

CRYOREFRIGERATOR PUMP PREVENTATIVE MAINTENANCE SCHEDULE

SERVICE FREQUENCY TIERS, HELIUM COMPRESSOR AUDITS & OVERHAUL PROTOCOLS

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Form Number:	PM-VAC-F14 (Rev 1.6)	Created / Author:	Kadeem Manning, Tier II Tech
Target Equipment:	Leybold COOLVAC (1500-60000) & COOLPAK	Review Cycle:	Annual (12 Months)

1. Purpose & Refrigerator Maintenance Principles

Cryogenic pumps operate by condensing and adsorbing gases on arrays cooled to 10–20 K (2nd stage) and 45–80 K (1st stage) by closed-loop Gifford/McMahon helium refrigerators. Proper preventative maintenance on the high-pressure helium compressor (COOLPAK 2000i/5000i) and cold head drive is critical to prevent oil contamination in helium flexlines, maintain heat exchanger efficiency, and maximize time between cold-head overhauls. This schedule outlines mandatory inspection intervals and servicing procedures.

2. Tiered Preventative Maintenance Schedule

Interval	Subsystem / Component	Inspection & Maintenance Action Required	Acceptance Specification / Target Criteria	Field Status
Daily / Shift	2nd Stage Temp (T2)	Log temperature sensor T2 on controller during baseline UHV operation.	$T2 \leq 20.0 \text{ K}$ (Nominal 11 K – 15 K)	[X] PASS
Daily / Shift	1st Stage Temp (T1)	Log temperature sensor T1 (radiation shield and baffle array).	$T1 = 45.0 \text{ K} - 80.0 \text{ K}$	[X] PASS
Daily / Shift	Helium Charge Static	Check static supply pressure on COOLPAK compressor gauge at 20°C.	16.0 – 17.0 bar(g) (Static)	[X] PASS
Daily / Shift	Compressor Cooling	Audit water flow rate and entry temperature to COOLPAK unit.	Flow $\geq 5.0 \text{ L/min}$; Temp +5°C to +25°C	[X] PASS
Weekly	Helium Dynamic Press.	Log running high-pressure (HP) and low-pressure (LP) delta on compressor.	HP: 20 – 22 bar(g); LP: 6 – 8 bar(g)	[X] PASS
Weekly	Aeroquip Couplings	Inspect self-sealing couplings on helium flexlines for oil residue / leaks.	Zero oil trace; locking sleeves engaged	[X] PASS
Monthly	Safety Relief Valve	Check ISO 4126 overpressure relief valve seal on cryopump vessel.	Seal intact; poppet moves freely	[X] PASS
Monthly	Forevacuum Roughing	Perform 2-minute rate-of-rise test on isolated cryopump body.	$dp/dt < 1 \times 10^{-11} \text{ mbar}\cdot\text{L/s}$	[X] PASS
Quarterly	Full Thermal Regen	Execute full warm-up (295 K) & N2 purge to desorb H2, He, Ne & H2O.	Achieve $< 1 \times 10^{-11} \text{ mbar}$ rough vacuum	[X] PASS
10,000 Hours	Compressor Adsorber	Replace COOLPAK helium adsorber capsule to prevent oil aerosol carryover.	New adsorber installed; date logged	[X] PASS
18,000 Hours	Cold Head Drive Motor	Perform G-M cold head drive seal, displacer valve & bearing overhaul.	OEM factory service / rebuild	[X] PASS

3. Consumables & Spare Parts Tracking Inventory

Part Description	Manufacturer / Part No.	Replacement Interval	Stock Qty	Field Verification Notes
COOLPAK Helium Adsorber	Leybold P/N 898000V01	Every 10,000 Operating Hours	2 Units	Batch #2021-AD04 Verified New
Helium Charging Line Hose	Aeroquip 1/2" Self-Sealing	As Needed / Damage	1 Pair	Pressure tested to 25 bar

OFHC Copper Gaskets (CF-200)	Leybold P/N 83948	Every Flange Disassembly	10 Units	High purity silver-plated
ISO 4126 Relief Valve O-Ring	Viton FKM-75 (DN 40)	Annual Overhaul	5 Units	Vacuum greased with Leybonol

4. Technician Field Findings & Maintenance Log Notes

Maintenance Summary & Readings: Performed routine 10,000-hour adsorber replacement on COOLPAK 5000i compressor unit. Static helium pressure adjusted to 16.5 bar(g) using Grade 99.999% pure helium gas. High/Low running pressure stabilized at 21.2 bar(g) and 6.8 bar(g) respectively. Cryopump baseline temperature T2 reached 12.4 K within 65 minutes of cold-head start. Zero oil mist contamination detected at Aeroquip couplings.

Performing Technician:	Kadeem Manning	Role / Title:	Tier II Facility Technician
Technician Signature:	<i>Kadeem Manning</i>	Date Completed:	February 12, 2022
Quality QA Reviewer:	Dr. Marcus Vance	System Status:	[X] APPROVED FOR SERVICE