Three cases you can inspect and reproduce

SKALNAV evaluation kit · version 1.0.0

Start with published evidence. See what the model assumes. Recompute the outputs in the app before applying the workflow to your own shell.

Axial compression — aluminium cylinder

In this case MDC is less conservative than the published NASA estimate and remains below the reported experimental result. This does not establish a general accuracy ranking.

External-pressure screening — Nguyen S.1 geometry

The test is hydrostatic; this model checks the pure external-pressure axis. End-cap axial load, restraint and unknown imperfections prevent an accuracy ranking or a matched-test validation claim.

Internal pressure — photographed ZJU-X3 head

Compare each resistance on its stated basis. The photograph identifies the specimen, while the supplement and explicit assumptions define the numerical comparison.

What you receive

Three app-importable project JSONs, readable input records, full-precision result CSVs, source locators and this PDF. The separate FE cut kit provides a tested arithmetic converter, synthetic equilibrium fixtures, two unexecuted solver templates and setup guidance for three solver families.

How to use the package

1. Read the case assumptions and source locator before comparing a number.

2. Open app.skalnav.com. Use Project > Import and select a case project.json. Empirical-percentile results and the FE import need suitable licence / Project Access; the free Explorer uses a different mean basis.

3. Check geometry, material, load case and basis. Recomputed results should match results.csv for the stated engine version; future releases may change them.

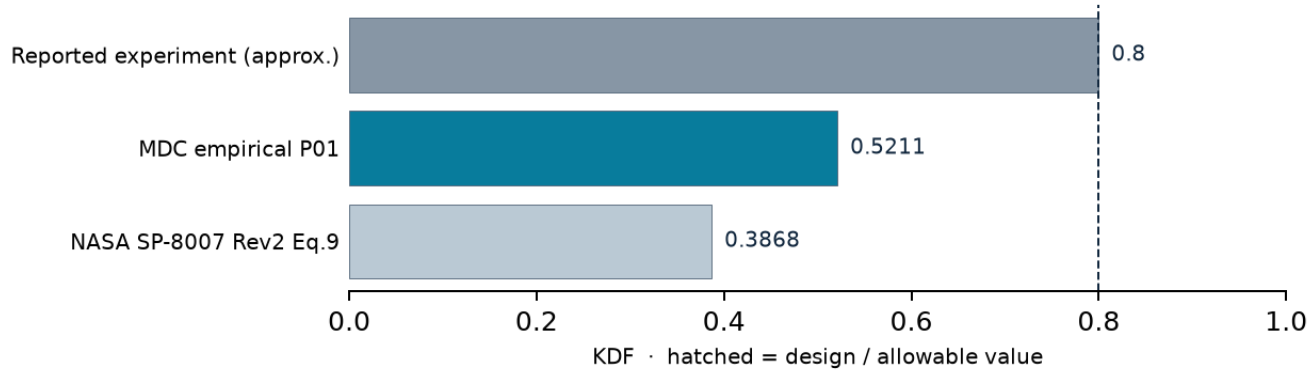
4. Use the FE fixture to verify units, sidedness, moment origin and signs. Qualify your own solver export on a real run.

These examples do not establish general superiority, code compliance, certification, or guaranteed mass savings. The external-pressure case deliberately exposes a load idealisation mismatch. A parsed file is not a verified solver integration. ESA BIC participation does not certify the software.

Axial compression — aluminium cylinder

Reported experimental knockdown, approximately 0.80

Published nominal geometry and material: R=500 mm, L=600 mm, t=1.5 mm, E=70 GPa, yield=450 MPa; w/t approximately 0.30.



In this case MDC is less conservative than the published NASA estimate and remains below the reported experimental result. This does not establish a general accuracy ranking.

Design / allowable pressures and reference resistances use different safety concepts. A larger bar is not automatically a better prediction. Unavailable methods have no bar. Full method basis and factor notes are in results.csv.

Source: Wagner et al. (2025), Structured Chaos, §3(a), Fig.15; reported aluminium-cylinder example citing Wang et al. (2018)

Section 3(a), Fig.15. The experimental KDF is reported approximately; this is not a newly digitised raw test record.

Reproduce this case

Axial compression — aluminium cylinder

Assumptions and limits

• Poisson ratio 0.30 assumed. Uniform unstiffened isotropic wall; axial compression, no pressure. Rigid end rings and laterally restrained reference model are comparison assumptions.

• MDC a_basis selects empirical P01. It is not a material A-basis allowable or a probability of structural failure.

• NASA comparison directly evaluates Eq.9 of NASA/SP-8007-2020/REV2, coefficient 0.901. The current app legacy helper uses 0.902, shown separately.

App workflow

1. Open Skalnav, sign in with access to empirical percentile results, then Project > Import the project JSON.

2. Check cylinder / axial compression; dimensions are radius 500, length 600 and thickness 1.5 mm. Enter E=70000 MPa, yield=450 MPa and nu=0.30.

3. Set w/t=0.30 and MDC empirical P01 (A-basis label). Compare the active axial KDF with the CSV. The free Explorer displays a different mean / elastic basis.

4. For the NASA published comparison use the stated Rev2 equation; expect the documented 0.001-coefficient difference from the app legacy helper.

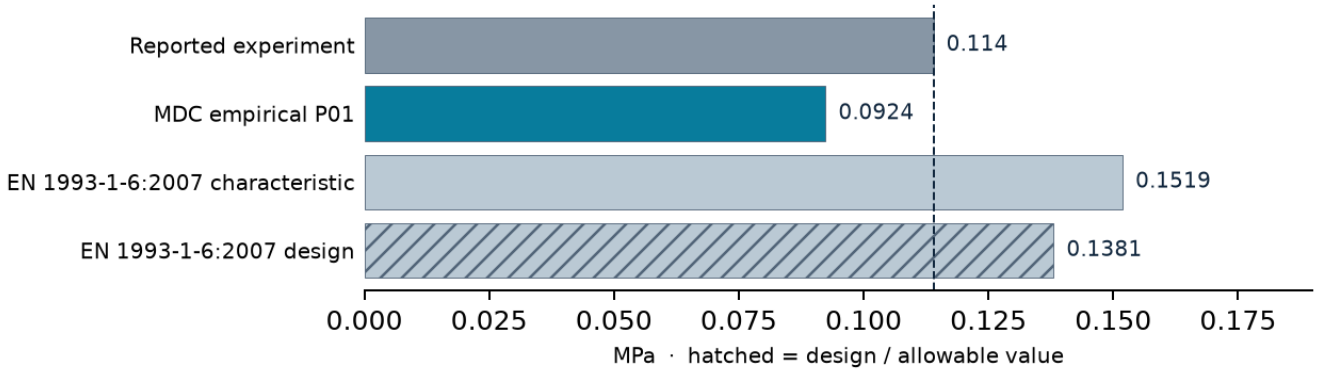
Files: 01-axial-cylinder/project.json · inputs.json · results.csv

Original reference: https://doi.org/10.1098/rspa.2025.0196

External-pressure screening — Nguyen S.1 geometry

Reported initial buckling pressure, 1.14 bar

Table 8 gives OUTSIDE diameter 99.20 mm, L=106 mm, t=0.237 mm, E=198 GPa, nu=0.30 and yield=197 MPa. The shell calculation uses mid-surface radius (Do-t)/2 = 49.4815 mm. No EPS or sand confinement in S.1.



The test is hydrostatic; this model checks the pure external-pressure axis. End-cap axial load, restraint and unknown imperfections prevent an accuracy ranking or a matched-test validation claim.

Design / allowable pressures and reference resistances use different safety concepts. A larger bar is not automatically a better prediction. Unavailable methods have no bar. Full method basis and factor notes are in results.csv.

Source: T. N. Nguyen (2017), Flambage sous contact d'une coque cylindrique soumise à pression externe, INSA Lyon, NNT 2017LYSEI070

§2.3, Table 8 geometry/material and Table 11 initial buckling pressure; free shell S.1. Do not use the separate sand-confined CL-series imperfection survey.

Reproduce this case

External-pressure screening — Nguyen S.1 geometry

Assumptions and limits

• LOAD-CASE LIMIT: the experiment applies pressure to the wall AND end caps (§2.3.1), causing hoop and axial compression. These app files calculate the pure external-pressure axis only. This is a screening comparison, not a matched hydrostatic test prediction.

• w/t=1.0 is assumed; this series has no measured imperfection field. It is not fitted to the reported pressure.

• Simply-supported, rigid-ring analytical reference. The test lower end is fixed (§2.3.2); exact end-restraint equivalence is not established. A full reproduction also needs its end-cap axial force and interaction rule.

• EN 1993-1-6:2007 class A and BC1/BC1 are comparison assumptions, not measured fabrication certification. Characteristic and design values are separate; gamma_M1=1.1.

• The MDC value uses the current workspace composition. The older Hub row uses half the outside diameter and an elastic-only reference; it is not the expected workspace answer. No new GMNIA was performed.

App workflow

1. Import the project JSON. This is an external-pressure-axis screening calculation, not the full hydrostatic test. Use the full length of 106 mm.

2. Check mid-surface radius 49.4815 mm from outside diameter 99.2 mm, thickness 0.237 mm, E=198000 MPa, yield=197 MPa and nu=0.30.

3. Enter w/t=1.0 as an assumption and select empirical P01. No end-cap force is generated by the pure-pressure model. A complete hydrostatic reproduction requires a combined load case.

4. For EN 2007 set fabrication class A, BC1/BC1 and gamma_M1=1.1. Compare characteristic and design values in their own rows.

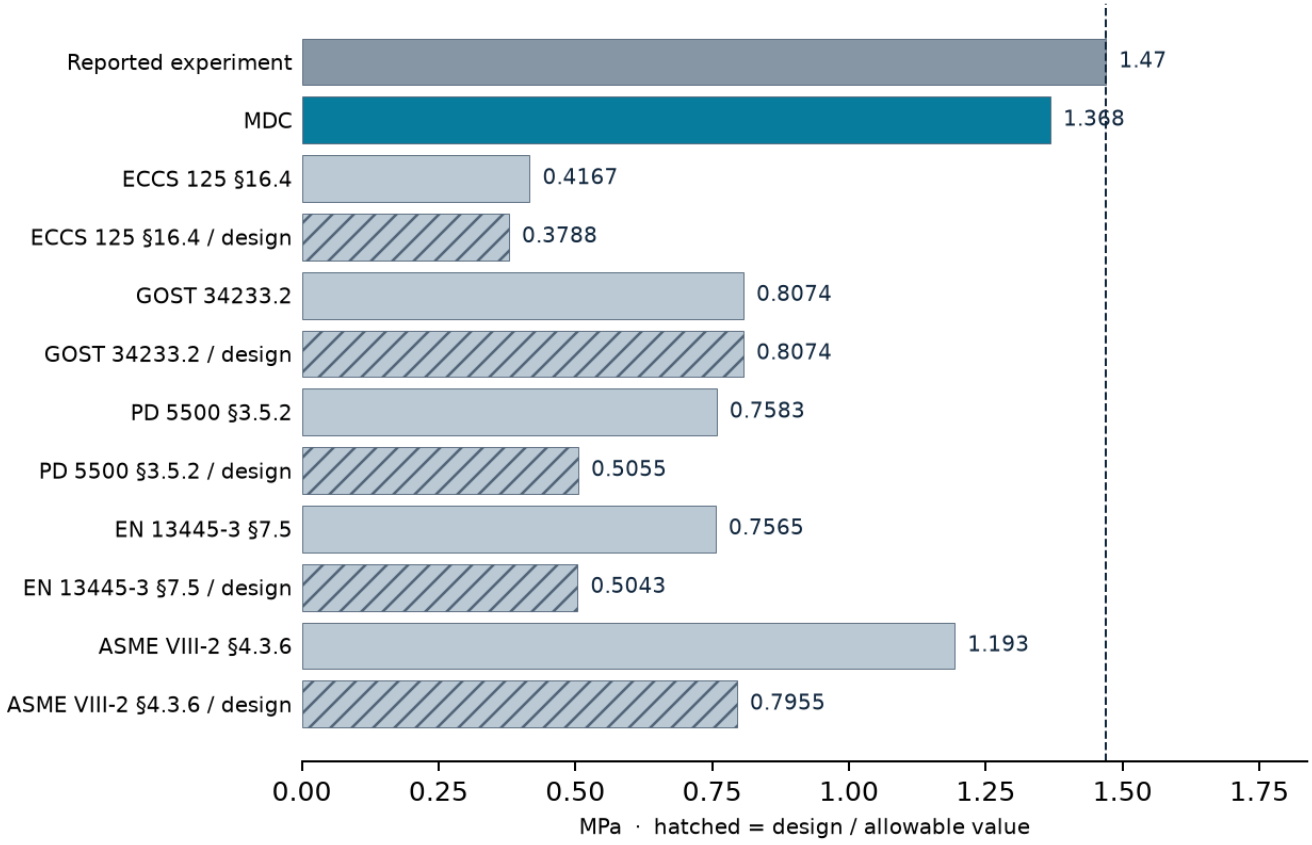
Files: 02-external-pressure/project.json · inputs.json · results.csv

Original reference: https://theses.hal.science/tel-01921593

Internal pressure — photographed ZJU-X3 head

Reported buckling pressure, not ultimate burst/collapse

Di=1200 mm; Di/t=400; crown Ri/Di=1; knuckle ri/Di=0.12; yield=340 MPa; reported buckling pressure=1.47 MPa.



Compare each resistance on its stated basis. The photograph identifies the specimen, while the supplement and explicit assumptions define the numerical comparison.

Design / allowable pressures and reference resistances use different safety concepts. A larger bar is not automatically a better prediction. Unavailable methods have no bar. Full method basis and factor notes are in results.csv.

NASA SP-8032: no applicable value; elastic only (Thurston & Holston, Fig. 12) — no value: no Fig. 12 closure within ±2° / ±5 % of ¯ 25.6°, R_t/R_c 0.121 (nearest ¯ 14.1°, R_t/R_c 0.146); t/R_t = 0.0206 also outside the figure (0.002–0.01)

Source: Ye et al. (2024), photographed ZJU-X3 head, Fig.9(a); publisher electronic supplement Table S1

Photograph Fig.9(a), printed p.626; Table S1 of the publisher supplement supplies X3 geometry, yield and initial buckling pressure.

Reproduce this case

Internal pressure — photographed ZJU-X3 head

Assumptions and limits

• Published torispherical comparison geometry is used; a photograph alone does not establish exact circular arcs.

• E=195 GPa, nu=0.30 and Su=680 MPa (=2Sy) assumed; minimum knuckle thickness=0.9t=2.7 mm and local dimple w/t=0.10 are app defaults, not specimen measurements.

• One-piece fabrication; skirt length 15.37 mm is an application assumption. ECCS class A and austenitic material groups assumed; no cold-spinning enhancement credited.

• Reference resistances and code design pressures have different safety concepts. The CSV labels them separately and keeps unavailable methods empty. No general method ranking is inferred.

• X3 may overlap a method development/calibration dataset; this kit does not establish a held-out validation campaign.

App workflow

1. Import the project JSON, then select torisphere / internal pressure. Di=1200, Ri=1200, ri=144 and nominal t=3 mm.

2. Set yield=340 MPa; declare the assumed E=195000 MPa, Su=680 MPa, nu=0.30 and one-piece fabrication.

3. Keep the declared minimum knuckle thickness 2.7 mm and local dimple w/t=0.10. These are comparison defaults.

4. Use the comparison selector for each available method. Read its reference resistance separately from its design pressure; check method limits and the CSV notes.

Files: 03-torispherical-head/project.json · inputs.json · results.csv

Original reference: https://doi.org/10.1631/jzus.A2300432

From FE loads to a reviewed case

The cut determines the answer

A whole-body equilibrium sum can cancel internal forces. A partial ring can understate them. The kit requires explicit cut-node and one-sided element lists and includes both nodal couples and force lever arms about a declared origin.

What has been checked

Ten independent Python checks cover axial compression, force-generated bending, torque, translated moment origin, one-side filtering, duplicates, missing nodes/cases, inconsistent coordinates and nonfinite values. The generated CSV is also checked against the actual app parser and load-case mapper.

What still needs a solver run

Abaqus and MAPDL files are reviewed setup templates, not solver-verified integrations. Nastran is a setup guide, not a universal F06 parser. Use your actual solver version to run the three known-load cases and record the resultants before exporting proprietary model loads.

A deliberate load decision

The converter retains torque. Transverse shear is refused unless explicitly omitted, with its values recorded in each row. Pressure side is explicit. End-cap axial force is not generated from the pressure column. The importer refuses unsupported combinations rather than silently removing a load.

Start here

Open fe-cut-kit/README.md. Convert samples/nodal-ring.csv with the supplied command, compare samples/expected.csv, then import samples/loads.csv using the FE load import. Synthetic fixtures test arithmetic and file handling, not a commercial solver.

Discuss your own model

skalnav.com/contact/ · contact@skalnav.com