

Designation

RSC — Regolith Shield Cartridge

A square, open-top ISRU box + matching lid. The box is a thin hard shell. After placement it is filled with loose (lightly tamped) lunar soil and capped. The sealed unit is both **radiation mass** and **structure the RSC-CS Course Spider is allowed to stand on**.

The cartridge and the spider are one interface. If the rim cannot take a clamp, the robot has no wall.

Jobs the part must do at once

Job	Who uses it
Stop GCR/SPE / catch secondaries in bulk soil	Habitat behind the wall
Hold fines so dust does not fountain	RSC-CS pour chute + skirt
Take clamp loads on the lid rim , not the lid span	RSC-CS feet
Give a known square mouth for the pour tool	RSC-CS chute
Stack with a keyed bond so the next course has rims to grab	Wall geometry
Be made mostly from local soil	RSC-CS / mold line

Fail any one of those and it is the old sandbag problem again.

Anatomy

Shell (open tub)

Cold-set / modest-heat ISRU ceramic or geopolymer skin. Walls and floor a few centimeters thick. Square planform. Chamfered mouth. Draft so the mold core releases.

Lid

Same recipe. Recessed top. Raised **hookable rim**. Underside seal face (gasket strip or a packed-dust labyrinth). Corner fiducials.

Fill

As-dug (sieved) regolith, poured after the empty shell is in the wall. Not sintered. Light tamp only. This is almost all of the finished mass and almost all of the shielding.

Seal

Lid pressed on after fill. Good enough to stop lofted fines and to make a rim the next robot can classify as **CAPPED**. Not a spacecraft hatch.

Geometry contract (what RSC-CS is built around)

Nominal family (one size; do not proliferate):

Feature	Intent
Outside plan	Square, order 0.6–0.8 m
Fill depth	0.35–0.45 m
Shell wall	~2–4 cm
Mouth	Square, chamfered, sized to the pour chute + dust skirt
Lid recess	Inner shoe of the foot sits here
Lid rim	Outer hook of the foot captures this lip
Corners	Clamp pinch + fiducial + optional pin hole
Bond	Running or stacked with a rim always available; no empty joint under a foot

The spider's gait assumes: **span one sealed cell, pour the neighbor**. Cell pitch must match **RSC-CS** stance.

Load path (this is new, and it drives the part)

RSC-CS dry ~90–130 kg; climb with a limited hopper. In 1/6 g that is still a real point load if it lands on the lid center.

Allowed: compression around the lid rim, into the vertical walls, down into the fill and the course below.

Forbidden: bending the lid like a floor panel; standing on an open mouth; standing on a green (uncured) shell.

So the lid is a **rim beam**, not a thin plate. The shell walls are the columns. Fill, once capped, backs the walls and keeps the box from racking.

Design the lid-to-wall joint so a hook cannot peel the lid off if a foot slips outward. A small interlocking lip or pin is cheaper than a thicker lid.

States the robot must be able to see

Every unit on the wall is in one discrete state:

1. **EMPTY** — shell placed, mouth open, **not a foothold**
2. **FILLING** — chute seated, still not a foothold
3. **FULL** — soil in, no lid yet, not a foothold
4. **CAPPED** — lid seated and classified — **only legal foothold**
5. **REJECT** — cracked rim, missing fiducial, cocked lid

RSC-CS will not commit a foot unless the cell reads **CAPPED**. The cartridge has to make that readable: high-contrast marks on the lid, a rim profile the vision model cannot confuse with an open mouth.

Manufacture (what the part is made of)

Two streams from the same dig:

1. **Shell stream** — sized soil + a few percent binder / cold-sinter recipe → mold → thin tub + lid → vacuum cure.
2. **Fill stream** — the rest of the soil, dumped into the cured tub on the wall.

The cartridge is **not** a compacted-dust brick. Unbound pressed soil will not take a rim clamp or a thermal cycle.

Green shells stay on the ground or on a cure tray. They do not enter the climbable wall.

Shielding function (why the fill is loose)

Mass is the point. A few tens of centimeters of packed soil per course, stacked several courses deep, is the GCR/SPE blanket. The thin shell is a small fraction of areal density. Hydrogen-rich habitat liner still sits **inside**, behind the wall; the RSC is the outer, high-Z / high-mass layer.

Voids after settle are a radiation leak and a lid-support leak. Light tamp at pour is required. No need to sinter the fill volume.

Stack and wall rules

- Only **cured, capped** units are structure.
- Next course sits on lid rims, not on raw dirt.
- Vertical joints staggered if the climb gait needs a rim at mid-cell.
- Edge of the wall needs a return or a thicker “header” cell so the spider does not hook a free edge and peel a course.
- Habitat stays inside the wall; the spider never walks on the inflatable.

Inspection and reject

A cracked rim is a failed foothold even if the fill is fine. That cell can still shield if it is boxed in, but it is tagged **REJECT** and is never a step. Better to waste one box than to drop **RSC-CS** through a course.

What NASA would be buying if they take the idea

Not “bags of moon dust.” They would be buying a **specified masonry unit**:

- planform and rim geometry frozen to **RSC-CS** feet and chute
- lid clamp load rating
- mouth + skirt leak spec

- ISRU shell recipe and cure
- state marks for autonomy
- stack bond pattern

The dirt inside is local and free. The product is the **interface**.

One-line spec: *An RSC is a square ISRU-shelled, soil-filled, rim-lidded brick whose capped lid is the only legal foothold for the Course Spider and whose open mouth is the only legal pour target.*