DECK 014 sector layout and interfaces

2025-08-16

SPEC-00-STR-DECKS-014-sector-layout-and-interfaces-EN-DE-v0.1.0-DRAFT

Project: Sphere Space Station – Earth ONE (Ø 127.00 m) **Evolution:** EVOL-00 • **Spin Law:** 1 g at r = 52.00 m (DECK 012) → ω = 0.43430 s^{-1} ≈ 4.147 rpm **Document Status:** DRAFT v0.1.0 • **Date:** 2025-08-16

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0. Summary / Kurzfassung (EN/DE)

EN: DECK 014 hosts the **nuclear primary systems (SMR)** and **power conversion/distribution** close to the hull for minimal thermal path length, while keeping equipment loads lower than on DECK 015. Compartmentalization, radial relief to space (VENT/BOP), and remote operations minimize operational risk and crew exposure.

DE: DECK 014 beherbergt die **nuklearen Primärsysteme (SMR)** sowie **Energie-Wandlung/Verteilung** in Hüllennähe für kurze Kühlwege – bei geringerer g-Belastung als auf DECK 015. **Kompartimentierung**, **radiale Entlastung ins All (VENT/BOP)** und **Remote-Operation** reduzieren Betriebsrisiken und Personalexposition.

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1. Scope & Purpose / Zweck und Geltung

- **EN:** Sector-level layout, interfaces, safety zoning, and operations constraints for DECK 014.
- **DE:** Sektor-Layout, Schnittstellen, Sicherheitszonen und Betriebsgrenzen für DECK 014.

Dependencies / Abhängigkeiten: Global Geometry & Gravitation SPEC (EVOL-00), DECK 013/015 specs, station-wide safety & ICD conventions.

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2. Geometry & Environment / Geometrie & Umgebung

- **Radial band / Radialband: 56.00–59.50 m** (Δr = 3.50 m)
- **g-levels (ceiling→mid→floor): 1.077 g → 1.111 g → 1.144 g**
- **Deck height / Deckhöhe:** structural thickness per band; habitable clearance per compartment.
- **Windows:** none / **Fenster:** keine (hull-near technical zone)

3. Sectorization & Access / Sektorierung & Zugänge

- **Sectors / Sektoren (12 × 30°):** A…L (A: 0–30°, B: 30–60° … L: 330–360°)
- **Radial bulkheads / Radiale Schotts:** at all sector borders A|B,…,L|A; **PT-A** doors (primary), **PT-B** (service)
- **Shafts / Schächte: HL-0/90/180/270** (heavy-lift), **PAX** at ±22.5°, 67.5° …, **UTIL** dual rings (inner/outer)
- **Relief / Entlastung: VENT** to space via radial lines; **BOP** blow-out panels at designated sectors (no tangential relief)

4. Sector Allocation (Functional) / Sektor-Belegung (Funktional)

Sector	HZ	EN – Primary Function	DE – Primärfunktion	Notes / Hinweise
A	**3**	**SMR Cell-1 (Containment)**: RPV-1, primary loop-N, shield	**SMR-Zelle-1 (Containment)**: RDB-1, Primär-Loop-N, Schild	HL-0 access; VENT-014-A→Space + filtered; ESFAS/SIS
B	2	Nuclear auxiliaries (chem/boron, sampling)	Nuklear-Hilfssysteme (Chem/Bor, Probenahme)	Chem control, drains to 013
C	2	**Power Conversion-N** (Brayton/Rankine skid)	**Energie-Wandlung-N**	Acoustic damping; THM tie-ins north
D	2	DC bus & switching (N)	DC-Bus & Schalter (N)	HL-90 access; DC-HV islanding
E	1	Remote shop & tele-ops	Werkstatt & Tele-Ops	Maintenance, robot staging
F	1	Inspection & AL-C airlocks	Inspektion & AL-C-Schleusen	Decon route to 013
G	**3**	**SMR Cell-2 (Containment)**: RPV-2, primary loop-S, shield	**SMR-Zelle-2 (Containment)**: RDB-2, Primär-Loop-S, Schild	HL-180 access; VENT-014-G→Space + filtered
H	2	Nuclear auxiliaries (south)	Nuklear-Hilfssysteme (Süd)	Chem/boron systems
I	2	**Power Conversion-S**	**Energie-Wandlung-S**	THM tie-ins south
J	2	DC distribution (S/W)	DC-Verteilung (S/W)	HL-270 access
K	1	Water shield ring (upper)	Wasser-Schildring (oben)	Tie-in to 013/015
L	1	Remote OPS & MCC (unmanned)	Fernbetrieb & Leitwarte (unbemannt)	Red/Blue fiber rings

HZ classes: 1 = normal technical, 2 = elevated energy/thermal, **3 = critical (nuclear/containment)**.

5. Interfaces / Schnittstellen

5.1 MECH (Structure & Mounts)

- Ring girder raster: **M18** on 014; isolation mounts $\zeta \geq 0.08$ at turbomachinery.
- Inspection clearances, crane/monorail in A/G cells.
- **DE:** Ringträger-Raster **M18**, Schwingungsdämpfung $\zeta \geq 0{,}08$; Kran/Monorail in A/G.

5.2 PWR (Electrical)

- **DC-HV backbone:** ±800 V split **DC-B1 (N/E)**, **DC-B2 (S/W)**; N+1 **UPS ≥ 30 min** for safety actuators.
- Islanding at **C/I** (conversion), switching at **D/J**.
- **DE:** DC-HV-Rückgrat wie oben; Inselnetze in C/I, Umschaltung D/J; USV N+1 ≥ 30 min.

5.3 THM (Thermal)

- **Primary loops** from **A/G** to **hull HX headers (N/S)** via shortest radial paths.
- Secondary headers to 015 (pump nodes D/J).
- **DE:** Primär-Loops A/G → Hüllen-Header (N/S); Sekundär-Header nach 015 (Pumpen D/J).

5.4 COM (Communications)

- Dual **Red/Blue fiber rings**; dedicated **SAFE-bus** for ESFAS/SIS; remote ops hub at **L**.
- **DE:** Doppelte Glasfaserringe; separater **SAFE-Bus**; Leitwarte in **L**.

5.5 GAS (Process & Inert)

- Inertization **N_2/Ar** feed from 015-H; monitored sector valves.
- **DE:** Inertisierung **N_2/Ar** aus 015-H; Sektor-Drosseln überwacht.

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6. Safety, Schotts & Relief / Sicherheit, Schotts & Entlastung

- **PT-A** main sector doors (motor/manual, interlocked), **PT-B** service doors (fail-safe closed).
- **AL-C** airlocks with $\Delta p/O_2$/smoke/temp dual sensors.
- **VENT-014-A/G→Space** via filtered trains; **BOP** as last resort in A/G; no tangential relief lines.
- **DE:** PT-A/-B wie oben; AL-C mit Zweifach-Sensorik; VENT/BOP radial; keine tangentiale Entlastung.

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7. Operations & Human Factors / Betrieb & HF

- **Exposure:** Category **E** in A/G (≤ 2 h), **D** elsewhere (≤ 4 h); **remote ops default**.
- **Wayfinding:** sector color codes; restricted access badges.
- **DE:** Verweilen: **E** in A/G (≤ 2 h), sonst **D** (≤ 4 h); **Remote-Betrieb** Standard.

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8. Verification & Acceptance / Verifikation & Abnahme

- **Containment tests:** proof/leak-down A/G; interlock & ESFAS functional.
- **Thermal:** flow/ΔT capacity to hull HX; pump N+1 failover.
- **Electrical:** islanding switchover; UPS autonomy ≥ 30 min.
- **DE:** Dichtigkeits-/Funktionstests gemäß obigen Punkten.

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9. ICD & Naming / Bezeichner

- **Shafts:** `HL-0|90|180|270`, `PAX-22.5|…|337.5`
- **Relief:** `VENT-014-<Sector>`, `BOP-014-<Sector>`
- **Nuclear cells:** `SMR-014-A|G`, Conversion: `PCON-014-C|I`

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10. Change Log / Änderungshistorie

- v0.1.0 (2025-08-16): Initial EVOL-00 layout, interfaces, safety & OPS limits.