

DN50 VJ Pipe — Adsorbent Installation & Dosage Guide

CryoGetter®5A13X + CryoGetter®AG450 Dual-Adsorbent System
Complete Field Installation Reference for Vacuum Jacketed Pipe Systems

Applicable Standards: AIGA 106/19

PER-METER DOSAGE

Adsorbent	Dosage	Basis
CryoGetter 5A13X	80 g/m	VJ pipe adsorbent system — East Far Materials proprietary process
CryoGetter AG450	2 g/m	Weight ratio 5A13X:AG450 = 60–80 : 1.5–2 ()

PER-SPOOL DOSAGE (DN50)

Spool Length	5A13X	AG450	Total	Capsules (AG450)
3 m (10 ft)	240 g	6 g	246 g	2–3
6 m (20 ft)	480 g	12 g	492 g	4–6
9 m (30 ft)	720 g	18 g	738 g	5–9
12 m (40 ft)	960 g	24 g	984 g	6–12

Note: Each pipe spool (bayonet section) must have its own independent adsorbent system. Do not rely on adsorbents from adjacent spools — vacuum is isolated at each bayonet joint.

CRYOGENIC STORAGE TANK — DOSAGE GUIDANCE

⚠ Important: Cryogenic storage tanks are fundamentally different from vacuum jacketed pipe. The dosage values in this guide (80 g/m 5A13X, 2 g/m AG450) apply **only to DN50 VJ pipe systems**. Tank dosage **cannot** be determined by a simple per-meter rule.

Factor	Impact on Adsorbent Dosage
Vacuum interlayer volume	Larger volume → more residual gas → higher adsorbent mass required
Insulation type	Perlite (high outgassing) vs. MLI (lower outgassing) → different dosage needs
Service temperature	LH ₂ (20K) vs. LN ₂ (77K) → different gas loads and adsorption kinetics
Vessel geometry	Cylindrical body, heads, piping penetrations → non-uniform gas distribution
Material outgassing rate	SS vs. aluminum vs. carbon steel → H ₂ generation varies significantly

Recommended approach: Tank adsorbent dosage must be calculated on a case-by-case basis based on the specific vacuum interlayer volume and measured/estimated outgassing rate. **Please consult with East Far Materials engineering team** — we will work with your design engineers to determine the optimal adsorbent type, quantity, and placement for your specific tank configuration.

General reference range: 200–500 g/m² (5A13X) and proportional AG450 based on interlayer volume, but actual values require engineering assessment.

WEIGHT RATIO CONFIGURATION

Configuration	5A13X : AG450	Application
Conservative (longer life, lower cost)	80 : 1.5	Standard runs
Enhanced H ₂ protection (recommended)	60 : 2	Long runs / high-H ₂ -risk

CRYOGETTER®5A13X — INSTALLATION METHOD

Method A — Spiral Wrap (Recommended for DN50)

- Load 5A13X beads into a perforated stainless steel mesh tube (SS304, mesh 200µm, ID 10–15mm).
- Spiral-wrap the mesh tube around the inner pipe outer wall along the full length of the spool.
- Secure with SS wire ties at **300mm intervals**.
- Ensure even distribution — no gaps longer than **50mm** between spiral turns.

Method B — End Capsule (Redundancy)

- Pack 5A13X into perforated SS capsules (cylindrical, 50mm length × 25mm diameter).
- Install **2 capsules per spool end** (4 capsules total per 6m spool).
- Mount capsules at inner pipe support ring locations.

Recommended: **Method A (spiral wrap) for primary + Method B (end capsules) for redundancy**

CRYOGETTER®AG450 — INSTALLATION METHOD

Method — Dispersed Capsule Placement

- Pack AG450 beads into small perforated SS capsules (**15mm length × 10mm diameter**, mesh 200µm).
- Install capsules at **both ends** of each spool, near the bayonet joints.
- For spools >6m: add **1 additional capsule at the midpoint** support.
- Typical dosage per capsule: **2–4g** (adjust based on spool length).

Placement Rationale: **H₂ migrates freely in vacuum — end placement provides sufficient coverage. Central placement is supplementary for long runs.**

INSTALLATION SEQUENCE

- 1 Activate** both adsorbents at 350°C / 6h under vacuum (<10 Pa) or dry N₂ purge
- 2 Cool** to room temperature under vacuum or dry N₂
- 3 Install** CryoGetter 5A13X spiral wrap on inner pipe outer wall
- 4 Install** CryoGetter AG450 capsules at spool ends + midpoint (if >6m)
- 5 Assemble** inner pipe into outer jacket
- 6 Evacuate** annular space to ≤5×10⁻² Pa
- 7 Seal** vacuum port — verify leak rate ≤1×10⁻⁹ Pa·m³/s

⚠ Critical: Activated adsorbents must be installed **within 2 hours** of removal from activation furnace. Exposure to ambient air >2 hours requires re-activation.

ACTIVATION & REGENERATION SUMMARY

Parameter	CryoGetter 5A13X	CryoGetter AG450
Activation Temperature	350°C	350°C
Activation Duration	6 hours	6 hours
Activation Condition	Vacuum <10 Pa or dry N ₂	Vacuum <10 Pa or dry N ₂
Regeneration Temperature	250–300°C	N/A
Regeneration Cycles	≥500 times	0 (replace when saturated)
Service Life	10+ years	10+ years (design)
Saturation Indicator	Vacuum rise in annular space	N/A — life = pipe service life

DUAL SYSTEM VS. SINGLE SYSTEM PERFORMANCE

Metric	5A13X Only	5A13X + AG450
Initial vacuum (after seal-off)	≤5×10 ⁻² Pa	≤5×10 ⁻² Pa
Vacuum after 1 year	1×10 ⁻¹ Pa	≤5×10 ⁻² Pa
Vacuum after 5 years	5×10 ⁻¹ Pa (degraded)	≤5×10 ⁻² Pa
Vacuum after 10 years	>1 Pa (failure)	≤5×10 ⁻² Pa
H ₂ partial pressure (10 yr)	>0.5 Pa	<0.01 Pa

Key Insight: Without AG450, hydrogen accumulates from stainless steel outgassing, increasing gas conductivity and degrading thermal insulation performance by **30-50% within 5 years**. (Ref:)

SAFETY & QUALITY NOTES

- LOX Compatible — AG450 will NOT react with oxygen
- Wear gloves — activated adsorbents are hygroscopic
- Avoid skin contact with AG450 (silver compounds)
- Spent AG450: heavy metal waste disposal
- Spent 5A13X: non-hazardous inert solid waste

Quality Check (before install): **5A13X water adsorption ≥21 wt% · AG450 silver ≥40 wt%, H₂ capacity ≥2.0×10³ Pa·L/g**