Steward Observatory Flight Design Factors of Safety* ^ V1.0

Test Design Factors of Safety

Metallic - Micro Yield	1.00
Metallic - Yield	1.25 [1] [2]
Metallic - Ultimate	1.40 [1] [2]
Glass - Ultimate	3.00 [2]
Composite - Ultimate	1.50 [1]
Bonds to Glass - Ultimate	1.50 [2]
Bonds - All Other - Ultimate	2.00 [2]
Buckling - Ultimate	1.60

No-Test Design Factors of Safety

Metallic - Micro Yield	1.00
Metallic - Yield	2.00 [1]
Metallic - Ultimate	2.60 [1]
Glass - Ultimate	5.00 [2]
Bonds to Glass - Ultimate	2.60 [1]
Bonds - All Other - Ultimate	2.60 [1]
Buckling - Ultimate	3.00

Fasteners - Test Design Factors

Fitting Factor	**1.15 [3] [a]**
Metallic - Yield	1.25 [2]
Metallic - Ultimate	1.40 [2]
Separation	1.25 [3] [d] [e]
Separation - Critical	1.25 [3] [d] [e]
Separation - Catastrophic	1.40 [3] [e]
Slip	1.00 [4]
Slip - Critical (Optics)	1.25 [4]

Fasteners No-Test Design Factors

Fitting Factor	**1.15 [3] [a]**
Metallic - Yield	2.00 [2]
Metallic - Ultimate	2.60 [2]
Separation	1.25 [3] [d] [e]
Separation - Critical	2.00 [3] [d] [e]
Separation - Catastrophic	2.60 [3] [e]
Slip	1.00 [4]
Slip - Critical (Optics)	1.25 [4]

Modifiers (Test Only)

Random/Acoustic	1.29 [1] [b] [c]

Modifier Example - RV Bolted Joint

Random Vibration		1.29
Fitting Factor (Joint)	x	1.15
Metallic Yield	x	1.25
Total FoS	=	1.85

Model Uncertainty Factor (MUF)

MUF	2.00 [f]

* Program specific values supersede the values in these tables.

^ Test factors reference GSFC-STD-7000B, Table 2.2-2 Test Factors Durations

References:

[1] GSFC-STD-7000B, General Environmental Verification Standard (GEVS) for GSFC Flight Programs and Projects

[2] NASA-STD-5001B, STRUCTURAL DESIGN AND TEST FACTORS OF SAFETY FOR SPACEFLIGHT HARDWARE

[3] NASA-STD-5020B - REQUIREMENTS FOR THREADED FASTENING SYSTEMS IN SPACEFLIGHT HARDWARE

[4] ARC-STD-8070.1 - Space Flight System Design and Environmental Test

Notes:

[a] Fitting Factor shall be applied as an additional factor of safety to all bolted joints, bonds, and fittings.

[b] Factor applied to acceptance levels only. Exclude if analyzing to qualification/protoflight levels. Factor shown assume that qualification/protoflight testing is performed at acceptance level plus 3dB. If difference between acceptance and qualification levels is less than 3dB, then above factors may be applied to qualification level minus 3dB instead of analyzing to acceptance level.

[c] Modifier factor derived from NASA-STD-7000B. If used, that overall FS should be rounded up to 1 decimal place.

[d] Smaller factors may be achieved if 5001B [2] supersedes 7000B [1] and the logic flow for separation factor of safety from 5020B [3] is followed.

[e] Factor should envelope test conditions to preclude separation during test [3].

[f] A Model Uncertainty Factor (MUF) may be used to provide conservatism and margin due to model or simulation uncertainties. Typical sources of uncertainty include modeling assumptions, boundary conditions and/or thermal distortions.