Safety Analysis Report for
F430/GC-40
Transport Package

IN/TR 1608 F430 (2e)

Non-Proprietary Information

MDS Nordion
Science Advancing Health

Safety Analysis Report for F430/GC-40 Transport Package

Signatures

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Document History

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[redacted]

NOTE: The portion of this text affected by changes is indicated by a vertical line in the margin.

2.3 MECHANICAL PROPERTIES OF MATERIALS

The MDS Nordion F-430 package is [redacted].

Table 2.1: Mechanical Properties of Materials

Item	Materials	Min. UTS (Mpa)*	Min. YS (Mpa)*	Reference
1	[redacted]	[redacted]	[redacted]	[redacted]
2	[redacted]	[redacted]	[redacted]	[redacted]
3	[redacted]	[redacted]	[redacted]	[redacted]
4	[redacted]	[redacted]	[redacted]	[redacted]
5	[redacted]	[redacted]	[redacted]	[redacted]
6	[redacted]	[redacted]	[redacted]	[redacted]
7	[redacted]	[redacted]	[redacted]	[redacted]
8	[redacted]	[redacted]	[redacted]	[redacted]

* [redacted]
** [redacted]

The carbon steel material is ASTM A-36; this is not an ASME material, however it is acceptable for use as it is used for the removable shipping skid. Other material used in the package is neoprene used as a gasket for both covers. The purpose of [redacted].

[redacted].

3.2 TIE-DOWN COLLAR STRESSES

The highest stresses in the model occur in one of the tie-down collar lugs. Figures A2.10.3-4 and A2.10.3-5 show the stresses in the lug that is loaded with the tie-down chain with the highest load. In Figures A2.10.3-4 and A2.10.3-5, the maximum stress shown is [redacted]. However this high stress is the result of a singularity caused by the chain load being applied at a single point in the model. In order to analyze more accurately the stresses in this tie-down lug, a refined and more realistic model was created. In this case the load from the tie-down chain was applied over a 30° sector in the hole through the tie-down lug, as shown in Figure A2.10.3-6. The results of this analysis are shown in Figure A2.10.3-7. The maximum stress in the tie-down lug is [redacted].

Away from the tie-down lug discussed above, the maximum stress in the tie-down collar is [redacted] (refer to Figure A2.10.3-8). This is safely below the yield strength of [redacted] high-strength steel. Figure A2.10.3-9 shows the stresses through the cross-section of the tie-down collar at this location.

The stress in the bolts that fasten together the two halves of the tie-down collar must also be considered. This stress will be calculated. It is assumed that only one bolt per side bears the entire load. Furthermore, the reduction in the bolt load due to the friction between the collar and the F-430 skin will be neglected.

[redacted] are subjected mainly to tension.

$$\sigma = F/A$$

where

σ = stress in the bolt

[redacted]

Therefore,

[redacted]

The bolts [redacted]

Therefore, the Safety Factor for the bolts is

$$SF = Sy/\sigma = 1.8$$

This analysis is very conservative since only one of the bolts was considered.

5. CONCLUSIONS

The maximum stress in the body of the F-430 package is [redacted] when the package and its payload are subjected to the prescribed accelerations. This stress is safely below the minimum yield strength of [redacted].

The maximum stress in the tie-down collar is [redacted] when the package and its payload are subjected to the prescribed accelerations. This is safely below the minimum yield strength of 100,000 psi (690 MPa) for the low-alloy high-strength steel.

The maximum stress in the tie-down collar bolts is less than 45,496 psi when the package and its payload are subjected to the prescribed accelerations. This is safely below the minimum yield strength of [redacted].

Therefore the tie-down system for the package satisfies the requirements of 10 CFR 71.45(b)(1).

6. REFERENCES FOR APPENDIX 2.10.3

[1] 10 CFR (Code of Federal Regulations), Chapter 1, Part 71 - Packaging and Transportation of Radioactive Material, 1-1-99 Edition.

[2] Pro/MECHANICA STRUCTURE Version 23.3(311), Parametric Technologies Corp. Waltham MA, 2001.