LEUPA

Type B(U) Package for Fissile Materials

CALCULATION REPORT

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CONTENTS

1 PURPOSE

1. This document contains the structural verification of the container of inner containers to transport low-enriched uranium for the LEUPA Project.

2 SCOPE

1. This calculation report includes only the container for inner containers, that is to say, the stainless steel container which contains the inner containers carrying uranium inside.

3 REFERENCES

[1] 0908-LE00-EBSIN-001-A “Database for the Design of the LEUPA Package”.
[2] 0908-LE01-3ASIN-005-A “Low Enriched Uranium Package (LEUPA) – Package”.
[3] ARN. *Transport of Radioactive Materials.* Standard AR 10.16.1. Rev. 2. Argentina: ARN (Nuclear Regulatory Authority), 2011.

4 DESCRIPTION

1. The container of inner containers is located in the LEUPA packaging, fixed and guided by side guides. Figure 1: contains a scheme of the container of inner containers.
2. This calculation is to verify the width of the pressure containment (following ASME III NB, section 3320) and the interior flat cover (using a finite elements model, code ANSYS).

Figure 1: Container of inner containers

Security-Related Information Figure
Withheld Under 10 CFR 2.390

Table 1: Design data

Data	Value
Internal Design Pressure	700 kPag [maximum required under AR 10.16.1, covering the 96.3 kPa (101.325 kPa – 5 kPa) stated in 0908-LE00-EBSIN-001]
Hydraulic Test Pressure	875 kPag
Design Temperature	70 °C
Mass of the Content	50 kg
X-ray	100%

5 MATERIALS

1. The container shall be made of type ASTM A312 TP316L stainless steel pipes and Standard ANSI 16.5 #150 5” flanges, one welding neck-type and another blind-type.

Table 2: Properties of stainless steel ASTM A312 TP304L

Description	ASTM A312 TP304L (seamless)[1]
Modulus of elasticity	192708 MPa
Tensile Strength	70000 psi (482.6 MPa)
Yield Strength	25000 psi (172.3 MPa)
Admissible Stress at 93°C	16700 psi (92.4 MPa)
Stress Intensity	16700 psi (92.4 MPa)[2]
Density	7825 kg/m^3

6 CALCULATION

1. The calculation of the containment is made using ASME III NB section 3320 and the design data stated in Table 1:. We can see them below:

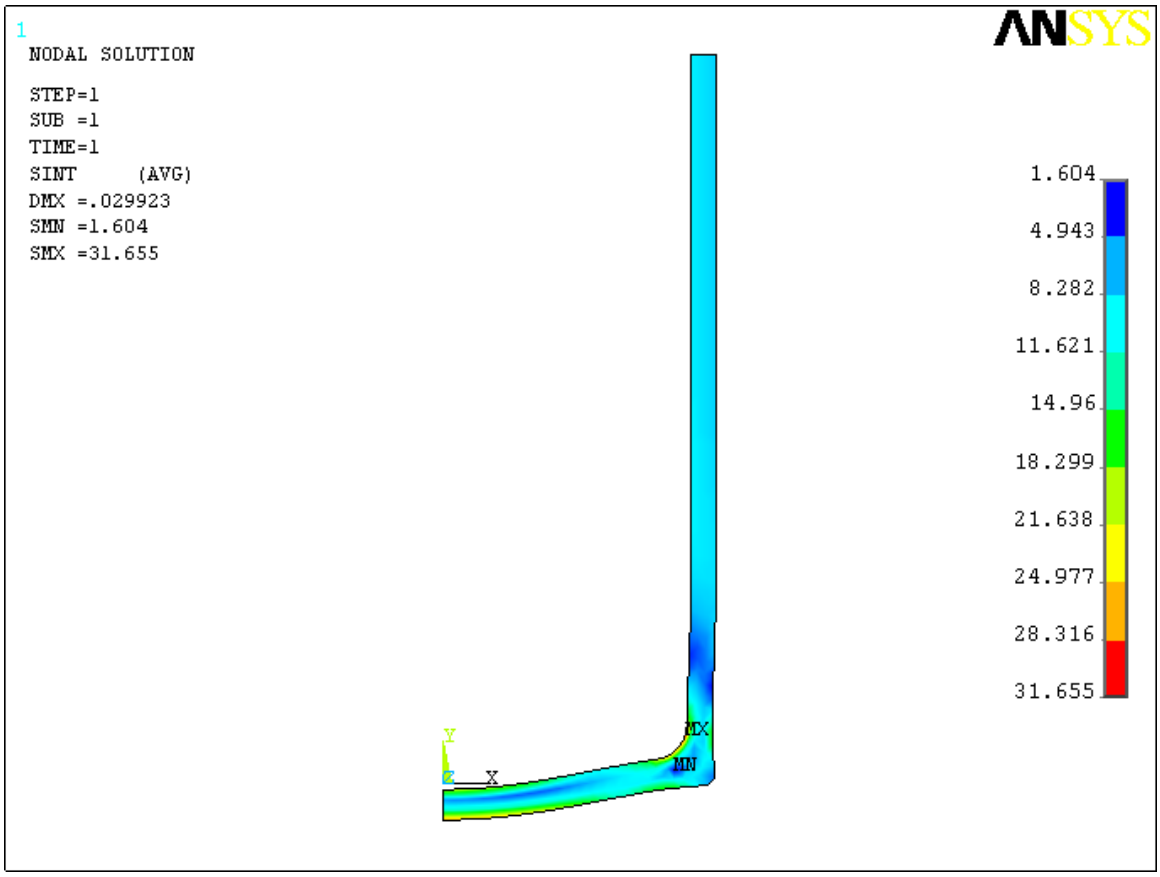
International System of Units S.I.	$kPa = 1000\ Pa$
Material	ASTM A312 – 304L
Stress Intensity	$S_m = 16700\ psi$
Yield Strength	$\sigma_y = 25000\ psi$
Tensile Strength	$\sigma_u = 70000\ psi$
Design Pressure	$P = 700\ kPa$
Internal Radius	$R_i = 128.2\ mm$
Minimum Required Width	$t = \frac{P \cdot Ri}{S_m - 0.5 \cdot P} = 0.391\ mm$

[1] Ref. ASME II Part D, Subpart 1, Table 1A.
[2] Ref. ASME II Part D, Subpart 1, Table 2A.

Available Nominal Width $6.55\ mm$

2. No flanged joint is verified because it is a conventional solution with Standard 150 series flanges, which, according to ANSI B16.5 is the proper type under this operating conditions (MaxT: 70 ºC and MaxP: 700 kPag).
3. The calculation for the flat cover is made through finite elements. Figure 2: shows the "intensity" stresses in part of the wrap and the flat cover. Axisymmetric model.

Figure 2: "Intensity" stresses in the blind flange and part of the wrap



4. Maximum stresses are around 32 MPa and the maximum displacement is three tenths of a millimeter.

7 CONCLUSIONS

1. The design verifies the admissible stress requirements in the Design Code and the available width. Available widths in the pressure containment verify admissible stresses for the material used and the selected flanges comply with the necessary rating for the application.