

# RELIABLE

WIRE AND CABLE SOLUTIONS

FOR NUCLEAR APPLICATIONS



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## WIRE AND CABLE SOLUTIONS

ShawFlex and DSG-Canusa are part of Shawcor's Connection Systems group and we have manufactured and developed ShawFlex wire and cable products and DGS-Canusa cable accessories for over half a century with innovation, precision, and dependability. We have over 25 years of experience designing complex cable configurations for the demanding requirements of nuclear power applications. Our nuclear-grade products include instrumentation, thermocouple, control, power and custom composite cable designs. We also provide comprehensive services, advanced in-house research, product development and prequalification testing.

We offer customers much more than a catalog of products. Our experts work with your engineers in direct response to your unique technical challenges. You get innovative solutions that are proven dependable, tested to the highest standards and precisely manufactured to your specifications. We provide the technological leadership and service responsiveness needed to meet all your project deadlines as well as performance requirements.

We have the financial, managerial and technological strengths to see every project through from start to finish, and deliver the best possible solution to any complex challenge.

### Proven expertise

Our ShawFlex wire and cable designs are backed by 50 years of experience in the power generation industry and invaluable knowledge depth in polymer science.

### Leading technology

We produce to exacting specifications with advanced electron-beam crosslinking technology and computerized manufacturing process controls.

### Unmatched commitment

Customers throughout the nuclear power supply chain rely on our attention to detail and focus on high quality and value in every product we design and every service we deliver.



### Product capabilities

- Fuel-handling cables
- System maintenance umbilical cables
- Instrumentation and control cables
- Low-voltage power cables

### Key design features

- Radiation resistance up to 250 Mrad
- Thermal resistance up to 90°C operating conditions
- Life expectancy qualified for up to 60 years
- Halogen-free/low-acid gas emissions

### Approvals

- IEEE 383 Type Testing of Class IE Electric Cables for NPGS
- IEEE 323 Qualifying Class 1E Equipment for NPGS
- IEEE 1202/FT4 Flame Propagation Testing of Cables
- LOCA/MSLB Design Basis Event Testing
- Condition Monitoring

### Quality standards

- QA program meets the requirements of N299.2
- QA program is registered to ISO 9001



## Proof from the field

### Increased durability & performance of fuel-handling cables

A major nuclear power generator in North America was experiencing recurring field failures of cables employed in its fuel-handling system. The original cables were designed for 30-year operational life – but were failing well short of this target time frame.

Shawcor engineered a new ShawFlex cable design and purpose-built a qualification test facility to simulate the 30-year service life required. Test specifications included:

- Thermal aging
- Irradiation aging to 60 Mrad
- Mechanical flex testing

The design validation program was highly successful, with the cables exhibiting full functionality. Cables were installed at the reactor site beginning in 2011 and continue performing as expected.

### Unique umbilical design for reactor inspection & maintenance

Ontario Power Generation developed a robot to go inside the core tubes of a nuclear reactor, electronically survey each pressure tube assembly and make key repairs. The robot needed an umbilical to safely and reliably supply electrical and hydraulic power, as well as relay sensitive sensor data for analysis. The requirements were anything but straightforward:

- Operate in high radiation fields (gamma, alpha neutrons and x-ray) for extremely long periods without serious degradation of flexibility
- Perform in heavy water at 40-60 psi and 60°C without short circuiting or developing unacceptable signal attenuations or distortion
- Withstand tens of thousands of pressure cycles from zero to 3,500 psi, twists of  $\pm 180^\circ$  and linear motion at high tension around tight bends
- Measure to an exact O.D. with a very specific tolerance range
- Contain few or no halogens, particularly fluorine

Shawcor designed a sophisticated umbilical that met every one of these extreme requirements. Quality was ensured by inspecting and testing every inch of every component before it proceeded to the next operation. The tests we performed included visual, electrical and electronic, immersion in pressurized hot water, radiation exposure to 250 Mrad, and severe mechanical duty cycling.





## INTEGRITY DRIVES EVERYTHING WE DO.

Ensure electrical and mechanical reliability with the engineered products and solutions of Shawcor's Connection Systems Group.

By combining the resources, expertise and technologies of DSG-Canusa and Shawflex, we're able to offer a complete range of custom cable and advanced cable accessories to simplify installation and to protect your electrical systems.

That's reliable connectivity and proven asset protection you can count on, and it's only from the leading integrated energy services company in the world—Shawcor.

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ShawFlex is registered to ISO 9001:2008