

# REUSABLE AND NON-EXPLOSIVE ACTUATOR FOR HOLD DOWN AND RELEASE MECHANISMS

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## ABSTRACT

This paper presents the development of a fast-acting, fully re-usable, non-explosive, ultra-low shock actuator for hold-down and release mechanisms (RUNE).

Currently, the RUNE family of HDRM is composed two different preload sizes: 10kN and 20kN (nominal preload). This paper presents the results from development of the RUNE 10kN mechanism.

A QM/EM RUNE mechanism has been designed, manufactured with representative materials and processes and tested in representative conditions, corresponding to TRL5/6. The mechanism is developed as a qualification model (QM) up to DDR, and the production, assembly and testing are carried on an engineering model (EM).

Assembly, Integration and test (AIT) procedures require multiple HDRM releases, and are greatly simplified when re-usable HDRM are employed. The re-usability of an HDRM is thus a key feature with respect to its implementation in space systems. RUNE is fully reusable (i.e., resettable). The mechanism reset operation is performed without disassembly, by one operator in less than a minute.

The RUNE mechanism is a discrete point separation device of generic type, i.e. independent from any specific application. Its design is scalable in order to widen as much as possible the range of potential applications and preloads.

The force reduction characteristic of the mechanism is based in Euler friction provided by a cable which wraps around a cylindrical body while constraining the coupling elements. In conjunction with the used coupling elements, this provides the required load uncoupling and provides a very effective preload relief function.

HDRM are characterized with respect to their self-generated Shock Response Spectrum (SRS) peak: RUNE generates ultra-low shock (<50g SRS) during its operation.

The high force reduction achieved enables the use of

low mass and volume SMA initiator, while maintaining the electrical requirements of existing pyro lines (current, voltage and pulse times). RUNE uses standard pyrotechnic electric signals.

Time-critical releases and multi point simultaneous releases require reliable and repeatable releases, with minimal scattering (dispersion) of individual release times, even for HDRMs at different temperature. RUNE is a fast-acting mechanism with low actuation time scatter between different actuations.