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Ty-Rap™ Cable Ties in Space & on Earth

As the NASA Mars 2020 Perseverance rover begins exploring its new planetary home, its operating with the world's most advanced technology while being equipped with Ty-Rap™ cable ties from ABB Installation Products, the same ties that are widely used on earth.

Ty-Rap™ cable ties in Space

- The business known today as ABB Installation Products has provided products to the space program since 1973 when it introduced the Fluoropolymer cable tie.
- After traveling nearly 300 million miles, the surface operations of the Mars 2020 Perseverance Rover mission will last at least one Mars year (about 687 Earth days). The mission is part of NASA's Mars Exploration Program, a long-term effort of robotic exploration of the Red Planet that addresses high-priority science goals for Mars exploration and key questions about the potential for life on Mars.
- NASA is using the same High Performance Polyamide ETFE Ty-Raps that are commercially available worldwide to fasten the Mars Perseverance rover's interior and exterior conduit and components and secure research and lab equipment.
- Made of Tefzel ETFE (ethylene-tetrafluoroethylene) resins, the high-performance Ty-Rap cable ties used on the rover are melt-processable copolymers tested for physical durability and resistance to chemicals, UV, and extreme radiation and temperatures. Relevant features include:
  - Radiation Resistance 2 x 10^8 rads, which is 2,000 times more radiation resistant than natural nylon 6.6 used in standard cable ties. Radiation on Mars is 2.5x higher than the International Space Station due to no protective Magnetosphere, and its atmosphere being only equivalent to 1% of Earth's.
  - Heat resistance rating for temperatures up to 150 °C (302 °F) based on the 20,000-hour criterion and good creep resistance. Temperatures on Mars average -80F (-60C) and range from -195F (-125C) to 70F (20C). The ties need to be able to handle these extreme swings.
  - Low-moisture absorption that performs 130 times better than natural nylon 6.6 used in standard Ty-Raps.
  - Low wear factor (1/10 of reinforced nylon)
  - High-impact strength and dimensional stability
  - Low flammability
  - Strong weathering capabilities, up to at least 20 years
  - Resistant to solvents, acids and bases
  - Aquamarine Ty-Rap cable ties used on the Mars Rover vehicle are 7" in length, ABB part# TYZ28M, ref# ST12014-4, ref# TYZ528M and made at the ABB Installation Products Caribe facility in Vega Baja, Puerto Rico.

- Ty-Rap cable ties are in continued use on the still active NASA Curiosity rover and were previously used on the twin Spirit and Opportunity rovers.
- ABB has a long-standing relationship with NASA that began more than 30 years ago with optical sensor contributions to support experiments on the space shuttle. In November 2020, the company announced a contract for NASA's Jet Propulsion Laboratory that will see key technology from ABB and its partner Nüvü Camēras fly onboard the space telescope in 2025, on course to

capture the first spaceborne images of planets outside our solar system. ABB is also a key supplier to the JPSS U.S. weather satellite series under NASA procurement. These weather satellites are critical pieces of hardware for operational or flagship U.S. space missions.



Ty-Rap™ cable ties on Earth

Ty-Rap cable ties are found 500 feet below sea level, 35,000 feet in the air, going 230 mph on roads, and in indoor and outdoor commercial and household settings worldwide.

- Originally patented in 1958, standard Ty-Rap cable ties were first used to bundle Boeing airplane wires as a replacement for waxed string.
- Since then, nearly 30 billion standard and high-performance Ty-Rap cable ties have been produced – laid end-to-end, enough to stretch from earth to the Moon and back more than a dozen times.
- As the world's first self-clinching cable tie, Ty-Rap cable ties have become known for their Grip of Steel™ locking device in business and household use and are available in more than 250 different varieties and multiple materials.
- Designed to withstand wide-ranging weather conditions, Ty-Rap cable ties are commonly used in outdoor construction and industrial applications such as oil and gas facilities, rail, marine and ground transportation. Continued innovation has resulted in Ty-Rap heat-reactive cable ties that change color to warn of potentially dangerous high temperatures, and other colored ties that have buoyancy for easy visual detection vital in food & beverage processing.