Introduction to Harsh Environments:

Circular connectors are finding increased usage in today’s interconnected industrial electronic equipment. As a result of this increase in connectorization, there is an ever growing appetite for connectors that can withstand a wide range of use and “abuse”. These ruggedized connectors are expected to perform reliably under extreme environmental and mechanical conditions while sustaining physical abuse from potentially untrained connector users.

Harsh environment, for electronic equipment, can broadly be defined as operating conditions combining one or more of the following:

- Exposure to extreme low (-55°C or less) or high temperatures (+125°C or higher)
- Continuous immersion in water
- Exposure to high pressure water spray
- Exposure to salts, acids, gasoline, lubricants, cleaning fluids, etc.
- High mechanical shock or vibration
- Exposure to snow or ice
- Unprotected outdoor usage resulting in exposure to sunlight and UV
- High current (40 Amps or higher) and voltage (600V)

It is not too difficult to imagine the challenge associated with meeting just one of these requirements. The challenge becomes even greater when one or more of these conditions have to be met, simultaneously. The connector manufacturers are constantly striving to establish the optimum balance between these requirements and product costs in order to provide the most price competitive solution.

Some examples of harsh environment applications requiring connectivity solutions:

- Data acquisition and datalogging systems
- Solar power generation systems
- Wireless towers and base stations
- Outdoor display and signage
- Agricultural electronics
- Construction equipment
- Medical equipment
Connectivity Solutions from Souriau for Harsh Environments:

Souriau (www.souriau-industrial.com), an interconnect industry pioneer, specializes in harsh environment applications. Souriau offers one of the most extensive range of connectors and cable assembly solutions in the industry offering selection from sealed full plastic to full metal connectors and over molded cable assembly solutions. The ability to function reliably in harsh environments is at the core of every Souriau connector and cable assembly. Souriau Trim Trio connector family in particular is a proven platform for harsh environment applications.

At a glance

Souriau Trim Trio Circular Connectors
- **UTS** – IP68/69K plastic circular connectors
- **UT0** – metal circular connectors
- **UTV** – reverse bayonet metal circular connector
- **MBG** – 5000 mating cycle connectors

Key Characteristics and Trim Trio Connectors:

*Environmental sealing:* Environmental sealing to prevent dust and moisture ingress is an essential requirement for harsh environmental applications. Connectors and enclosures are frequently required to offer Ingress Protection per IEC 60529 (IP 68) or NEMA (6, 6P) standards.

The Souriau Trim Trio connectors exceed these requirements and offer advanced sealing options:
- Continuous immersion under water for 1 week at 1M depth *(IP 68)*
- Exposure to high pressure (1,400 psi) hot water (80°C) spray *(IP 69K)*
- Total protection from dust ingress *(IP 68)*
When environmental sealing is needed, there is sometimes a need for connectors that offer sealing when the mating plug is disconnected. Souriau Trim Trio circular connectors address this requirement:

- **Sealed in the mated condition** – when the plug and receptacle are mated. This is the most common sealing requirement. (UTS, UT0, UTV)
- **Sealed in the unmated condition** – when the plug is disconnected or without sealing cap. This feature is needed to protect the electronics inside the box when there is a possibility of exposure to moisture or humidity when the plug is not connected. (UTS only)
- **High Pressure spray (IP 69K)** – when subject to high pressure

**Rugged:** Harsh environments are characterized by environmental and mechanical extremes that require unique blend of material and design characteristics. The connectors need to be physically strong to withstand mechanical shocks resulting from:

- 50 – 100 ft physical drop (up to 30G)
- Physical impact from moving parts

The Trim Trio UTS plastic connectors are made from high strength engineered thermoplastic material and the UTV / UT0 metal connectors are made from high strength Aluminum alloys suitable for demanding applications.

These connectors are required to maintain physical integrity when subjected to thermal shocks associated with rapid exposure to extreme temperatures (−55°C to +125°C). In addition, Souriau Trim Trio connectors are designed to maintain sealing integrity (IP 68/69K) when subjected to these adverse conditions.

**Exposure to UV:** Typical outdoor applications involve installation of connectors on equipments that are either mounted on a pole/tower or on rooftops. There are also inline, cable to cable connections used for connecting a network of equipment. These connectors and cables are often left unprotected and exposed to the elements. Ability to withstand UV exposure is a key characteristic for connectors in such applications involving 5 – 25 years service life. Plastic connectors in general are particularly susceptible to UV exposure. Souriau UTS connectors were designed with this in mind. Tests per ISO 4892-2 have shown no significant variation in color, crazing, cracking, and no variation of mechanical characteristics were found.

**Quick, Reliable, and Secure Mating:** These features are of particular importance in harsh environment applications as there may be significant financial involvement with correcting problems arising from faulty connections. Aside from the obvious cost of specialized labor required for initial deployment and maintenance, these type of applications require a breed of connectors that can be mated/unmated quickly and reliably under challenging circumstances such as rain, snow/ice, and insufficient lighting. For example, for an outdoor weather monitoring system in Canada or Alaska, the crew would typically mate/unmate connectors with gloved hands. The connectors must provide enough positive feedback for the crew to be certain of proper mating. It is usually not possible to check visually check every single connector for proper mating in this type of large scale deployments.
Souriau Trim Trio circular connectors offer quick-mating 1/3 turn bayonet coupling system. The advantages of bayonet coupling systems are:

- Quick connector engagement with 1/3 turn of the coupling ring
- Full mating indicated by a tactile feel and audible click
- Proper mating can be verified by lightly tugging on the plug

Souriau Trim Trio connectors, with Bayonet Coupling System, are naturally designed for harsh environment applications.

**Conclusion**

Harsh environments pose unique challenges to connector engineers and often push design and material limits. While advances in technology allow connector design engineers to break new grounds, the ultimate challenge lies with providing the complete solution at a competitive price point.