

UpCable power cable

Ensures robust, reliable power delivery for any well with any ESP system

The Challenge: No power, no production

Premature ESP system failures are frequently caused by vulnerabilities in the power system, harsh environmental operating conditions or human error during installation. A simple error during run-in or cable splicing creates lost time during installation, or even worse, the system may appear functional during installation only to fail under environmental loads at a later date.

Economic impact

Reviving well production after an ESP failure can take weeks or months in some environments—nonproductive time that leads to significant deferment of the revenue stream and the high cost of an unplanned intervention.

Ideal solution

In partnership with two major operators, Baker Hughes developed the game-changing, ultra-reliable UpCable™ power cable that addresses installation and operating challenges associated with the ESP power cable, packer penetrators, splices, and wellhead penetrators.

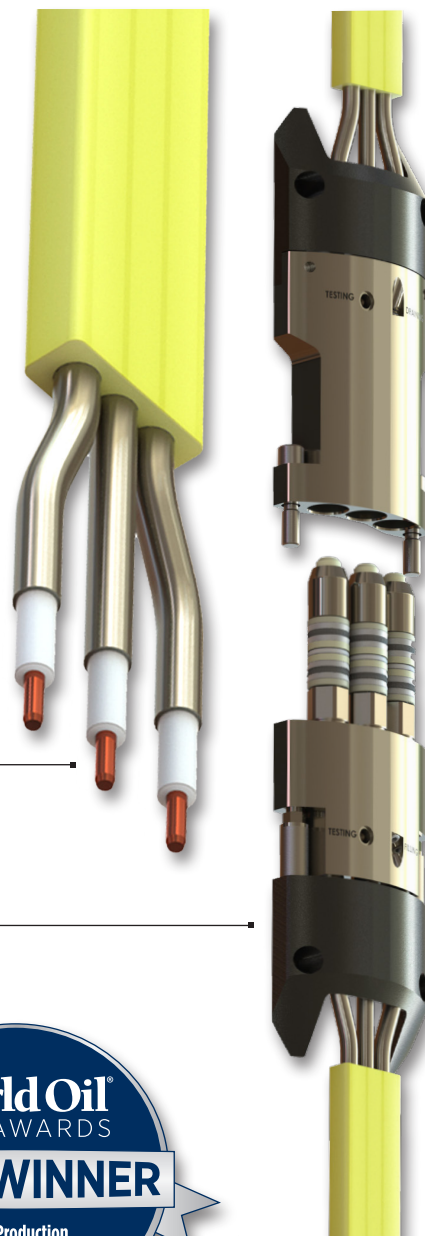
Extensive qualification tests have established that this system is capable of extended operations lasting up to 20 years under a variety of harsh environmental loads and achieves the objective of outlasting the life of typical production tubing.

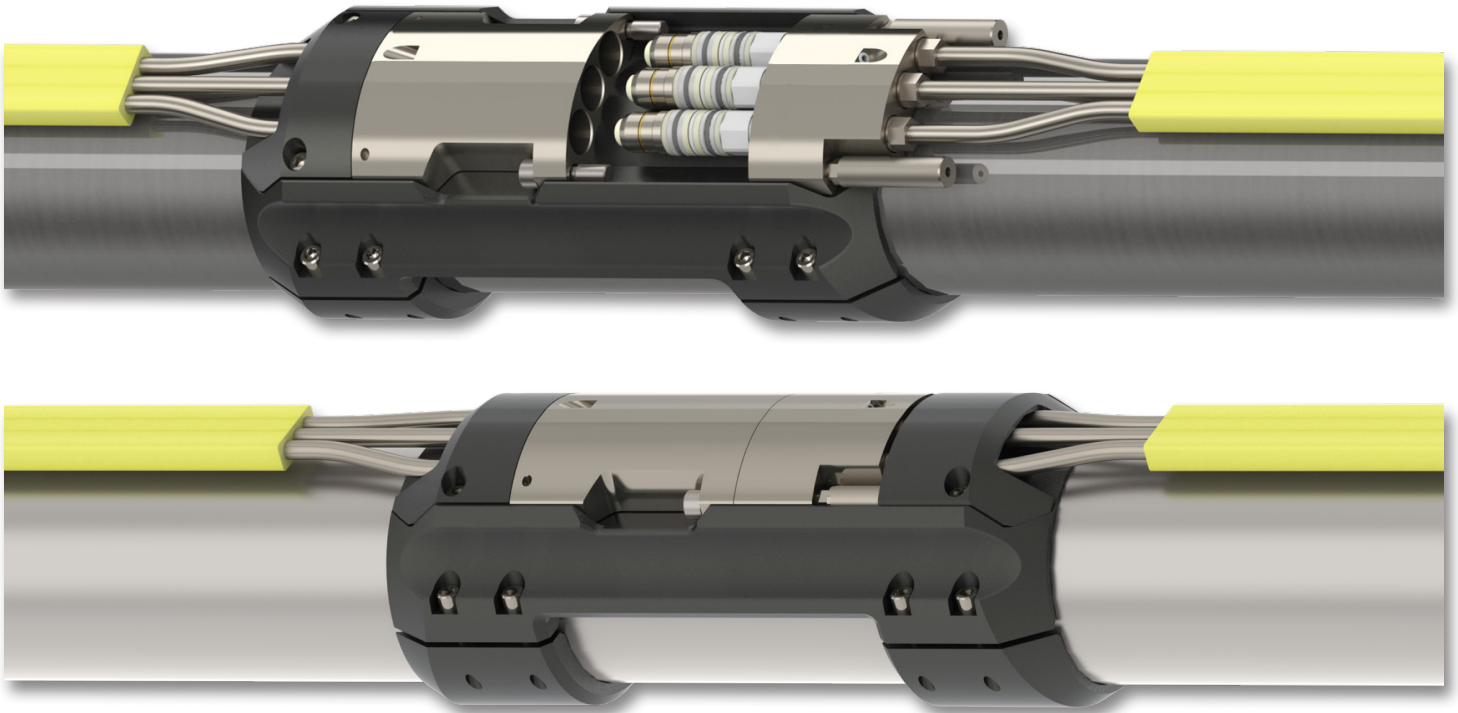
The UpCable system was developed to complement the longevity of AccessESP™ retrievable ESP system; however, UpCable technology is scalable for both onshore and offshore applications of conventionally deployed ESP systems to ensure robust, reliable power delivery for any well with any ESP system.

When operators choose an UpCable system, they get a power delivery system designed to significantly minimize heavy interventions and maximize recovery.

To improve protection against mechanical damage, an outer encapsulation (flatpack) surrounds three metal tubes, insulation material and solid copper conductors.

The innovative, robust field-connect dry-mate socket and plug eliminate field splicing to reduce installation time and risk, increase reliability, and extend service life. The metal-to-metal seal is testable at the wellsite after making up the connection on the rig floor.





The UpCable dry-mate field-connect socket and field-connect plug eliminate splicing to reduce risk and installation time from hours to minutes, increase reliability and extend service life. Key features include pressure test ports, an oil filled pressure compensated connector, metal to metal sealing, a non-elastomeric backup seal stack, and metal bellows pressure compensator/intensifier.

UpCable technology = uninterrupted power

Key to reliability of the system is a tubing encapsulated cable featuring a solid conductor encased in a high-strength, pressure-rated INCOLOY® alloy 825 or stainless steel tube, which protects the insulation and conductor from well fluids and harsh environmental conditions. The tube is terminated into a metal-to-metal seal at every connection or termination in the system. All UpCable designs are enclosed in an outer jacket that incorporates the three tubes for easier handling and installation. Connections are all factory installed and pre-assembled.

Production packer flexibility

The innovative dry-mate connector design allows a production packer to be quickly installed and positioned anywhere in the string. Simplifying installation and packer placement reduces rig time.

Illustration shows that the production packer (center) can be quickly installed and positioned using upper and lower dry-mate connectors (left and right).



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All system components have been adapted and qualified to the high-voltage and high-current requirements of an ESP. This breakthrough technology was rigorously tested to industry standards by a joint committee of operators under laboratory and field conditions to confirm the thermal, mechanical and electrical performance of the system.

Multiple installation tests have been performed to validate the reliability of the cable system, packer/wellhead penetrations, and downhole splices.

Features:

- Eliminates cable splices
- Connects easily and quickly via oil-filled, pressure-tested dry-mate connector
- Delivered to the field ready to install with simplified system integration and assembly
- Protected by a metal tube, eliminating exposure of the conductor to produced fluids
- Highly resistant to slip strikes and rough handling
- Robust in-tight wellbores while protecting from mechanical damage

Benefits:

- Reduced rig deployment time
- Mitigates ESP assembly failures and NPT
- Reduces installation time for ESP completions by completely eliminating splices
- Eliminates risk of electrical failure—associated downtime during completion operations
- Lowers intervention operations cost by extending service life up to 20 years
- Reduces costs over the lifetime of the well
- Lead (Pb) free, reducing CO₂ emissions

Applications:

- Rigless or tubing-deployed ESP systems
- Offshore platform or subsea wells
- High-volume or high-intervention-cost land wells
- Enables multiple reruns



The UpCable reel is delivered to the wellsite or platform with factory-fitted connectors to save rig time and eliminate splicing errors. The fully insulated cable is enclosed in INCOLOY® alloy 825 or 316 stainless steel to provide exceptional mechanical strength and resistance to many corrosive environments.

Specifications

- Xtreme performance: High temperature and depth, and corrosive environments
- Superior performance: High temperature and depth, and low corrosive environments

Superior performance							
UpCable	Temperature range	Corrosion resistance	Conductor	Insulation	Conductor tube	Encapsulation*	Type
Xtreme performance	−30°F to 450°F [−34°C to 232°C]	H ₂ S, CO ₂	#2 or #6 AWG Cu	EPDM	INCOLOY alloy 825		8.6 kV flat
Superior performance	−30°F to 450°F [−34°C to 232°C]	<3% H ₂ S	#2 or #6 AWG Cu	EPDM	316 SS		8.6 kV flat

* Multiple options available as required:

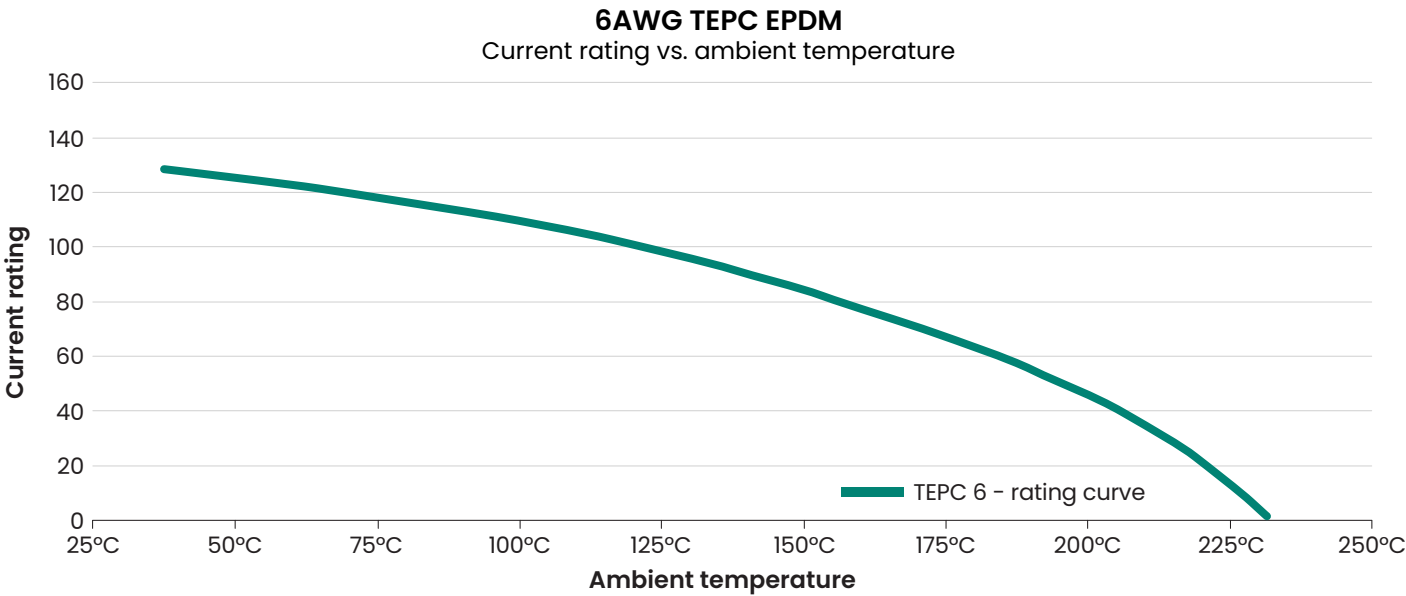
AWG: American Wire Gauge
EPDM: ethylene propylene diene
FEP: fluorinated ethylene propylene

PFA: perfluoroalkoxy
PP: polypropylene
PTFE: polytetrafluoroethylene

PVDF: polyvinylidene difluoride
SST: stainless steel
TPV: thermoplastic vulcanizates

AWG	Tube diameter	Nominal dimensions*		Weight	
		in.	mm	lbm/ft	kg/m
#2*	1/2-in.	1.95 × 0.716	50 × 18	1.60	2.38
#6	3/8-in.	1.575 × 0.591	40 × 15	1.10	1.64

*Determined by outer jacket material.
** #2 AWG available for applications exceeding 600HP.



Encapsulation recommendations

#6 AWG		Temperature range		Resistance to			Encapsulation Fluid
Encapsulation	Trade names	Min.	Max.	Abrasion	Water/brine	Hydrocarbon	
TPV	TT-260, Santoprene	-22°F (-30°C)	302°F (150°C)	3	5	3	Water/brine based only
Nylon 12	TT-200, Nylon 11/12, Rilsan	-76°F (-60°C)	275°F (135°C)	5	3	5	Hydrocarbon only
PPS	Fortron	-40°F (-40°C)	302°F (150°C)	4	5	5	Water/brine based, hydrocarbon
FEP	Teflon, TT-400	-166°F (-110°C)	302°F (150°C)	3	5	5	Water/brine based, hydrocarbon
PFA	Teflon, TT-500	-166°F (-110°C)	302°F (150°C)	3	5	5	Water/brine based, hydrocarbon

1 = poor 5 = excellent