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A SMA WIRE ACTUATED HOLD-DOWN AND RELEASE DEVICE USING TWO BALL LOCK MECHANISMS

Abstract

Spacecrafts require a variety of hold-down and release devices to accommodate the separation from the launch vehicle or deployment of solar arrays and other appendages. Pyrotechnic devices usually produce high shock and contaminants, which greatly threaten the success of aerospace missions. Therefore, we developed a shape memory alloy (SMA) wire actuated non-explosive hold-down and release device in this paper. A two-stage design, which enables two ball lock mechanisms to account for triggering and release separately, is employed. To ensure a high reliability, two SMA wires are used redundantly to actuate the trigger. Three prototypes of the hold-down and release device are fabricated and tested. According to the performance test results, the proposed device can release a maximum preload of 1,5000 N. The release time is as short as 100 ms under an operation current of DC 5.0 A. The minimum current required for activating the device is as small as DC 1.4 A. The lifetime test indicates the device has a lifetime of more than 150 cycles. Moreover, launch environment tests show that the device can endure the typical thermal and vibration environment tests without unexpected trigger or structure damage.