

RSCC Perma-TEC® Product Family



Why does RSCC offer the Perma-TEC® line of downhole products for the energy industry?

Our customers deploy the finest personnel and equipment to search for abundant sources of natural energy for the world. We believe there's one thing they *shouldn't* have to search for — the reliable downhole cable technology that consistently and accurately monitors and delivers critical data from the deepest and harshest well sites.



The Perma-TEC® family of cable systems from the RSCC Downhole Products group

 **Standard-TEC**  **Pressure-TEC**  **Digi-TEC**  **Flat-TEC**  **Safety-TEC**  **Perma-FLOW**

We know the drill.

Why Us?

RSCC Downhole Products has taken on the challenge of designing and manufacturing wire & cable products for the most demanding applications in the world, even as those challenges become more diverse. We lead the industry in constant, relentless innovation to solve customer problems by producing high performance cables that withstand demanding conditions in the field.



Pressure-TEC™

RSCC's next generation electrical cable.

If you're looking for a cabling system with the most advanced features that can help you minimize risk, talk to us today about Pressure-TEC.

- 150C Versions Available
- *Only* Commercially Available 200C Pressure Testable Cable
- Stainless Steel Cladding Alloys — 316L, I-825, and I-625

Each Pressure-TEC cable adds an extra layer of protection by enabling the weld to be verified through an internal pressure test, thus reducing the risk of premature cable failure resulting from a weld defect.

Unlike earlier foamed cables, Pressure-TEC's centralized conductor is designed for ease of termination of the cables — allowing for automatic removal of the filler layer if required.

Compared to standard roll reduced constructions, RSCC's proprietary manufacturing process creates a superior bonding force between the armor tube and filler layer. This unique bond assures that the core will not fall into the tube when terminated on the topside and will not pull out from the gauge.

Learn more about Pressure-TEC patented inner core technology.



Standard-TEC®

The petroleum industry's "go-to" cable choice.

RSCC's time tested and innovative manufacturing technology make us the leading designer and producer of Downhole Metal Clad cables that fit a wide range of needs from benign applications up to your most severe well conditions.

- Operating Temperatures — 150C up to 300C
- Single Conductor Configurations — 8 AWG–24 AWG Custom Gages Available
- Multi-Conductor Configurations — 2C–7C 16 AWG–24 AWG Custom Configurations Available
- Stainless Steel Cladding Alloys — 316L, I-825, and I-625

Our closely monitored Eddy current technology enables us to verify a precise weld line during the armoring of TEC. And the Cable Armoring Compressive Force we incorporate prevents cable core snapping due to excessive movement.

RSCC downhole products are always up to the job.



In 1965, RSCC wires were installed on the Surveyor lunar explorer, and on the Apollo lunar exploration vehicle four years later. From nuclear reactors to locomotives to underwater oil exploration, RSCC cables can be found operating continuously and reliably in some of the most forbidding and sensitive industrial environments.

Our capabilities are supported by ISO 14001 and ISO 9001 certified quality programs, qualified third party testing laboratories, committed onsite R&D, and highly experienced technicians. RSCC cable processing centers can turn around engineered solutions to meet or exceed production schedules.



Digi-TEC

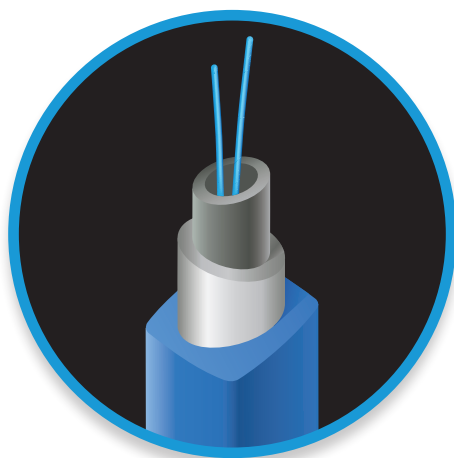
Optimize your custom sensing application.

Digi-TEC cabling is your transmission pipeline to deliver critical digital and analog readings of well conditions such as pressure and temperature in high or low temperature applications.

- Multi-Fiber or Fiber-Copper Hybrid Constructions
- Wide Range of Jacket Encapsulation — 150C – 300C
- Stainless Steel Cladding in 316L, I-825, and I-625

RSCC Downhole Products can build custom cables designed to your stringent specifications. With our strong ties to many optical fiber manufacturers, we can guarantee the ability to meet the demands of any fiber cable design project.

When it comes to fiber, we know the drill.



Flat-TEC

The multi-component cable system.

When the industry needs a multi-purpose capability cable, RSCC Downhole Products is flat out the best choice.

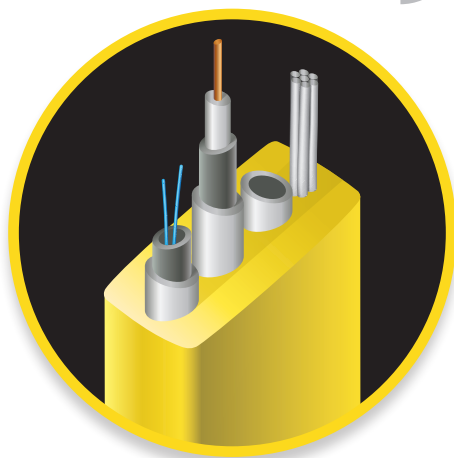
Flat-TEC eliminates the need for multiple cables and can be used to perform multiple operations using RSCC Standard-TEC, Pressure-TEC, and Digi-TEC products.

With Flat-TEC you can configure two to up to six different parts in one single cable that can incorporate strength members, pressure tubing, and Perma-TEC products all within a single cable.

- Wide Range of Jacket Encapsulation — 150C – 300C
- Stainless Steel Cladding in 316L, I-825, and I-625
- Flatpack Width Sizes — 11mm–50mm, Custom Sizes Available

The RSCC Downhole Products division works directly with its worldwide network of customers to design cable for use not only for today's oil reservoir monitoring and extraction processes, but also in the development of future technologies.

Supporting energy discovery for decades to come.



Further, our in-house capabilities, combined with our access to our Marmon Electrical affiliates, means that customers can avoid multi-sourcing and rely on RSCC Downhole Products to deliver on time and on spec.

“We’re problem solvers, not order takers”



Safety-TEC™

The way to strip the jacket cable in a zip.

RSCC Safety-TEC cables provide enhanced safety for drilling equipment engineers installing cables for oil and gas drilling applications. A unique ripcord feature allows safe removal of the cable jacket in the field without use of a knife. Whether stripping by hand or with the assistance of a stripping tool, Safety-TEC cables are designed for easy removal of cable jackets without compromising the integrity of the specified materials. Available on all Perma-TEC® products, and high- and low-temperature encapsulations.

Safety-TEC, faster, better for jobs on the line.



Perma-FLOW®

Delivering critical control downhole.

Perma-FLOW rounds out the RSCC family of downhole products for oil and natural gas production. Designed to the most demanding and exacting standards for industry, Perma-FLOW can be used in a standalone function providing hydraulic and chemical injection, or in conjunction with a multiple-cable configuration such as the RSCC Flat-TEC system that can incorporate downhole sensing capabilities. Available in both 316L and I-825 alloy grades depending on production requirements.

Take control with Perma-FLOW.



Alloy 316L Seam Welded Pressure Tubing

Heat Treated/30 KSI Minimum Yield Strength/UNS S31603

Mechanical Properties

Property	Minimum	Maximum	Typical
Ultimate Tensile Strength UTS, (psi)	75,000	–	82,000
0.2% Offset Yield Strength, VS (psi)	30,000	–	36,000
Elongation in 2 inches, E (%)	35	–	43%
Hardness, HRB	–	90	69-71

Acceptable Tube Variations

Nominal Outside Diameter (in)	OD (± in)	t (±%)
Less than 0.625 +0.004/–0.000	–	10
Equal to or greater than 0.625	0.005	10

Size Dependant Characteristics/Properties (based upon nominal tubing dimensions)

Nominal Outside Diameter (in)	Nominal Wall Thickness (in)	Minimum Burst Pressure (psi)	Minimum Collapse Pressure (psi)	Flow Cross Section (in)	Volume per unit Length (gal/1000 ft)
0.250	0.035	18,676	6,540	0.0254	1.3
0.250	0.049	26,146	8,635	0.0181	0.9
0.250	0.065	34,684	10,666	0.0113	0.6
0.375	0.035	12,500	4,583	0.0731	3.8
0.375	0.049	17,500	6,183	0.0603	3.1
0.375	0.065	23,214	7,849	0.0471	2.4
0.375	0.083	29,643	9,514	0.0343	1.8
0.500	0.035	9,394	3,522	0.1452	7.5
0.500	0.049	13,151	4,799	0.1269	6.6
0.500	0.065	17,445	6,167	0.1075	5.6
0.500	0.083	22,276	7,587	0.0876	4.6
0.625	0.035	7,524	2,695	0.2419	12.6
0.625	0.049	10,533	3,906	0.2181	11.3
0.625	0.065	13,973	5,054	0.1924	10.0
0.625	0.083	17,842	6,271	0.1655	8.6

Alloy 825 Seam Welded Pressure Tubing

Heat Treated and Cold Worked/35 KSI Minimum Yield Strength/UNS N08825

Mechanical Properties

Property	Minimum	Maximum	Typical
Ultimate Tensile Strength UTS, (psi)	85,000	–	91,000
0.2% Offset Yield Strength, VS (psi)	35,000	–	39,000
Elongation in 2 inches, E (%)	30	–	43%
Hardness, HRB	–	90	71-73



Take control with Perma-FLOW.

Acceptable Tube Variations

Nominal Outside Diameter (in)	OD (± in)	t (±%)
Less than 0.625 +0.004/–0.005	–	10
Equal to or greater than 0.625	0.005	10

Size Dependant Characteristics/Properties (based upon nominal tubing dimensions)

Nominal Outside Diameter (in)	Nominal Wall Thickness (in)	Minimum Burst Pressure (psi)	Minimum Collapse Pressure (psi)	Flow Cross Section (in)	Volume per unit Length (gal/1000 ft)
0.250	0.035	27,391	19,621	0.0254	1.3
0.250	0.049	38,348	25,906	0.0181	0.9
0.250	0.065	50,870	31,997	0.0113	0.6
0.375	0.035	18,333	13,750	0.0731	3.8
0.375	0.049	25,667	18,550	0.0603	3.1
0.375	0.065	34,048	23,546	0.0471	2.4
0.500	0.035	13,777	8,792	0.1452	7.5
0.500	0.049	19,288	14,398	0.1269	6.6
0.500	0.065	25,586	18,500	0.1075	5.6
0.625	0.035	11,035	5,263	0.2419	12.6
0.625	0.049	15,449	10,854	0.2181	11.3

Data is approximate and subject to normal manufacturing tolerances. These specifications are subject to change without notice.



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Perma-TEC® Cable Specifications

	316L Stainless Steel						INCOLOY 825					
Wall thickness, mm (in)	(0.028)	(0.035)	(0.049)	(0.028)	(0.035)	(0.049)	(0.028)	(0.035)	(0.049)	(0.028)	(0.035)	(0.049)
Mechanical												
Working pressure, kPa (psi)	(10,000)	(15,000)	(20,000)	(10,000)	(15,000)	(20,000)	(10,000)	(15,000)	(20,000)	(10,000)	(15,000)	(20,000)
Collapse pressure, kPa (psi)	(20,000)	(30,000)	(40,000)	(20,600) ¹	(30,900) ¹	(40,000)	(20,600) ¹	(30,900) ¹	(40,000)	(20,600) ¹	(30,900) ¹	(40,000)
Working temperature	See cable encapsulation table below.											
Tensile strength of 6.4 mm (0.25-in) tube (nominal), kPa (psi)	(105,000)	(105,000)	(105,000)	(120,000)	(120,000)	(120,000)	(120,000)	(120,000)	(120,000)	(120,000)	(120,000)	(120,000)
Yield strength of 6.4-mm (0.25-in) tube (nominal), kPa (psi)	(95,000)	(95,000)	(95,000)	(110,000)	(110,000)	(110,000)	(110,000)	(110,000)	(110,000)	(110,000)	(110,000)	(110,000)
	.028 316L	.035 316L	.049 316L	.028 825	.035 825	.049 825	.028 825	.035 825	.049 825	.028 825	.035 825	.049 825
Electrical Specifications												
Voltage Rating V DC	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Max. Conductor Resistance Ohms/KFT 20°C	7	4.4	7	4.4	7	4.4	7	4.4	7	4.4	7	4.4
Max. Conductor Resistance Ohms/KFT 150°C	10.5	6.5	10.5	6.5	10.5	6.5	10.5	6.5	10.5	6.5	10.5	6.5
Capacitance pF/ft 20°C	26	27.2	32	29.3	36	34.9	26	27.2	32	29.3	36	34.9
Capacitance pF/ft 150°C	27.5	30.9	33.5	33.3	40.8	39.7	27.5	30.9	33.5	33.3	37.5	39.7
Min. Insulation Resistance Mohms/KFT	6500	15,000	6500	15,000	6500	15,000	6500	15,000	6500	15,000	6500	15,000
Conductor Gauge (AWG)	18	16	18	16	18	16	18	16	18	16	18	16

¹ At 150 degC (302 degF)

Cable Encapsulation

Type	Polyolefin	Polyamide	ETFE	FEP	PFA	PFA
Cable Color	Yellow	Black	Blue	Natural	Natural	Natural
Max. working temperature, degC (degF)	150 (302)	150 (302)	175 (347)	200 (392)	250 (482)	300 (572)
Min. storage and transportation temperature, degC (degF)	-48 (-54)	-48 (-54)	-100 (-212)	-110 (-230)	-110 (-230)	-110 (-230)

Permanent Downhole Cable Selection Criteria

Tubing wall thickness	Working pressure rating
(0.028 in)	(0 to 10,000 psi)
(0.035 in)	(0 to 15,000 psi)
(0.049 in)	(0 to 20,000 psi)
Tubing metallurgy recommended for use in oil- or gas-base annular fluid types (no water)	
Use INCOLOY® 825 when H ₂ S is present in any amount.	
Use 316L stainless steel when H ₂ S is not present.	
Tubing metallurgy recommended for use in water-base annular fluid types	
Use INCOLOY 825 when H ₂ S is present in any amount.	
Use INCOLOY 825 if CO ₂ is present in concentrations >1%.	
Use INCOLOY 825 if CO ₂ is present in concentrations <1%, chlorides are present in any concentration, and bottomhole temperature (BHT) > 110 degC (230 degF).	
Use 316L stainless steel if CO ₂ is present in concentration <1%, chlorides are present in any concentration, and BHT <110 degC (230 degF).	
Use 316L stainless steel if CO ₂ is present in concentration <1% and no chlorides are present.	
Tubing encapsulation recommended for use in oil- and gas-base annular fluid types	
Use PFA when BHT >175 degC (347 degF).	
Use ETFE when BHT is 150 to 175 degC (302 to 347 degF).	
Use polyamide when BHT <150 degC (302 degF) when no water is present.	
Use ETFE when BHT <150 degC (302 degF) in water-oil-diesel mix.	
Tubing encapsulation recommended for use in water-base annular fluid types	
Use ETFE when BHT >125 degC (257 degF) and gas with CO ₂ is present.	
Use polyolefin when BHT <125 degC (257 degF) and gas with CO ₂ is present.	
Use polyolefin when gas is present but CO ₂ is not.	
Use polyolefin when BHT >90 degC (194 degF) and no gas or CO ₂ is present.	
Use polyamide or polyolefin when BHT <90 degC (194 degF) and no gas or CO ₂ is present.	



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