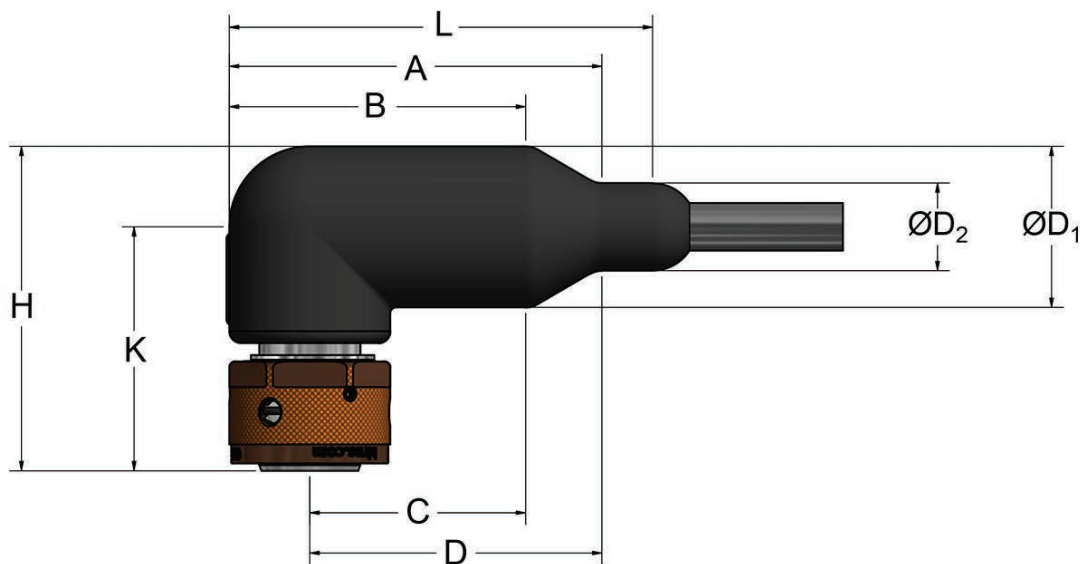
As molds transition to the new designs, select cables will continue to conform to legacy dimensions (see Legacy Overmolds, Page 25). Note the maximum cable OD limitations in the tables below. Special terminations, such as for 10GbE and HV, require longer molds. Optical and EO assemblies use special molds (see Optical Cable Assemblies, Page 30).

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

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-POM-ST.8	1.69	0.92	3.35	2.32	1.51	0.71
3O	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-POM-ST.12	1.94	1.15	4.93	3.89	3.07	0.94
3P	3P-POM-ST.13	1.94	1.94	5.18	5.18	5.18	1.69
	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



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 20.

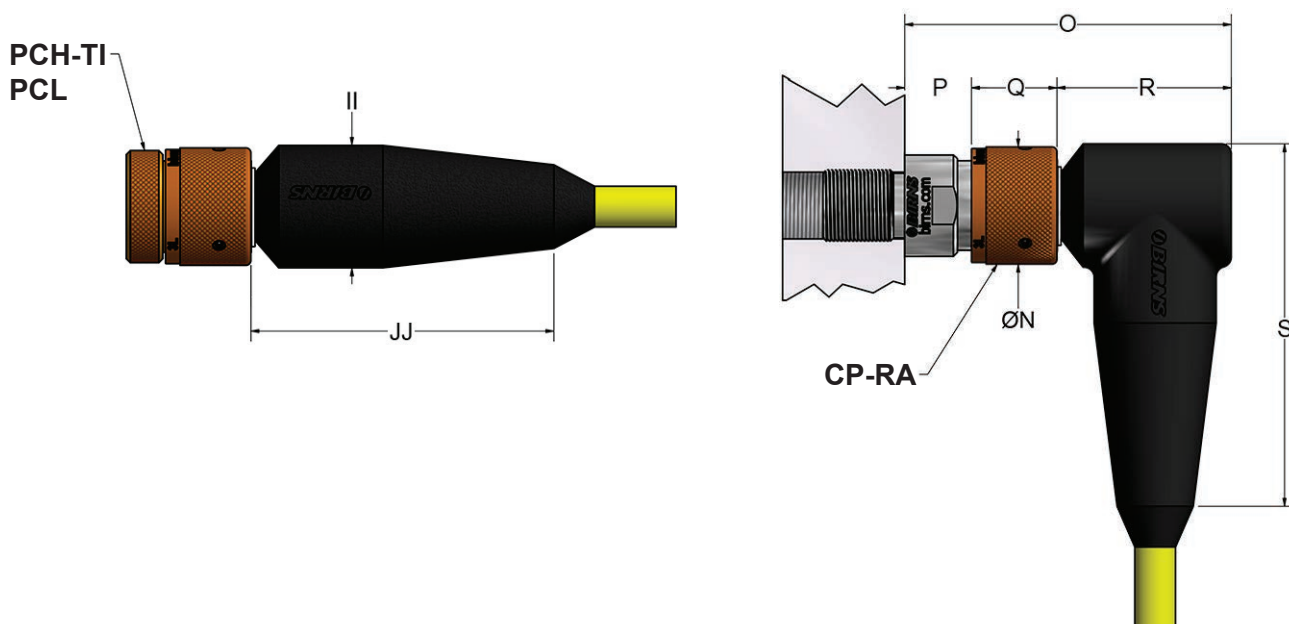


POM-RA Molds - mm											
Size	Mold	D ₁	D ₂	L	A	B	C	D	H	K	Cable Max OD (≤Ømm)
3G	3G-POM-RA.9	27	13	105	91	76	62	78	70	57	8
3K	3K-POM-RA.9	34	17	108	95	77	60	78	78	61	12
3L	3L-POM-RA.9	37	19	110	96	77	59	78	83	65	14
3M	3M-POM-RA.9	40	20	111	98	78	58	78	86	66	15
3O	3O-POM-RA.9	43	23	113	99	79	58	78	86	65	18
3P	3P-POM-RA.13	49	29	154	141	120	95	116	100	75	24
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
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
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
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
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

Legacy

As we transition to Next-Gen overmold designs, select cable assemblies continue to conform to Legacy dimensions as shown below.



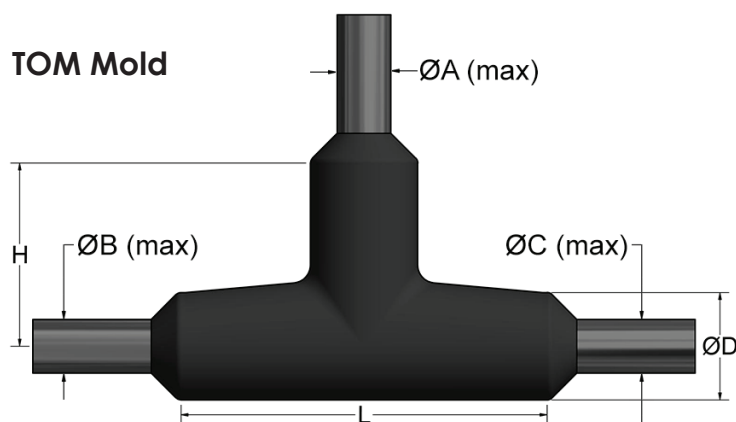
Legacy Mold Dimensions (mm)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
O	BR/CP-RA Combined Height	N/A	65	87	85	88	93	79	94	89
P	CP to Face Distance, on BR	11	17	23	21	15	20	12	27	15
Q	Coupling Ring Length	19	20	27	27	27	27	27	27	26
R	RA Overmold Height	N/A	29	38	38	46	46	40	40	48
S	RA Overmold 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

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

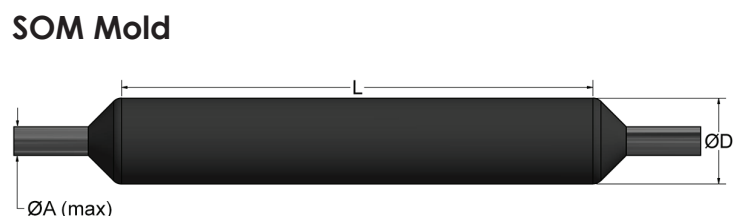
Type	Description	ID Method
TOM	T-junction	D-TOM-L.H
YOM	Y-junction	YOM-L.W
SOM	Splice	D-SOM-L

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.



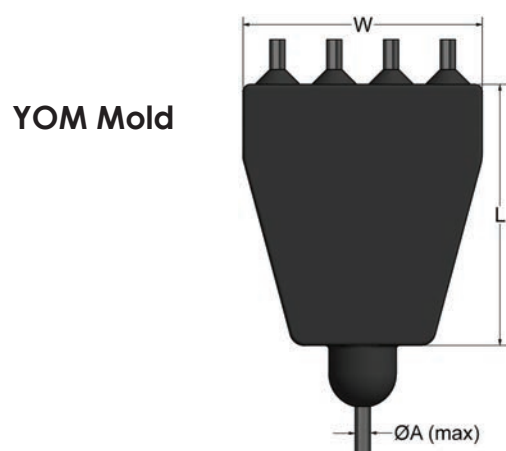
TOM Molds-mm						
Mold	L	H	ØD	Max Cable Max OD, A	Max Cable Max OD, B	Max Cable Max OD, C
4-TOM-13.6	127	64	38	Ø29	Ø29	Ø29

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	W	Max Cable OD, A
2-SOM-10	101	19	Ø13

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

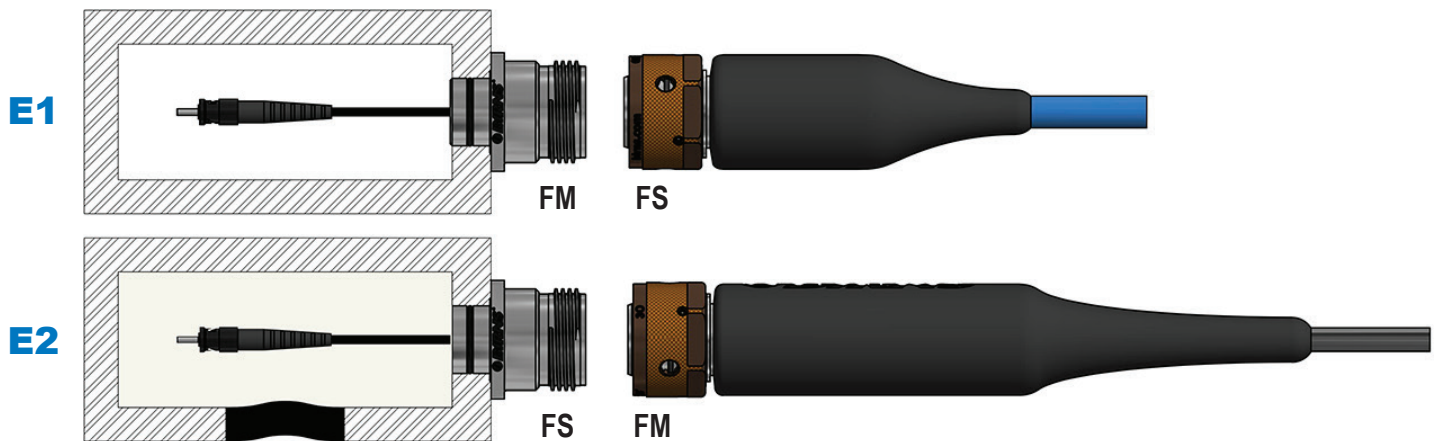


YOM Molds-mm			
Mold	L	W	Max Cable OD, A
YOM-11.10	111	101	Ø22

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

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 subjected 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.

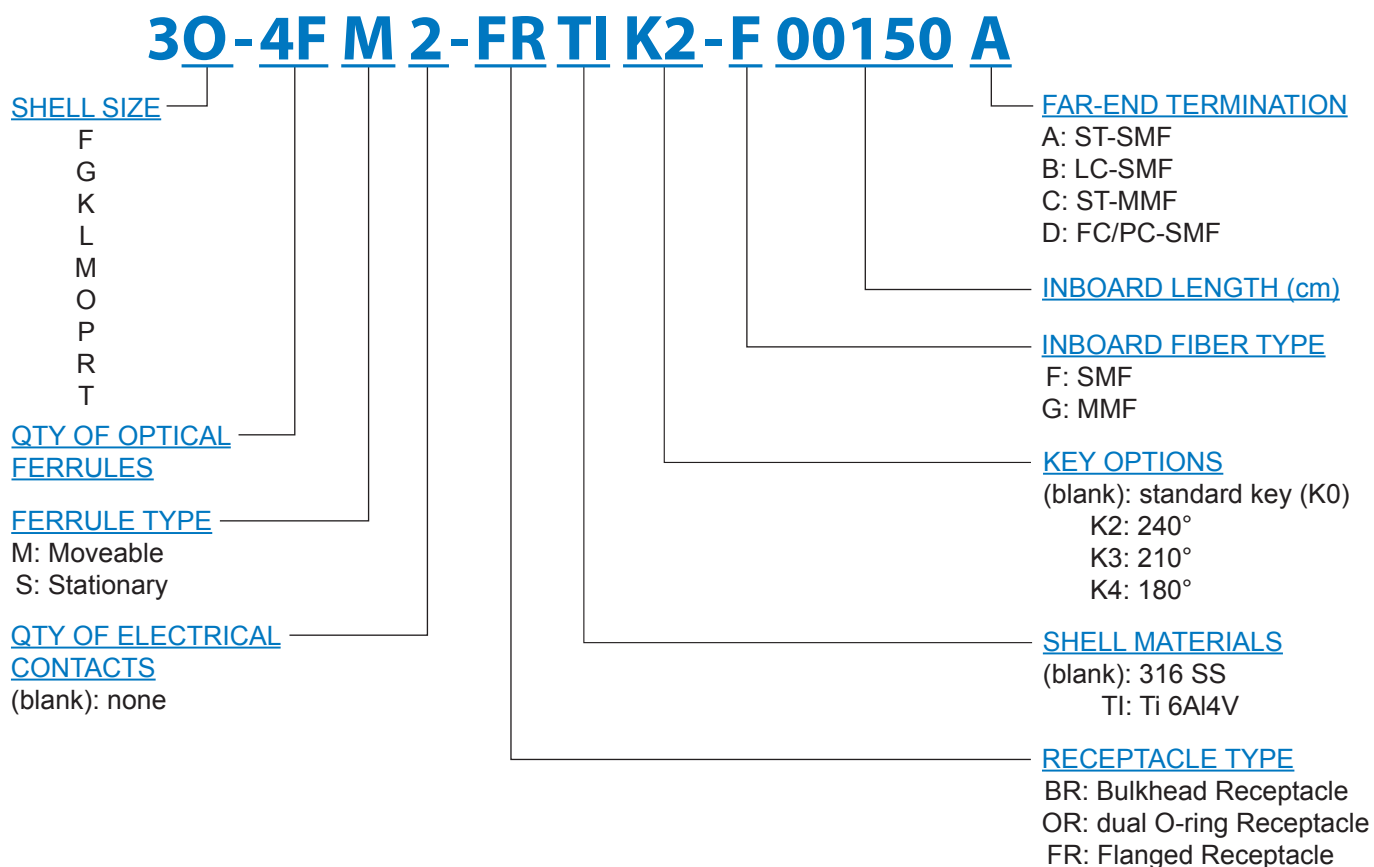
The part number reflects FM or FS. For example, the 3O-4F2 is the general designation of the 3O configuration with 4 ferrules and 2 copper contacts, but the part number of the connector begins with 3O-4FM2 (or 3M-4FS2) to designate Moveable or Stationary ferrules. (Not all Optical or EO connectors are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



BIRNS Millennium optical connectors incorporate UPC (Ultra-Physical Contact) ferrules^[1]. 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).

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.



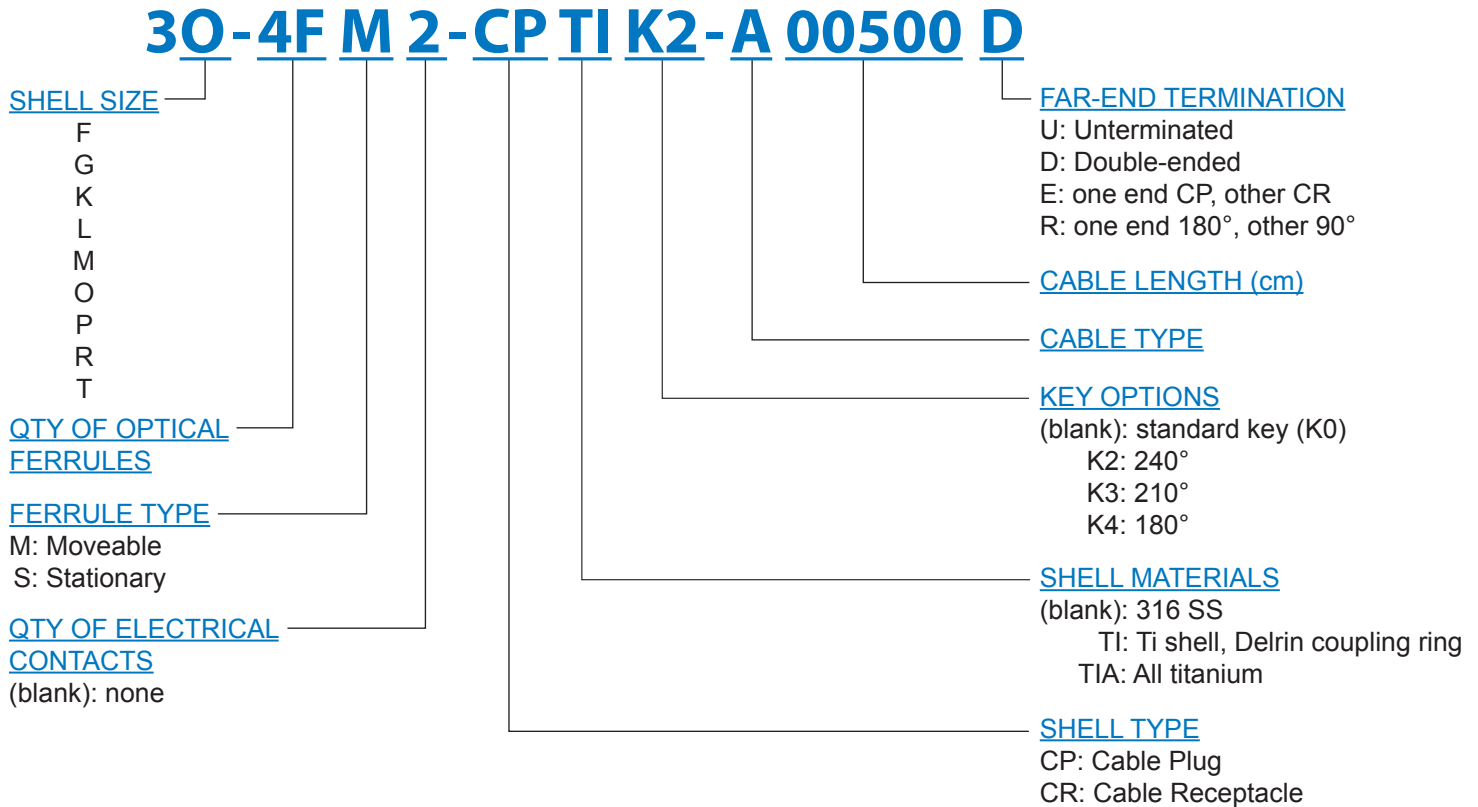
Receptacle Kit/Assembly Part Numbering Guide

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 46.
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 termination^[1]. 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]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 Guide

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).^[1]
5. Select a Key Option if desired (K2, K3, K4).

Steps 1-5 are for the connector kit without assembly or inboard termination^[2]. For a complete terminated assembly:

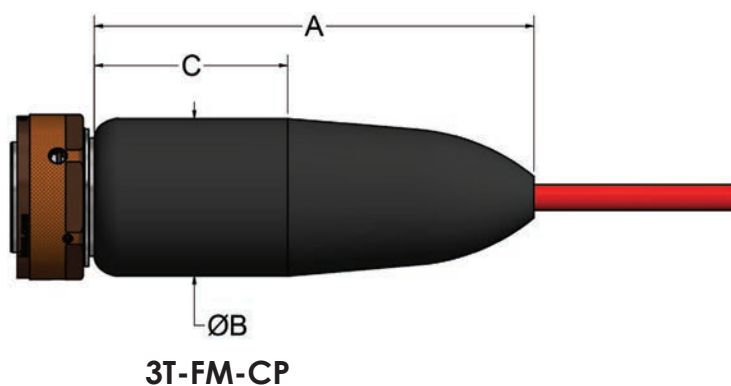
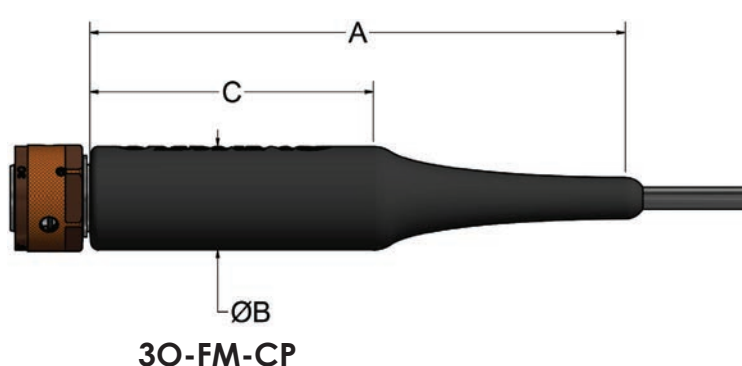
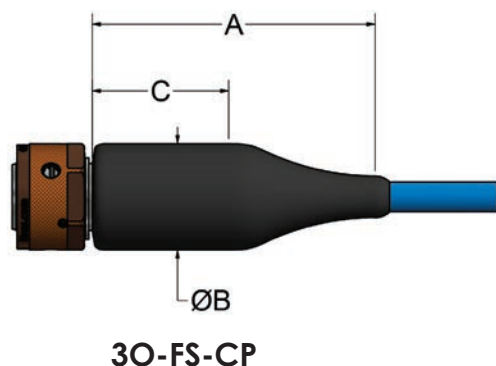
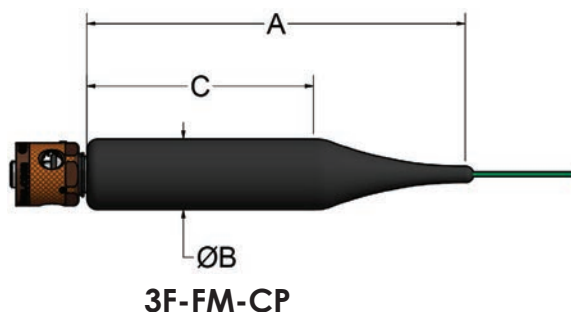
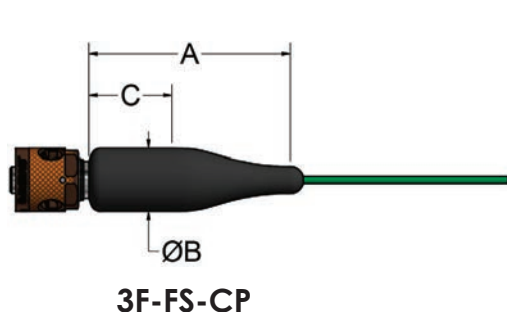
6. Select the cable type.
7. Select the desired termination length in centimetres
8. Select the far-end termination (U, D, R, E).

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] 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".

^[2] 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.



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	114	43	55
3O-FM-CP	217	42	115
3T-FM-CP	178	64	78

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	4.5	1.69	2.17
3O-FM-CP	8.53	1.64	4.52
3T-FM-CP	7	2.5	3.08

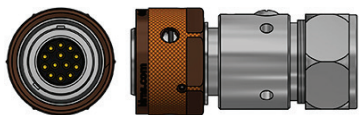
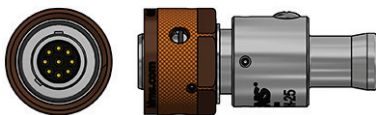

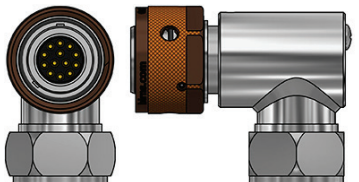
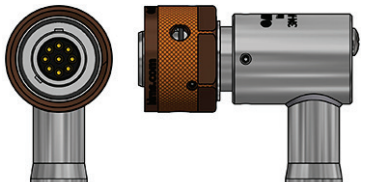
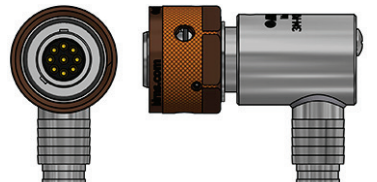
Oil-filled cable assemblies constitute conductive lines inside a hose containing an inert fluid. For some applications, oil-filled cable assemblies provide significant advantages: design flexibility, in-field serviceability, and inherent pressure balancing. However, successful use of oil-filled assemblies 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 assemblies^[1] 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 34.)

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-OF	0.19	5
	0.75	3G-OF-.75	0.41	10
3K	0.75	3K-OF-19	0.44	11
	1.00	3K-OF-1	0.62	16
3L	0.75	3L-OF	0.44	11
	1.00	3L-OF-25	0.62	16
3M	0.50	3M-OF-13	0.19	5
	0.75	3M-OF	0.44	11
	1.00	3M-OF-1	0.62	16
3O	0.75	3O-OF-3/4	0.44	11
	1.00	3O-OF	0.69	17
3P	0.75	3P-OF-3/4	0.44	11
	1.00	3P-OF	0.69	17

OFRA backshells (Fitting), Right Angle				
CP	Hose OD (in.)	Backshell	ID Min. (in.)	ID Min. (mm)
3G	0.50	3G-OF-RA	0.19	5
	0.75	3G-OF-RA-19	0.44	11
3K	0.75	3K-OFRA	0.44	11
	1.00	3K-OFRA-1	0.69	17
3L	0.75	3L-OFRA	0.44	11
3M	0.75	3M-OF-RA	0.44	11
	1.00	3M-OFRA-1	0.69	17
3O	0.75	3O-OFRA-3/4	0.44	11
	1.00	3O-OF-RA	0.69	17
3P	1.00	3P-OF-RA	0.69	17

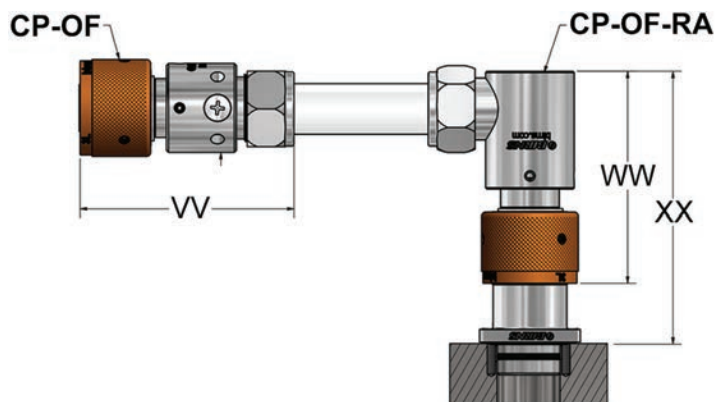
OH backshells (Hose clamp), straight					
CP	Hose OD (in.)	Backshell (SS)	Backshell (TI)	ID Min. (in.)	ID Min. (mm)
3G	0.75	3G-POH-19	3G-POHTI-19	0.36	9
3K	0.75	3K-POH-19	3K-POHTI-19	0.36	9
	1.00	3K-POH-25	3K-POHTI-25	0.60	15
3L	0.75	3L-POH-19	3L-POHTI-19	0.36	9
	1.00	3L-POH-25	3L-POHTI-25	0.60	15
3M	0.75	3M-POH-19	3M-POHTI-19	0.36	9
	1.00	3M-POH-25	3M-POHTI-25	0.60	15
3O	1.00	3O-POH-25	3O-POHTI-25	0.60	15
	1.25	3O-POH-32	3O-POHTI-32	0.84	21
3P	1.00	3P-POH-25	3P-POHTI-25	0.60	15
	1.25	3P-POH-32	3P-POHTI-32	0.84	21
3R	1.25	3R-POH-32	3R-POHTI-32	0.84	21
	1.50	3R-POH-38	3R-POHTI-38	1.05	27
3T	1.25	3T-POH-32	3T-POHTI-32	0.84	21
	1.50	3T-POH-38	3T-POHTI-38	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-POHRA-19	3G-POHRATI-19	0.36	9
3K	0.75	3K-POHRA-19	3K-POHRATI-19	0.36	9
	1.00	3K-POHRA-25	3K-POHRATI-25	0.60	15
3L	0.75	3L-POHRA-19	3L-POHRATI-19	0.36	9
	1.00	3L-POHRA-25	3L-POHRATI-25	0.60	15
3M	0.75	3M-POHRA-19	3M-POHRATI-19	0.36	9
	1.00	3M-POHRA-25	3M-POHRATI-25	0.60	15
3O	1.00	3O-POHRA-25	3O-POHRATI-25	0.60	15
	1.25	3O-POHRA-32	3O-POHRATI-32	0.84	21
3P	1.00	3P-POHRA-25	3P-POHRATI-25	0.60	15
	1.25	3P-POHRA-32	3P-POHRATI-32	0.84	21
3R	1.25	3R-POHRA-32	3R-POHRATI-32	0.84	21
	1.50	3R-POHRA-38	3R-POHRATI-38	1.05	27
3T	1.25	3T-POHRA-32	3T-POHRATI-32	0.84	21
	1.50	3T-POHRA-38	3T-POHRATI-38	1.05	27

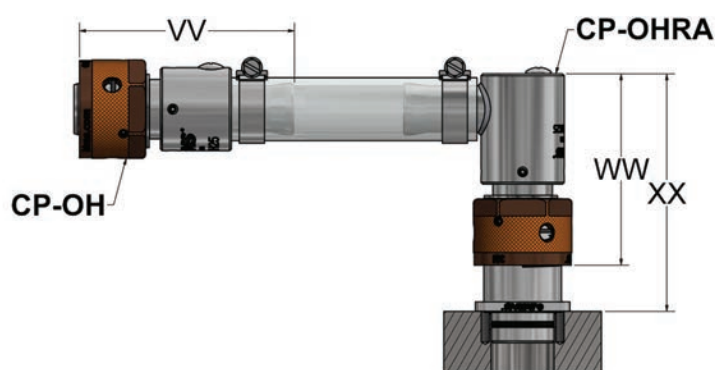
OB backshells (Barb), straight				
CP	Hose OD (in.)	Backshell (SS)	ID Min. (in.)	ID Min. (mm)
3G	0.75	3G-POB-19	0.28	7
3K	1.00	3K-POB-25	0.53	13
3L	1.00	3L-POB-25	0.53	13
3M	1.00	3M-POB-25	0.53	13
3O	1.00	3O-POB-25	0.53	13
	1.25	3O-POB-32	0.78	20
3P	1.25	3P-POB-32	0.78	20
3R	1.25	3R-POB-32	0.78	20
	1.50	3R-POB-38	1.03	26
3T	1.50	3T-POB-38	1.03	26

OBRA backshells (Barb), Right-Angle				
CP	Hose OD (in.)	Backshell (SS)	ID Min. (in.)	ID Min. (mm)
3G	0.75	3G-POBRA-19	0.28	7
3K	1.00	3K-POBRA-25	0.53	13
3L	1.00	3L-POBRA-25	0.53	13
3M	1.00	3M-POBRA-25	0.53	13
3O	1.00	3O-POBRA-25	0.53	13
	1.25	3O-POBRA-32	0.78	20
3P	1.25	3P-POBRA-32	0.78	20
3R	1.25	3R-POBRA-32	0.78	20
	1.50	3R-POBRA-38	1.03	26
3T	1.50	3T-POBRA-38	1.03	26

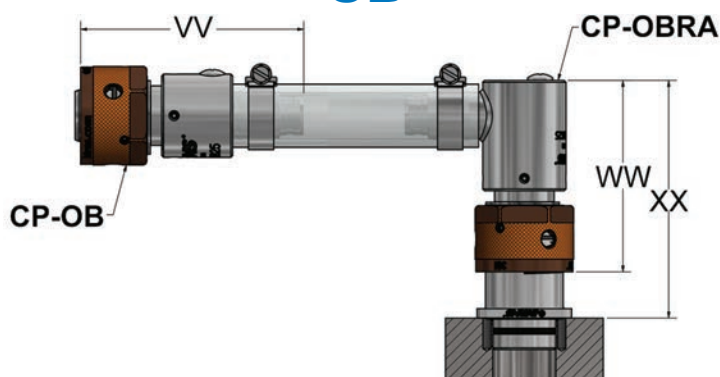
OF



OH



OB



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-OF 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

Oil-Filled Cable Assemblies Part Numbering Guide

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)^[1] (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)^[2]
6. Select hose Angle (180°, 90°)
7. Select hose outer diameter^[3]

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

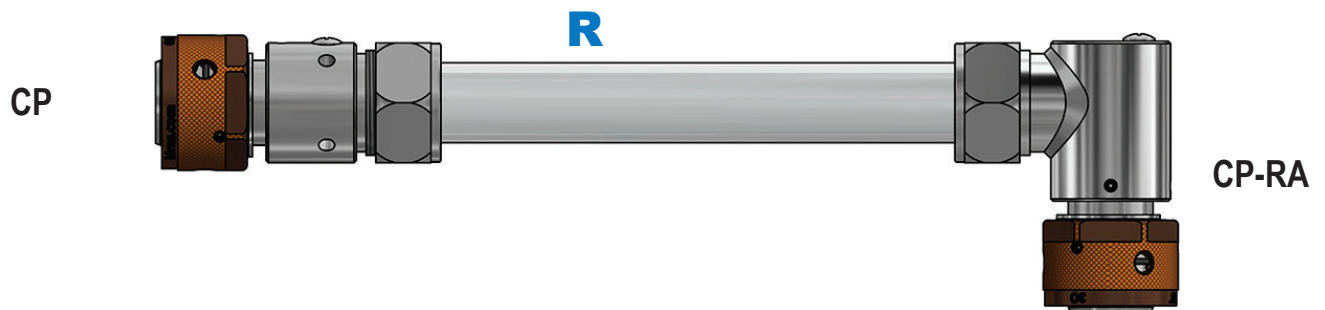
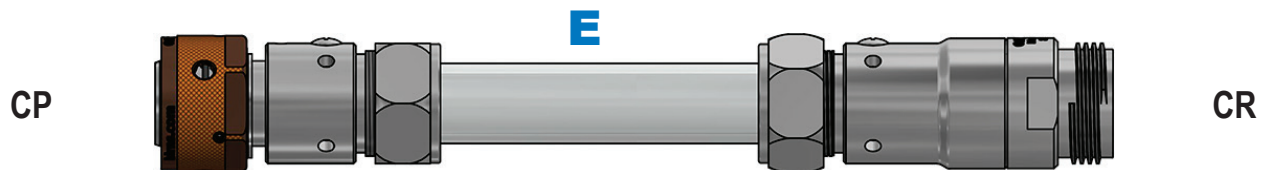
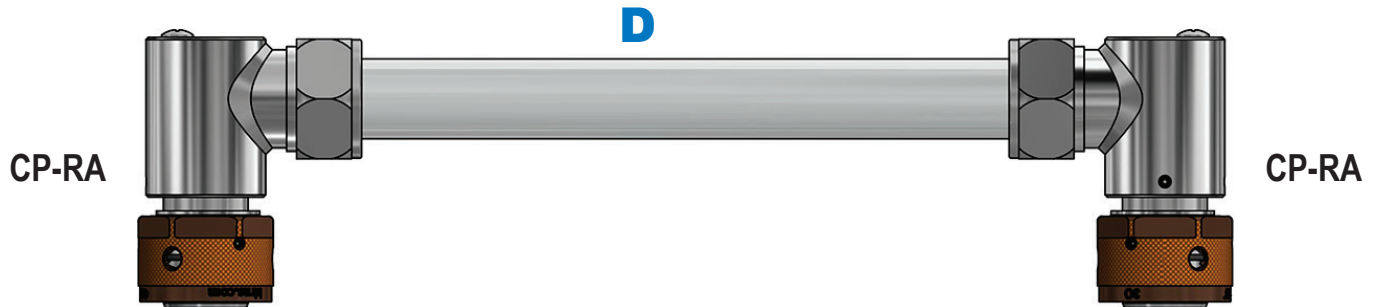
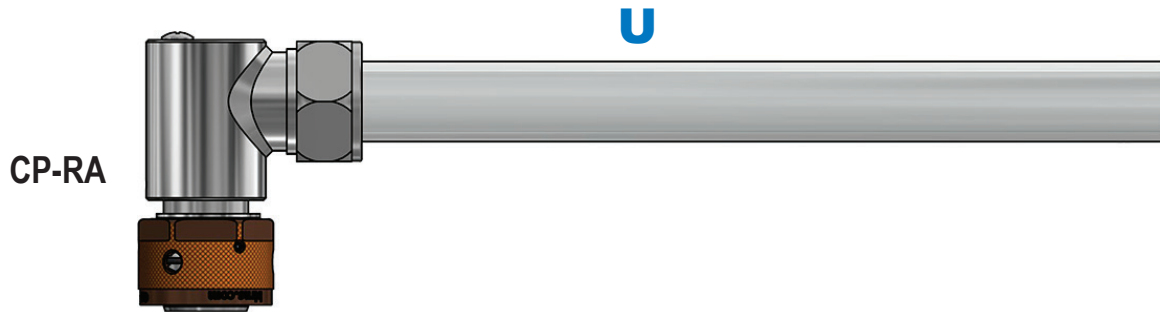
8. Select the hose type
9. Select the length in centimetres
10. Select the far-end termination (U, D, R, E) (see OF Cable Assemblies, Page 35)

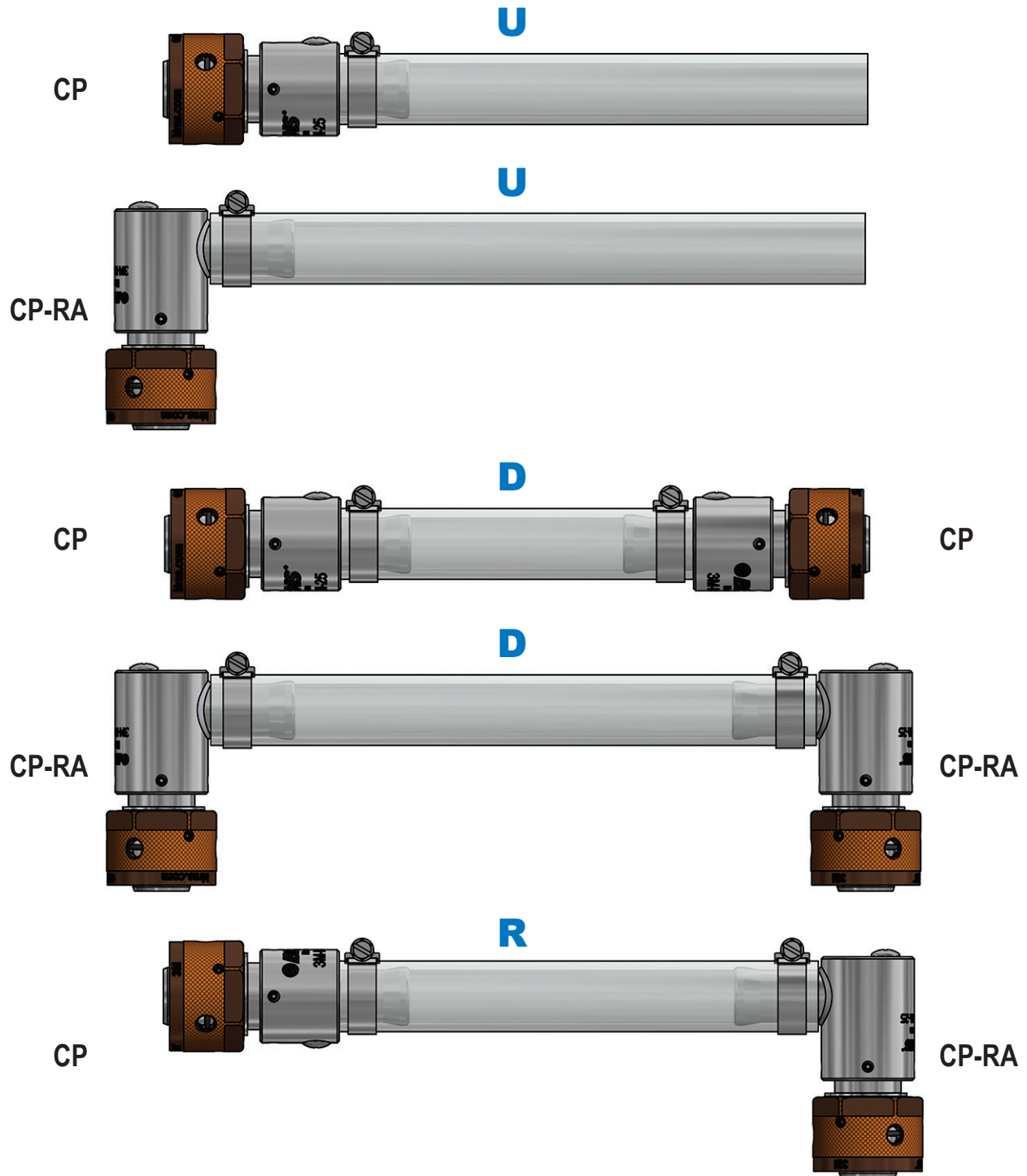
The part number does not include information such as wiring diagram, shield treatment, labeling, length tolerance, back-potting, clocking, rotation, or oil-fill material. Please ask for a BIRNS Configuration Drawing to define these details.

^[1] 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".

^[2] 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.

^[3] For adequate internal wire space, some shell sizes cannot be used with all hose sizes. All hoses have 1/8" (~3.2mm) wall thickness.



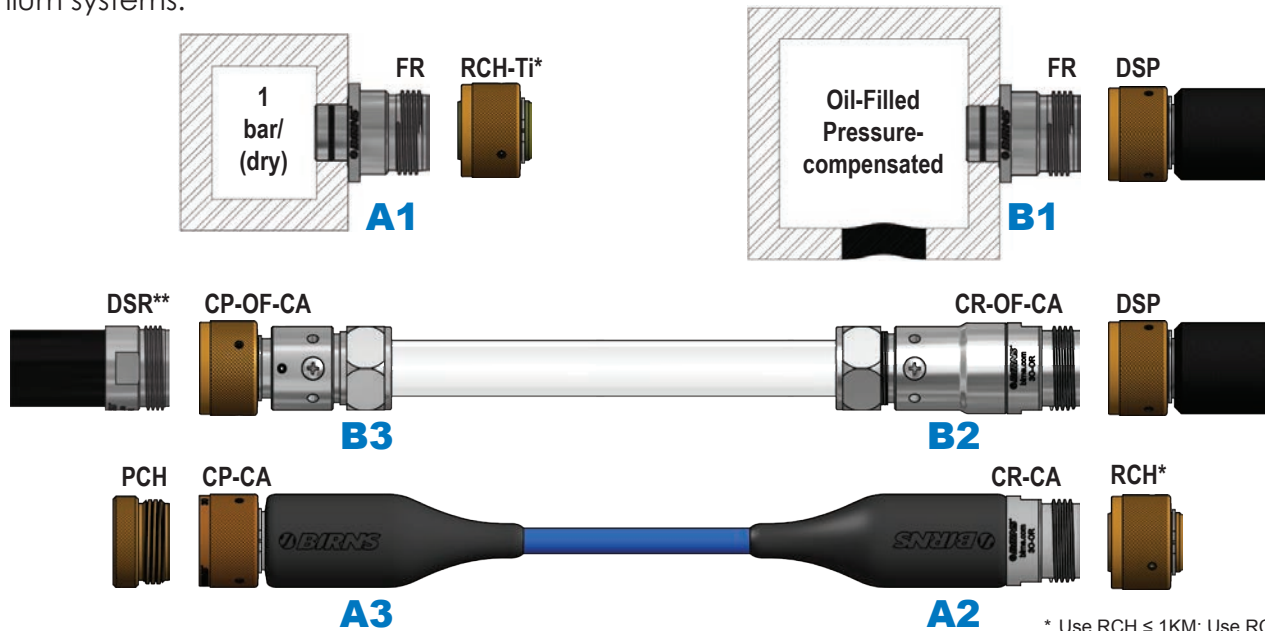


Caps

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.

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.



* Use RCH ≤ 1KM; Use RCH-TI ≤ 6KM
**Use PCH ≤ 1KM; Use DSR ≤ 6KM

Caps (Protective and Sealing/Pressure-Proof)				
Pressure Direction	Receptacle Caps		Plug Caps	
Face Pressure :	RCL	splash-proof	PCL	splash-proof
	RCH	≤ 100 bar	PCH	≤ 600 bar
	RCH-TI	≤ 600 bar	PCH-TI	≤ 600 bar
Rear Pressure :	DSP	≤ 600 bar	PCH	≤ 100 bar
			DSR	≤ 600 bar

Dummy Sealing Connectors

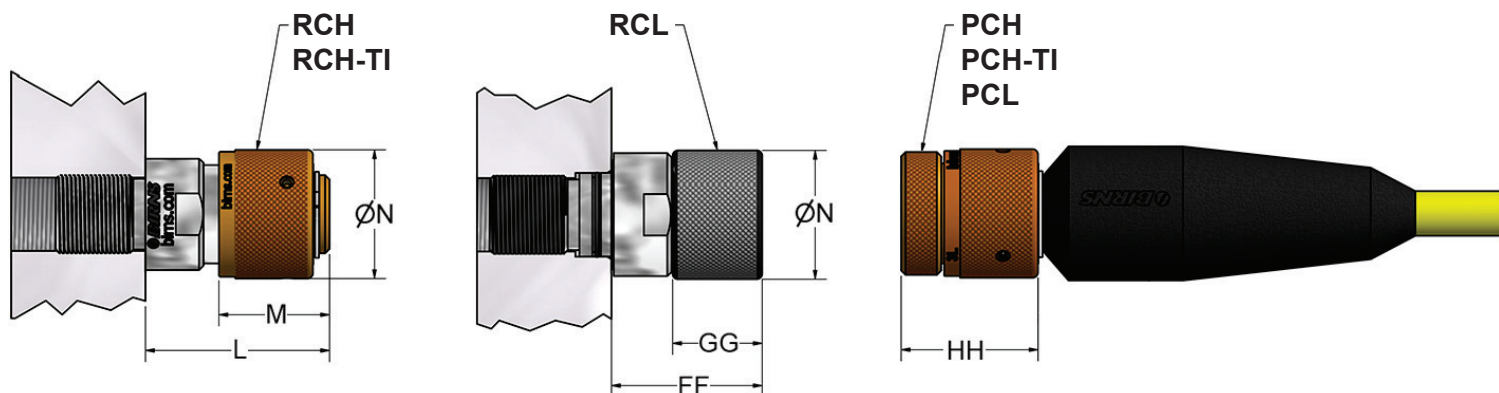
3M-13-DSP

Shell Size — DSP: Dummy Sealing Plug
Contacts — DSR: Dummy Sealing Receptacle

Pressure Caps

3M-RC H-TI

Shell Size — L: IP56
RC: Receptacle Cap H: 1,000m
PC: Plug Cap H-TI: 6,000m

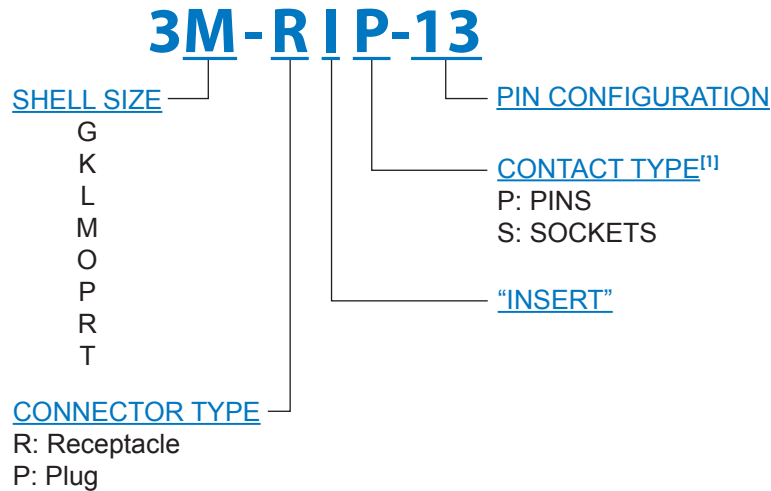


Cap Dimensions (mm)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
L	BR/RCH Combined Height	34	41	52	52	46	52	52	58	52
M	RCH Height	22	25	31	31	32	31	31	31	33
N	Coupling Ring Diameter	19	27	34	37	40	43	49	57	67
FF	OR/RCL Combined Height	27	29	44	41	39	44	44	44	44
GG	RCL Height	15	15	25	25	25	25	27	27	27
HH	Coupling Ring/PCH Combined Length	27	30	34	39	39	38	41	49	44

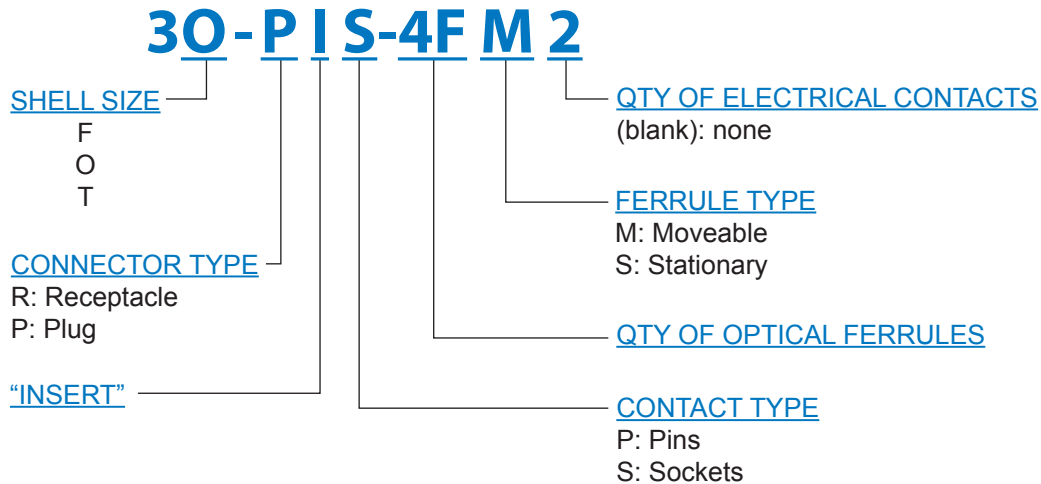
Cap Dimensions (inch)										
Item	Description	3F	3G	3K	3L	3M	3O	3P	3R	3T
L	BR/RCH Combined Height	1.33	1.63	2.06	2.05	1.83	2.05	2.06	2.29	2.04
M	RCH Height	0.86	0.98	1.24	1.23	1.25	1.24	1.23	1.24	1.28
N	Coupling Ring Diameter	0.75	1.06	1.32	1.44	1.56	1.69	1.94	2.25	2.63
FF	OR/RCL Combined Height	1.07	1.15	1.73	1.62	1.52	1.72	1.75	1.75	1.75
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	1.18	1.34	1.53	1.53	1.51	1.63	1.91	1.74

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.

^[2]An insert is included with every connector. This part number system is for spare/replacement inserts.

Materials		
Item	Material	Finish
SS Shells:	316 SS	Passivated per ASTM A967
TI Shells:	Ti 6Al4V, Grade 5	Passivated per ASTM B600
CP Coupling Rings:	C54400 Phosphor Bronze, ASTM B139	Hard temper H04
CP-TI Coupling Rings:	Acetyl Resin, Delrin	None
CP-TIA Coupling Rings:	Titanium, Grade 2	Tiodized Type II or Type IV
SS Hardware:	300-series SS	Passivated
TI Hardware:	Titanium, Grade 2 (CP)	None
Pins:	C36000 Copper Alloy	50μ Au/50μ Ni, MIL-G-45204 Type II Grade D Class 1
Sockets:	C17300H BeCu, heat-treated	50μ Au/50μ Ni, MIL-G-45204 Type II Grade D Class 1
Inserts:	GRE (glass-reinforced epoxy)	None
Optical Ferrules, Alignment Sleeves:	Zirconia ceramic	None
O-rings (standard):	NBR (standard)	None

Pressure Resistance (bar)				
Type	Electric	RF: 1C	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

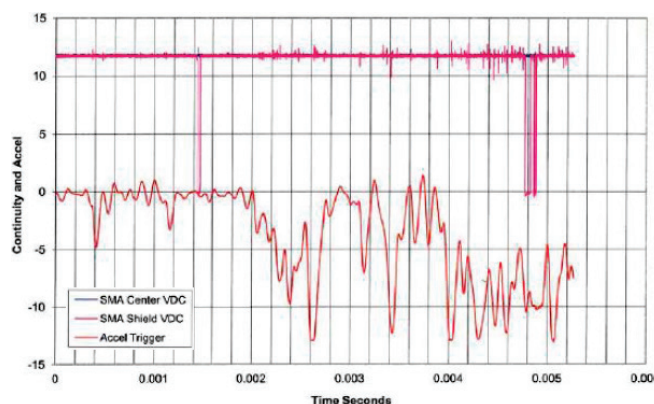
Note: select sizes have been tested and qualified to 625 bar open-face and 750 bar mated.

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:



BIRNS Millennium electrical connectors 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) contact combinations. 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. BIRNS recommends that NFPA 70 (NEC)^[1] Tables B.310 be followed for ampacity bundling-derating guidelines and for ambient temperature adjustments.

BIRNS ampacity ratings are based on 90°C insulation in 30°C air. BIRNS connectors' temperature limit (~165°C) is higher than that of most commercially-available wire insulation, so BIRNS connector ampacity is often limited by that of the wire/cable attached to it. Nonetheless, 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

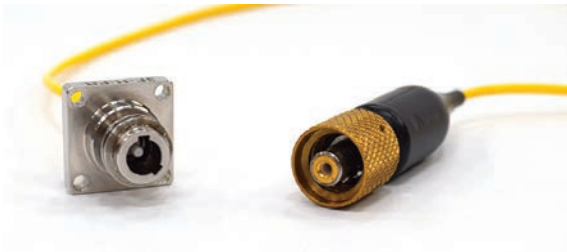
Actual measurements of AWG sizes can vary from manufacturer to manufacturer. BIRNS conductors are larger than some standard sizes for additional flexibility and safety.

(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 Loss^[1]
 - 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).



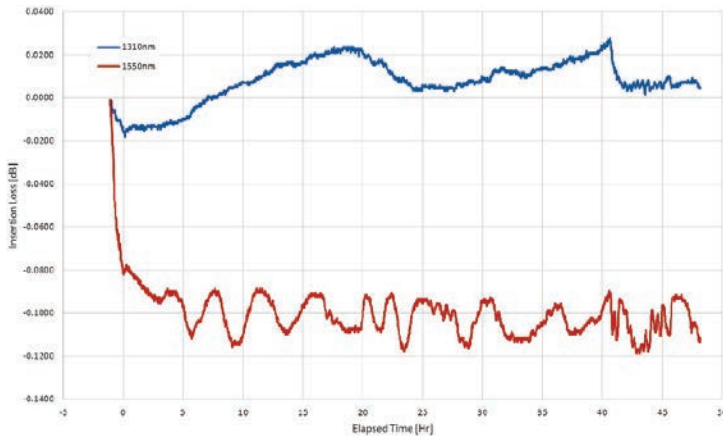
FERRULES

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



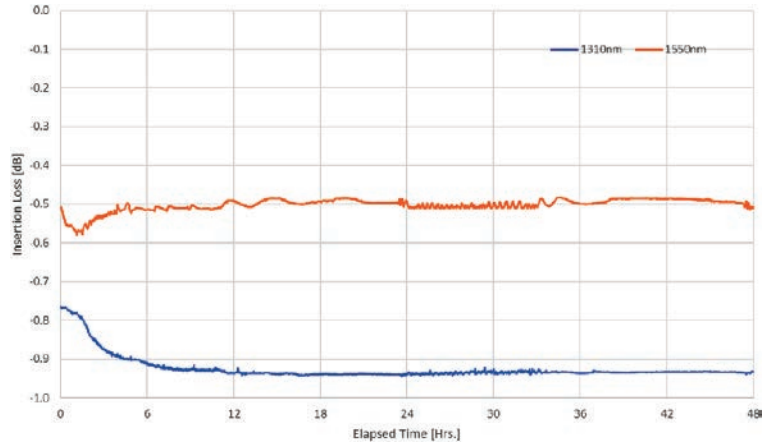
HYBRID

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

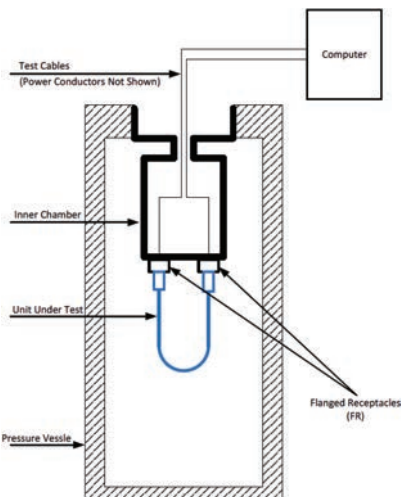
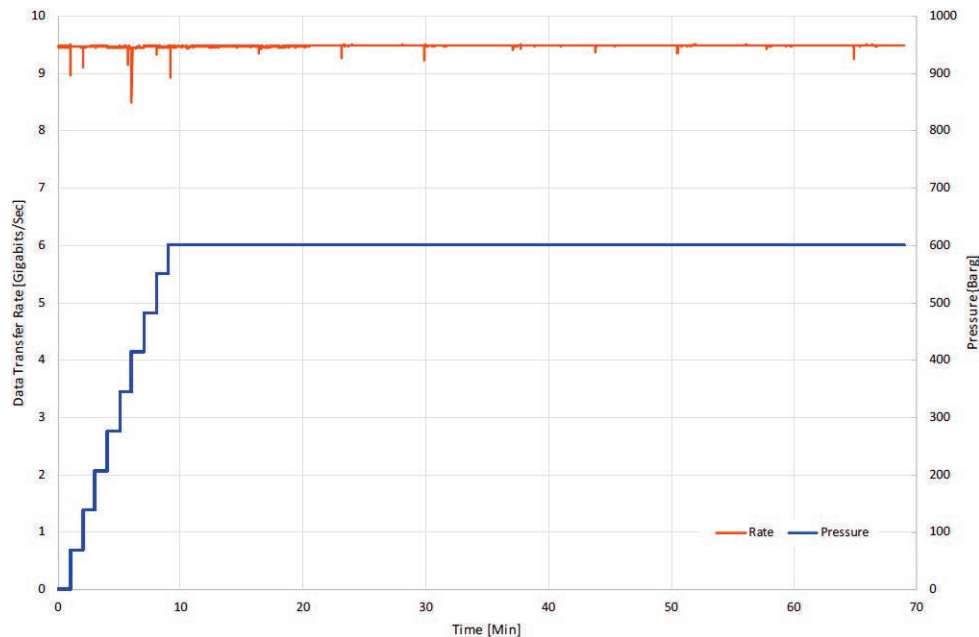
Insertion loss for the 3F-1F3 at 625 bar/1°C for 48 hours.

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

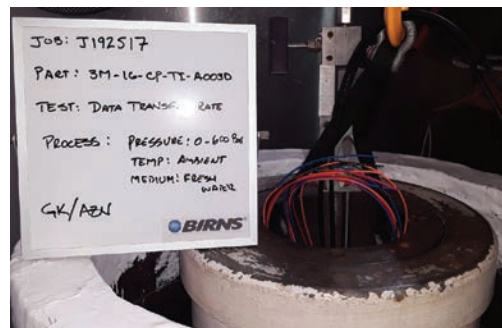
Gigabit Speed Data Transfer Capabilities: 9.4+/- 0.1 Gigabits per second

BIRNS developed exclusive deep submergence cable constructed for Cat 8.2 use, and can offer deep-submergence cable assemblies with data transfer rates of 9.4+/- 0.1 Gigabits per second. Performance testing proved that data consistently transmitted at this rate over the entire range of pressures from 0 to 8700 PSI/600 bar (6000m equivalent depth). The tested configuration is the BIRNS 3M-16 (twelve 22-AWG data contacts and four 16-AWG power contacts). Several sizes and pin configurations are available with data transfer rates of up to 9.4+/- 0.1 Gigabits per second at 6km equivalent depth: 3G-10 (Ethernet), 3M-13, 3M-16 and 3O-17 (Ethernet and Power). Additional high data-rate configurations will be introduced soon, using the exclusive BIRNS 52A-278 cable.

Data Transfer Rate and Pressure



Setup for the Gigabit data transfer test under pressure requirements



The Unit Under Test after installation in the test chamber



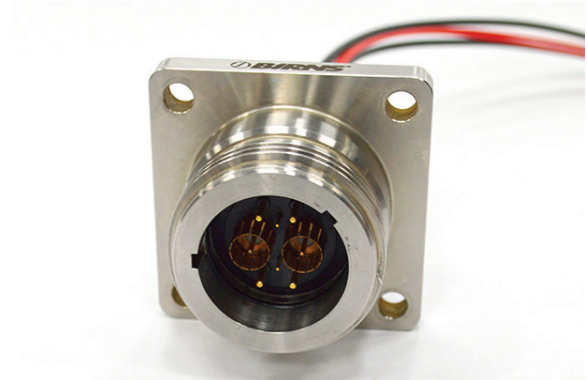
The pressure system controls located outside Hydrostatic Pressure Testing facility I (The chiller was not used for this test.)

BIRNS 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. Some shell sizes can be hybridized with electrical contacts and/or optical ferrules. BIRNS "1C" contacts withstand open-face pressure to depths of 1433m, with UHF insertion loss ≤ 0.7 dB and maximum UHF VSWR of 1.7:1.

US Military: ask about BIRNS "1B" pressure-rated low-loss RF contacts for use to SHF band K_U.

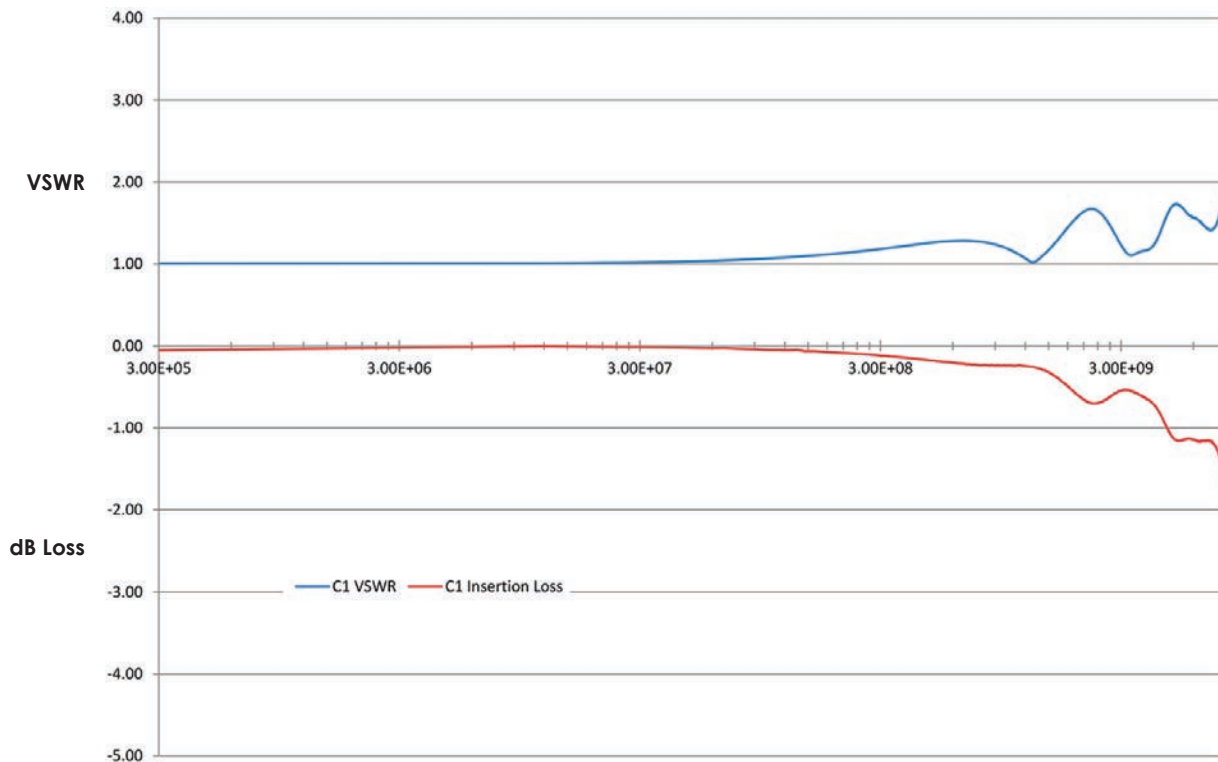


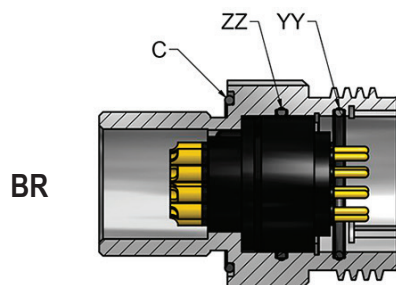
3P-1C



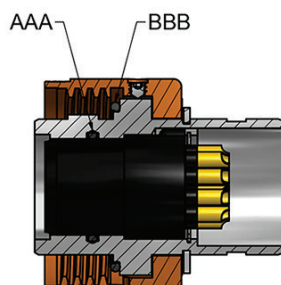
3P-2C6

3P-1C-FR to CP 151014 to 8 GHz

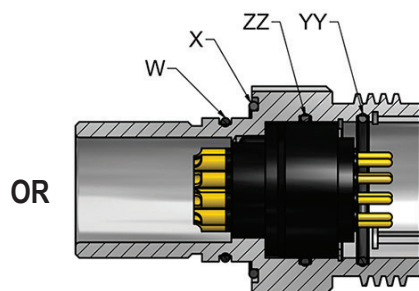




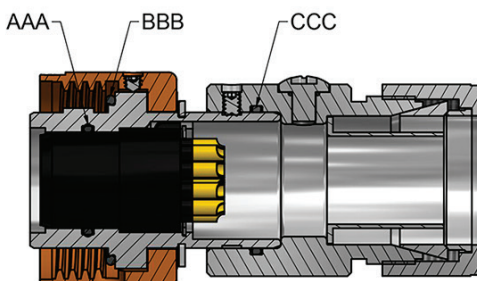
BR



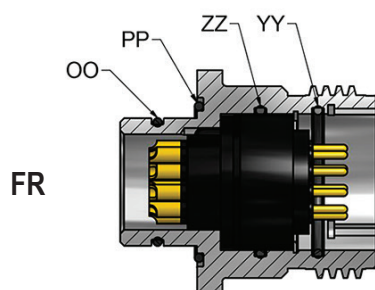
CP



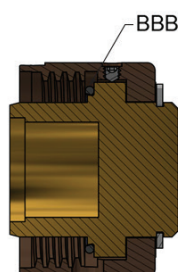
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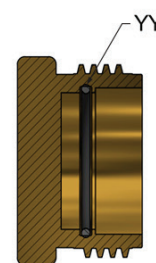
CP-OF, CP-OH, CP-OB,
CP-OFRA, CP-OHRA,
CP-OBRA



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

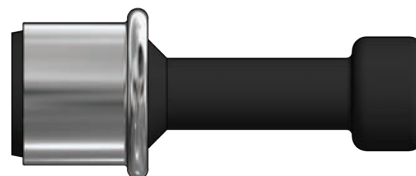


Nuts/Washer

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.
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 11), 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 37).

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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