DECK 015 sector layout and interfaces

2025-08-16

SPEC-00-STR-DECKS-015-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 015 is the **tank farm & thermal buffer deck** with secondary/tertiary loops, inert and oxidizer gas systems, and the cryogenic interface to hull-mounted pods. High g (~1.14–1.21 g) supports **phase settling** and hydrostatic stability; strict EX-zoning and radial relief ensure safety.

DE: DECK 015 ist das **Tank- & Thermik-Deck** mit Sekundär/Tertiär-Kühlkreisen, Inert- und Oxidatorgas-Systemen sowie der Kryo-Schnittstelle zu hüllenmontierten Pods. Die hohe g-Last (~1,14–1,21 g) begünstigt **Phasen-Settling** und hydrostatische Stabilität; strenge **EX-Zonierung** und **radiale Entlastung** sichern den Betrieb.

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1. Scope & Purpose / Zweck und Geltung

- **EN:** Sector layout, interfaces, safety zoning, and OPS constraints for DECK 015 (tanks/thermal, gases, cryo interface).
- **DE:** Sektor-Layout, Schnittstellen, Sicherheitszonen und OPS-Grenzen für DECK 015 (Tanks/Thermik, Gase, Kryo-Interface).

Dependencies / Abhängigkeiten: Global Geometry & Gravitation SPEC (EVOL-00), DECK 014 spec, station-wide EX-class rules & ICD.

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2. Geometry & Environment / Geometrie & Umgebung

- **Radial band / Radialband: 59.50–63.00 m** (Δr = 3.50 m)
- **g-levels (ceiling→mid→floor): 1.144 g → 1.178 g → 1.212 g**
- **Windows:** none / **Fenster:** keine (technical deck)

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3. Sectorization & Access / Sektorierung & Zugänge

- **Sectors / Sektoren (12 × 30°):** A…L
- **Radial bulkheads / Radiale Schotts:** at sector borders; **PT-A/PT-B** per criticality.
- **Shafts / Schächte:** **HL-0/90/180/270**; **PAX** at ±22.5°, 67.5° …; **UTIL** dual rings.
- **Relief / Entlastung:** **VENT** to space; **BOP** panels at designated sectors.

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

Sector	HZ	EN – Primary Function	DE – Primärfunktion	Notes / Hinweise
A	2	Water buffer / heat-sink	Wasser-Puffer / Heat-Sink	2× tanks ~150 m³; HX modules
B	2	Water storage (vertical) + N_2 blanket	Wasser-Großspeicher (vert.) + N_2-Blanket	Level/sampling, dikes
C	2	Borate/LiOH shield solution	Borat/LiOH-Puffer (Schild)	PH stations, containment
D	2	Secondary pump hall	Sekundär-Pumpenhalle	HL-90 access; accumulators
E	**3**	**Separated O_2/N_2 banks (EX)**	**Getrennte O_2/N_2-Bänke (EX)**	**VENT-015-E→Space**; gas headers
F	**3**	**Cryogenic interface (no storage)**	**Kryo-Schnittstelle (ohne Lager)**	Manifolds → hull pods; VENT
G	2	Water buffer / heat-sink	Wasser-Puffer / Heat-Sink	HL-180 access
H	**3**	**Inert gas central (N_2/Ar)**	**Inertgas-Zentrale (N_2/Ar)**	Mixing, sector valves
I	2	Heat-exchanger gallery (S)	Wärmetauscher-Galerie (S)	HX strings to hull headers
J	2	Pump racks (S/W)	Pump-Racks (S/W)	HL-270 access
K	2	Water shield ring	Wasser-Schildring	Ring tank ~250 m³; tie-in 014
L	2	Inspection & service / decon	Inspektion & Service / Dekon	AL-C airlocks, workshop

HZ classes: 1 normal, **2 elevated**, **3 critical (EX/Cryo)**.

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5. Interfaces / Schnittstellen

5.1 MECH

- Ring girder raster: **M20** on 015; tank saddles with restrainers; spill containment/dikes.
- **DE:** Ringträger-Raster **M20**; Tanksättel mit Haltern; Auffangwannen/Dämme.

5.2 PWR

- **DC-HV backbone** continues from 014 (DC-B1/B2); MCC panels at **D/J** pump nodes; UPS for valve/VENT/BOP actuation.
- **DE:** DC-Rückgrat aus 014; MCC in **D/J**; USV für Ventile/VENT/BOP.

5.3 THM

- **Secondary/Tertiary loops:** pump nodes **D/J**; HX galleries **I**; buffer tanks **A/G/K**.
- **DE:** Sekundär/Tertiär-Kreise über **D/J**; HX-Galerien **I**; Puffer **A/G/K**.

5.4 COM

- Red/Blue fiber rings; SAFE-bus monitoring for EX/Cryo sectors **E/F/H**.
- **DE:** Red/Blue-Ringe; SAFE-Bus-Überwachung in **E/F/H**.

5.5 GAS

- **O_2/N_2** separated banks (**E**); **N_2/Ar** inertization central (**H**); cryo manifolds (**F**) to hull pods.
- **DE: O_2/N_2** getrennt (**E**); **N_2/Ar** Inertisierung (**H**); Kryo-Manifolds (**F**).

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

- **PT-A/PT-B** doors per HZ; **AL-C** airlocks at service entries.
- **VENT-015-E→Space** dedicated for EX zone; additional sector VENT lines **F/H**; **BOP** at **A/K** for tank overpressure scenarios.
- **DE:** Türen/Schleusen wie oben; **VENT** in EX-Zonen priorisiert; **BOP** hull-nah; keine tangentiale Entlastung.

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7. Operations & Human Factors / Betrieb & HF

- **Exposure:** Category **D** (≤ 4 h) general; **E** (≤ 2 h) in **E/F/H**; slow head movement in high-g work.
- **Wayfinding:** EX-zone markings, gas color codes, decon routes to **L**.
- **DE:** Verweilen: **D** allgemein, **E** in **E/F/H**; klare EX-Markierungen; Dekon-Routen nach **L**.

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8. Verification & Acceptance / Verifikation & Abnahme

- **Hydrostatic/Leak** tests on tanks; **N_2 blanket** integrity; level/pressure alarms.
- **Pump N+1** failover, HX capacity tests; **VENT/BOP** functional drills.
- **EX compliance** (detectors, interlocks) and **cryo line** integrity at **F**.
- **DE:** Dichtheit, N_2-Blanket, Pumpen-Redundanz, VENT/BOP-Tests, EX/Cryo-Nachweise.

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9. ICD & Naming / Bezeichner

- **Shafts:** `HL-0|90|180|270`, `PAX-22.5|…|337.5`
- **Relief:** `VENT-015-<Sector>`, `BOP-015-<Sector>`
- **Tanks:** `WTR-015-<Sector>-<Nr>`, **Gas banks:** `GAS-015-E-<O2/N2>-<Bank>`
- **Cryo:** `CRYO-015-F-<LineID>`

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10. Change Log / Änderungshistorie

- v0.1.0 (2025-08-16): Initial EVOL-00 tank/thermal layout, EX zoning, interfaces, OPS limits.