

## Permanent Downhole Cable

### APPLICATIONS

- WellWatcher\* permanent monitoring systems
- Single-gauge or multigauge monitoring architecture
- Integrated intelligent completions

### BENEFITS

- Field-proven design that ensures long-term reliability of monitoring system

### FEATURES

- Range of conductor and insulation types, tubing materials, and encapsulation styles to suit a wide range of downhole conductors

The permanent downhole cable (PDC) is key to the reliability of WellWatcher permanent monitoring systems. It connects permanent reservoir and production monitoring sensors to the surface, where data are recorded and processed, and provides power to the downhole sensors and electrical valves. The Schlumberger PDC has been extensively tested and qualified for use with the Intellitite\* downhole dual-seal dry-mate connector.

### Track record of reliability

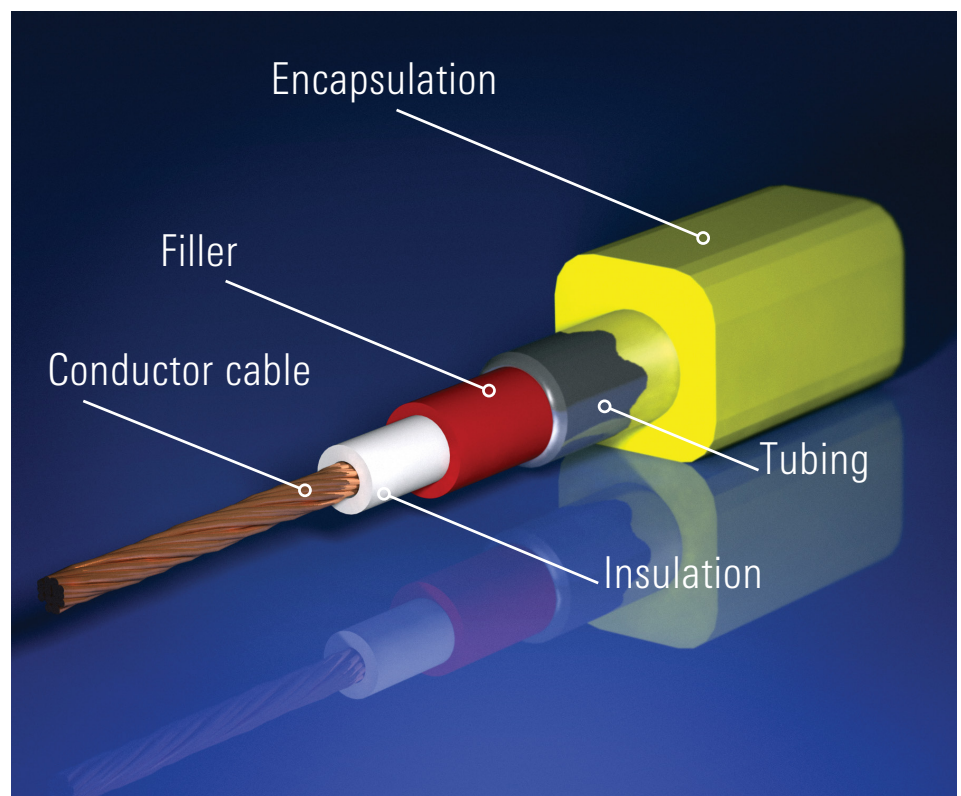
The PDC runs the length of the wellbore, from the gauge to the tubing hanger. During installation and production, it must withstand mechanical shock, vibration, and chemical aggression, as well as electrical and thermal stresses. Proprietary materials and stringent manufacturing quality control processes for this cable have delivered an excellent track record for permanent monitoring system reliability.

### PDC construction

The PDC is concentrically constructed with an insulated, stranded conductor inside a 0.25-in-diameter tubing encasement. Mechanical support for the conductor is provided by a cold-drawn filler material. A protective encapsulation can be extruded to the outside of the tubing encasement so that additional PDCs or hydraulic control lines can be included as a flat pack. Encapsulation provides optional protection during deployment and allows the cable to be properly secured inside the protector.

### Options to maximize performance

Correct cable selection is necessary to maximize system performance and reliability. Conductor size, insulation type, tubing material, tubing diameter, tubing wall thickness, and encapsulation must be specified for each application.



*The Schlumberger permanent downhole cable can be installed with or without protective encapsulation.*

# Permanent Downhole Cable

## Permanent Downhole Cable Selection Criteria

Tube wall thickness	Working pressure rating
0.71 mm [0.028 in]	0 to 68,950 kPa [0 to 10,000 psi]
0.89 mm [0.035 in]	0 to 103,425 kPa [0 to 15,000 psi]
1.24 mm [0.049 in]	0 to 137,900 kPa [0 to 20,000 psi]

### Tube material recommended for use in oil- or gas-base annular fluid types (no water)

Use INCOLOY® 825 when H<sub>2</sub>S is present in any amount.

Use 316L stainless steel when H<sub>2</sub>S is not present.

### Tube material recommended for use in water-base annular fluid types

Use INCOLOY 825 when H<sub>2</sub>S is present in any amount.

Use INCOLOY 825 if CO<sub>2</sub> is present in concentrations > 1%.

Use INCOLOY 825 if CO<sub>2</sub> 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<sub>2</sub> is present in concentrations < 1%, chlorides are present in any concentration, and BHT < 110 degC [230 degF].

Use 316L stainless steel if CO<sub>2</sub> is present in concentrations < 1% and no chlorides are present.

### Tube encapsulation recommended for use in oil- and gas-base annular fluid types

Use FEP<sup>†</sup> when BHT > 150 degC [302 degF].

Use ETFE<sup>‡</sup> when BHT is 140 to 150 degC [284 to 302 degF] and no water is present.

Use polyimide when BHT < 140 degC [284 degF] and no water is present.

### Tube encapsulation recommended for use in water-base annular fluid types

Use ETFE when BHT is 125 to 150 degC [257 to 302 degF] and gas with CO<sub>2</sub> is present.

Use polyolefin when BHT < 125 degC [257 degF] and gas with CO<sub>2</sub> is present.

Use polyolefin when BHT < 150 degC [302 degF] and gas is present but CO<sub>2</sub> is not.

Use ETFE when BHT < 150 degC [302 degF] and oil or diesel is present.

Use FEP when BHT > 150 degC [302 degF].

<sup>†</sup> Fluorinated ethylene propylene

<sup>‡</sup> Ethylene tetrafluoroethylene

## Permanent Downhole Cable Specifications

Tube material	316L Stainless Steel			INCOLOY 825		
	0.71 [0.028]	0.89 [0.035]	1.24 [0.049]	0.71 [0.028]	0.89 [0.035]	1.24 [0.049]
<b>Wall thickness, mm [in]</b>						
<b>Mechanical</b>						
Working pressure, kPa [psi]	68,950 [10,000]	103,425 [15,000]	137,900 [20,000]	68,950 [10,000]	103,425 [15,000]	137,900 [20,000]
Collapse pressure, <sup>†</sup> kPa [psi]	137,900 [20,000]	206,850 [30,000]	275,800 [40,000]	142,037 [20,600] <sup>†</sup>	>204,092 [>29,600] <sup>†</sup>	275,800 [40,000]
Working temperature	See cable encapsulation table below					
Tensile strength of 6.4-mm [0.25-in] tube (nominal), kPa [psi]	723,975 [105,000]	723,975 [105,000]	723,975 [105,000]	827,400 [120,000]	827,400 [120,000]	827,400 [120,000]
Yield strength of 6.4-mm [0.25-in] tube (nominal), kPa [psi]	655,025 [95,000]	655,025 [95,000]	655,025 [95,000]	758,450 [110,000]	758,450 [110,000]	758,450 [110,000]
<b>Electrical</b>						
Voltage rating, V DC	1,000	1,000	1,000	1,000	1,000	1,000
Max. conductor DC resistance at 20 degC [68 degF], ohm/km	23	23	23	23	23	23
Max. conductor DC resistance at 150 degC [302 degF], ohm/km	36	36	36	36	36	36
Capacitance, center conductor to 6.4-mm [0.25-in] tube, pF/m	92	99	114	92	99	114
Insulation resistance, center conductor to 6.4-mm [0.25-in] tube at 20 degC [68 degF], Mohm/km	2,900	2,900	2,900	2,900	2,900	2,900
Conductor wire gauge (AWG)	18	18	18	18	18	18

<sup>†</sup>At 150 degC [302 degF]

## Cable Encapsulation

Type	Polyolefin	Polyimide	ETFE	FEP
Cable color	Yellow	Black	Blue	Green
Max. working temperature, degC [degF]	150 [302]	140 [282]	150 [302]	175 [347]
Min. storage and transportation temperature, degC [degF]	-55 [-67]	-55 [-67]	-55 [-67]	-55 [-67]

[www.slb.com/wellwatcher](http://www.slb.com/wellwatcher)

<sup>\*</sup>Mark of Schlumberger  
Other company, product, and service names  
are the properties of their respective owners.  
Copyright © 2014 Schlumberger. All rights reserved. 14-CO-0105

**Schlumberger**