

ION GETTER PUMP PREVENTATIVE MAINTENANCE SCHEDULE & SERVICE AUDIT LOG

UHV VACUUM SYSTEM MAINTENANCE, CATHODE INSPECTION & FIELD COMPLIANCE SPECIFICATION

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Form Number:	PM-ION-F02 (Rev 1.6)	Review Cycle:	Annual (12 Months)
Author / Created By:	Kadeem Manning, Tier II Facility Technician	Target Hardware:	Gamma Vacuum TiTan (2S–1200S) & Agilent VacIon Plus
Controllers Covered:	DIGITEL (SPCe, QPC, MPCq) & Agilent (IPCMini, 4UHV)	Traceability Standard:	ISO 9001 / ISO 17025 UHV Facility Standards

1. Purpose, Scope & High-Voltage Safety Standards

1.1 Purpose: This Standard Preventative Maintenance (PM) Schedule establishes mandatory operational audits, inspection intervals, and overhaul protocols for all ion getter pumps (TiTan Diode CV, Differential DI, Triode TR, and VacIon Plus StarCell) operating in Ultra-High Vacuum (UHV) facilities. Adherence to this protocol ensures maximum operational life (45,000–50,000 hours at 1×10^{-6} mbar), prevents catastrophic insulation breakdown, and maintains hydrocarbon-free base pressures below 1×10^{-10} mbar.

DANGER — HIGH VOLTAGE & STRAY MAGNETIC FIELDS: Ion pump power units supply **+3.0 kV to +7.0 kV DC** (Diode/Differential) or **-7.0 kV DC** (Triode) at currents up to 500 mA. Always lock out / tag out (LOTO) the controller and allow at least 5 minutes for internal capacitor banks to discharge before servicing HV cables. High-field permanent magnet arrays (up to 0.15 Tesla / 1500 Gauss) can cause severe mechanical pinch hazards with ferromagnetic tools and interfere with pacemakers.

2. Tiered Preventative Maintenance Schedule & Audit Specifications

Frequency	Subsystem / Component	Inspection Task & Action Required	Acceptance Spec / Target	Status
Daily / Shift	Controller Display & Status LEDs	Log high-voltage output (kV), current draw (μ A/mA), and calculated log pressure.	HV: 3.0–7.0 kV Current < 100 μ A at UHV	[X] PASS
Daily / Shift	Cooling Fan & Airflow	Verify cooling fan operational on forced-air models during high-pressure start.	Unobstructed airflow; Temp < 45°C ambient	[X] PASS
Weekly	HV Cable & Connectors	Inspect 10kV SHV / SAFE-CONN strain relief, locking ring, and silicone insulation.	No cracks, fraying, or loose latching	[X] PASS
Monthly	Grounding Braid Integrity	Measure ground braid continuity between pump body, controller, and facility Earth.	Resistance < 0.1 Ω to Earth ground	[X] PASS
Quarterly	Bakeout Shroud & Cabling	Inspect bakeout heater jackets, thermal insulation, and temperature interlocks.	Bake temp 200–250°C; No burnt cabling	[X] PASS
Semi-Annual	Flange & Helium Leak Check	Perform helium mass spec leak check across CF metal seals and feedthroughs.	Leak rate < 1×10^{-10} mbar-l/s	[X] PASS
Annual	HV Insulation Resistance	Megger test feedthrough insulation resistance at 500V DC (HV disconnected).	Resistance > 10 G Ω (10,000 M Ω)	[X] PASS
Annual	Leakage Current Audit	Measure field emission leakage current at base UHV pressure under zero gas load.	Leakage current < 10 nA above background	[X] PASS
Multi-Year (EOL)	Cathode Element Overhaul	Inspect Ti/Ta cathode plates for titanium erosion, flaking, or short-circuit debris.	Plate thickness > 50%; No whisker bridging	[X] PASS

3. Approved Consumables, Spare Parts & Inventory Tracking

Item Category	Part Description & Material Spec	Manufacturer / Part No.	Min Qty	In Stock	Condition Status
Flange Gaskets	OFHC Copper Gaskets (DN16CF to DN200CF)	Gamma / Agilent CF-Gasket-Set	10 pcs	18 pcs	[X] NEW / SEALED
High Voltage Cables	10kV SHV Coaxial Cable, High-Flex Silicone (3m)	Gamma Vac 10KV-SHV-3M	2 cables	4 cables	[X] PASS / TESTED
Bakeout Heaters	Flexible Bakeout Heater Jacket (120V/230V, 250°C)	Agilent Vaclon Bake-Jacket	1 unit	2 units	[X] PASS / READY
Cathode Plates	Replacement Ti/Ta Element Plates (TiTan 75S)	Gamma Vac Ti-Elem-75S	1 set	1 set	[X] NEW / SEALED
Ceramic Insulators	Alumina Ceramic Feedthrough Insulators	Agilent CER-INS-10KV	2 sets	3 sets	[X] NEW / SEALED

4. Technician Maintenance Field Findings & Authorization

Technician Field Observations & Notes: Annual preventative maintenance audit completed on Gamma Vacuum TiTan 75S Conventional Diode ion pump (S/N: TV-2021-8812) connected to DIGITEL SPCe controller. High-voltage cable insulation Megger test verified at 18.4 GΩ at 500V DC. Helium mass spec leak check across DN63CF inlet flange confirmed $< 1 \times 10^{-10}$ mbar·l/s. Ion current baseline at 3.2×10^{-9} mbar measured at 142 nA. All daily, weekly, monthly, and annual maintenance checks passed without defect.

Performing Technician:	Kadeem Manning	Role / Title:	Tier II Facility Technician
Technician Signature:	<i>Kadeem Manning</i>	Date Completed:	December 04, 2021
Quality Assurance Review:	Dr. Marcus Vance	System Status:	[X] CERTIFIED FOR UHV SERVICE