



# Separation Systems

**Space Vector** has manufactured and flown hundreds of separation systems for a variety of customers. A separation system typically consists of a circular V-band manacle ring and pushers to provide delta velocity between the separated items. Pushers can either be pneumatic or spring loaded.



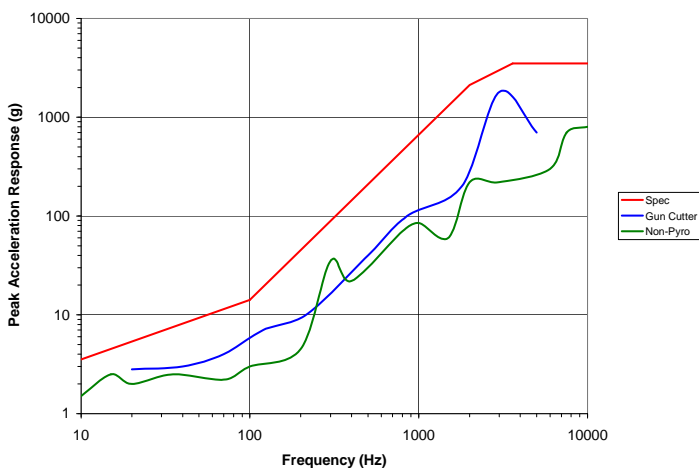
## V-band Manacle Rings

Space Vector provides manacle ring separation systems for diameters ranging from 9" to over 60". The joint consists of grooved mating rings clamped together by a 4-segment v-shaped ring. Joint separation can be induced by the 3 different methods summarized below:

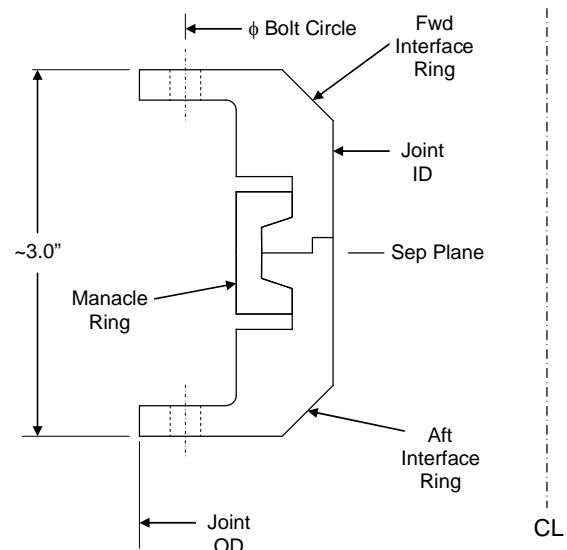
Method	Classification	Mounting	Redundancy	Signals	Functionality
Gun Cutter	1.4	Internal	Dual	4	Cuts retaining screws
Release Nut	Non-Pyro	Internal	Single	2	Releases retaining bolts
Release Nut	Non-Pyro	External	Dual	4	Releases retaining bolts

Manacle rings are very reliable having been used for many years to separate vehicle sections and release payloads. The Space Vector release system offers superior stiffness, low shock, full redundancy, and debris free separation. Optional tethers are used to retain the released bands with the spent stage. Bolt flanges can be external (as shown), internal, or vertical to accommodate radial fastening.

**Expected Shock Profile**



**Joint Cross-Section with Outboard Flange**



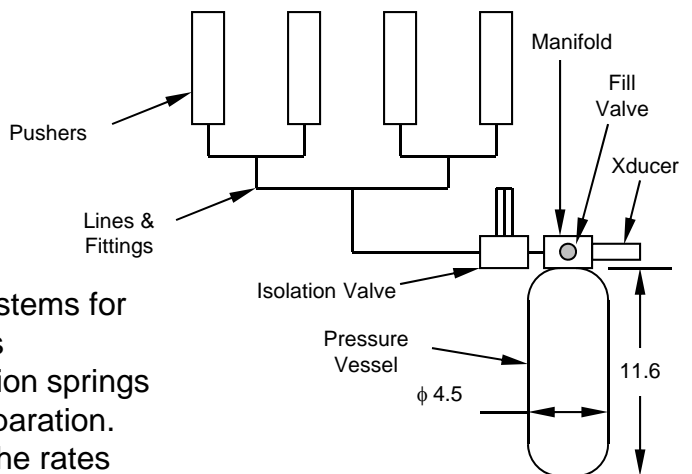
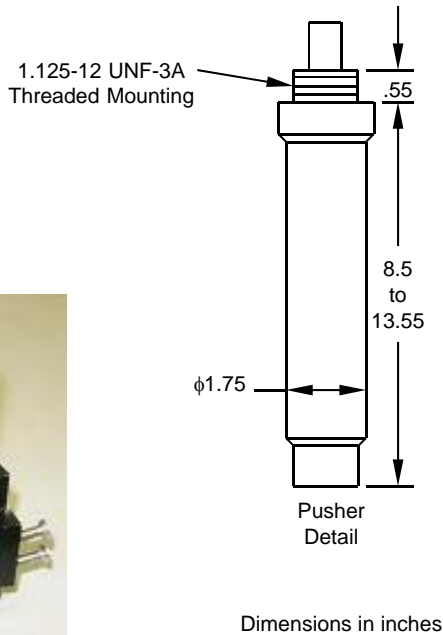


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## Pneumatic Pushers

Space Vector pneumatic pushers systems are used extensively to provide large separation velocity between two items. The velocity is adjusted by varying the initial supply pressure. Tip off is minimal since the pressure on each piston is essentially equal. A major advantage of pneumatic systems is the joint is not loaded until just prior to separation. A squib activated isolation valve mounted to the pressure vessel is actuated approximately 1 second prior to release (please refer to our separate pneumatics brochure for a description of the isolation valve).

The Space Vector separation simulation accurately predicts acceleration and velocity as well as determines the optimal number of pushers and stroke length required for a particular application. The system currently comes with 2.95 inch, 5.5 inch and 8.0 inch stroke pistons. Custom lengths can be created as required.



## Spring Pushers

Space Vector also fabricates spring pusher systems for use in lighter weight applications requiring less separation velocity. These systems use precision springs ground to high tolerance to ensure uniform separation. Different designs are available depending on the rates required.