For Reference Only

MOTOR IGNITION & STAGE SEPARATION SOURCE SHOCK LIBRARY
Revision G

By Tom Irvine
Email: tomirvine@aol.com

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Introduction

The following data is based on ground tests. Each level is a maximum predicted environment (MPE) level which contains a statistical uncertainty safety factor. The corresponding qualification or lot acceptance level would typically be 6 dB higher than the MPE level.

Note that individual structural and pyrotechnic device details can greatly affect the source levels.

The names of the corresponding vehicles are omitted for proprietary reasons.

V-band/Bolt-Cutter, Stage Separation (Diameter $\leq$ 48 inch)

Table 1. SRS Q=10, Source Shock, V-band, Stage Separation, MPE, Diameter $\leq$ 48 inch

Natural Frequency (Hz)	Peak Accel (G)
100	30
3000	1950
10000	1950

V-band/Bolt-Cutter, Stage Separation (Diameter = 72 inch)

Table 2. SRS Q=10, Source Shock, V-band, Stage Separation, MPE, Diameter = 72 inch

Natural Frequency (Hz)	Peak Accel (G)
100	95
800	7700
1700	4400
10000	4400

V-band/Bolt-Cutter, Shroud Separation (Diameter $\leq$ 50 inch)

Table 3. SRS Q=10, Source Shock, V-band, Shroud Separation, MPE, Diameter $\leq$ 50 inch	
Natural Frequency (Hz)	Peak Accel (G)
100	50
1500	2250
10000	2250

Additional V-band source levels are given in:

T. Irvine, V-band Separation Source Shock Scaling, Vibrationdata, 2008.

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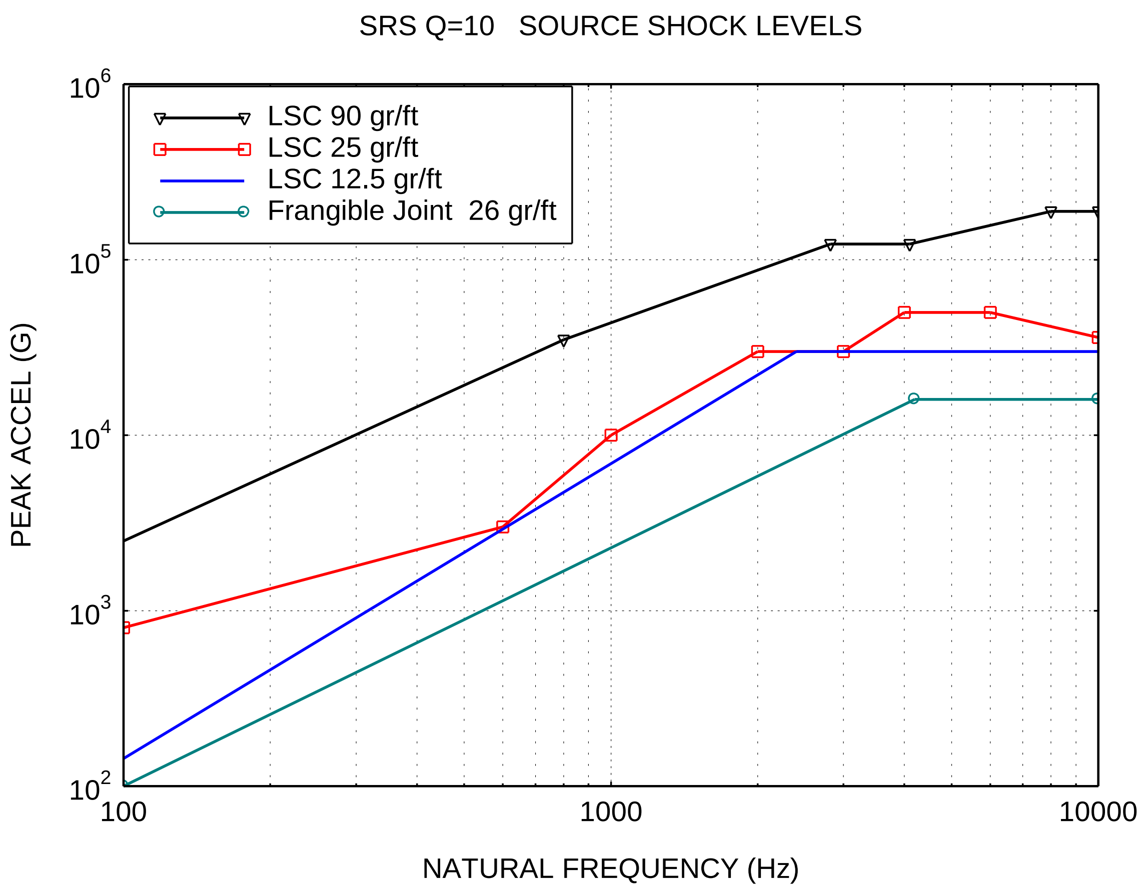


Figure 1.

Linear Shaped Charge 12.5 grain/ft

Table 4. SRS Q=10, LSC 12.5 grain/ft, Source Shock, MPE	
Natural Frequency (Hz)	Peak Accel (G)
10	3
2400	30000
10000	30000

Linear Shaped Charge, 25 grains/foot

Table 5. SRS Q=10, LSC, 25 grains/ft, Source Shock, MPE	
Natural Frequency (Hz)	Peak Accel (G)
100	800
600	3000
1000	10000
2000	30000
3000	30000
4000	50000
6000	50000
10000	36000

<u>Linear Shaped Charge, 90 grains/foot</u>

Table 6. SRS Q=10, LSC, 90 grains/ft, Source Shock, MPE	
Natural Frequency (Hz)	Peak Accel (G)
10	35
45	816
70	1585
800	34965
2820	122592
4100	122592
8000	188603
10000	188603

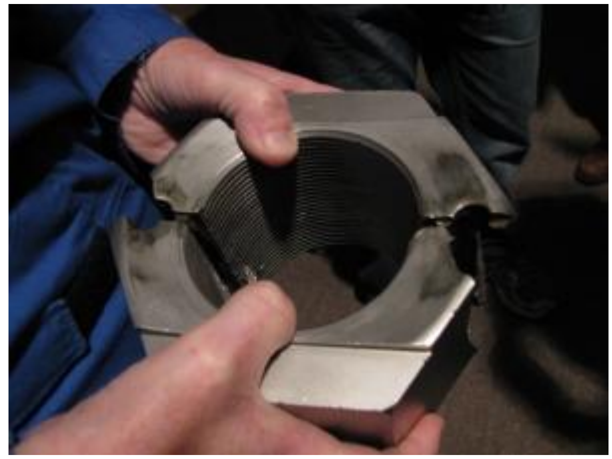
<u>Frangible Joint, 26.25 grain/ft</u>

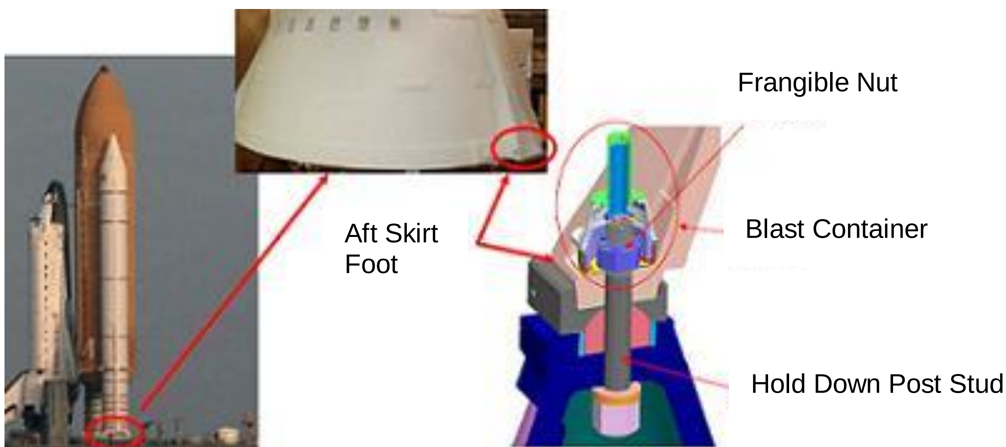
Table 7. SRS Q=10, Frangible Joint, Source Shock, MPE	
Natural Frequency (Hz)	Peak Accel (G)
100	100
4200	16000
10000	16000

SAAB Separation System

Table 8. SRS Q=10, SAAB Separation System, Source Shock, MPE	
Natural Frequency (Hz)	Peak Accel (G)
100	11
350	195
600	573
800	880
1280	1175
1690	1950
10000	1950

<u>Space Shuttle, Solid Rocket Booster, Frangible Nuts</u>





4 Hold Down Post Assemblies per
Each SRB

Table 9. SRS Q=10, SRB Frangible Nuts, MPE	
Natural Frequency (Hz)	Peak Accel (G)
50	94
100	375
4000	15000
10000	15000

The nut diameter is 3.5-inch.

The MPE level is in the near field 0-12 inches, stemming from release of 4 hold down devices.

Reference: SE-19-049—2HB page 190.

SR-19 Motor Ignition, Forward Motor Dome

Table 10. SRS Q=10, SR-19 Ignition, Fwd Motor Dome, MPE	
Natural Frequency (Hz)	Peak Accel (G)
100	100
200	200
600	5000
10000	1500

Note that the level in Table 9 includes the onset of SR-19 resonant burn, which is the most severe portion of this event.

Orion 50XL with Pyrogen Igniter, Motor Ignition

Table 11. SRS Q=10, Orion 50XL with Pyrogen Igniter, Fwd Motor Dome, MPE	
Natural Frequency (Hz)	Peak Accel (G)
100	120
150	470
1000	470
1700	1350
2650	1890
7500	2550
10000	2550

Further information on igniters is given in Appendix A.

Orion 50XL with Pyrotechnic Igniter, Motor Ignition

Table 12. SRS Q=10, Orion 50XL with Pyrotechnic Igniter, Fwd Motor Dome, MPE	
Natural Frequency (Hz)	Peak Accel (G)
100	400
150	1550
500	1550
7500	2550
10000	2550

Castor 4B, Motor Ignition

Table 13. SRS, Q=10, Castor 4B Fwd Dome, MPE	
Natural Frequency (Hz)	Peak Accel (G)
100	85
400	430
2000	650
10000	650

APPENDIX A

Motor Igniters

The following description was provided by Jason Campbell. The BSM is a booster separation motor.

> A pyrogen igniter is essentially a smaller rocket motor that contains a shaped propellant grain that is "case-bonded" (bonded to the igniter chamber ID via a line material). In some cases, such as in the earlier CSD BSM design, the propellant grain can be bonded to a rod that supports the propellant grain independent of the igniter chamber ID.
>
> A pyrotechnic igniter consists of a pyrotechnic charge such as Boron Potassium Nitrate (BKNO3) pellets or an equivalent that fills the void rather than a shaped "case-bonded" propellant grain.

A diagram of a pyrogen igniter is shown on the next page as taken from NASA SP-8051.

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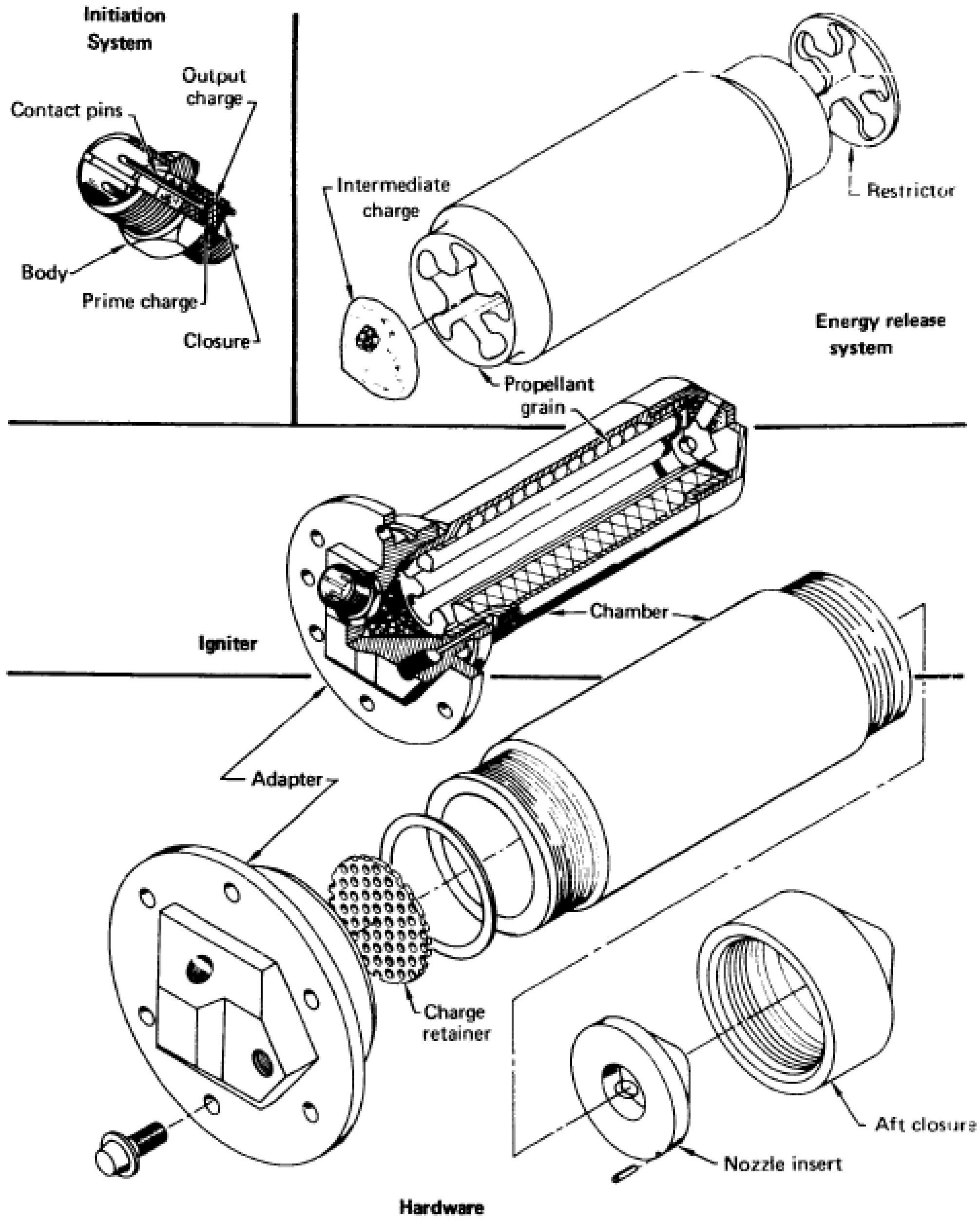

Figure 1.—Typical solid rocket pyrogen ignition system.