

THE UNIVERSITY OF UTAH
DVI JOB # 18097
SJ/20C EVAPORATION SYSTEM
SUMMARY SPECIFICATION
(8/9/96)

1.0 SUMMARY EQUIPMENT SPECIFICATION:

1.1 DEPOSITION CHAMBER:

- o 304L stainless steel chamber, electro-polished, measuring approximately 20" (wide) x 26" (deep) x 28" (high); incorporating a full-width front door mounted to chamber with articulating hinges (2 spare door o-rings provided with system).
- o Chamber removable from baseplate (2 spare lower o-rings provided with system).
- o 304 stainless steel internal studs for foil attachment.
- o Bottom-mounted pumping plenum.
- o Single rack control cabinet and integrated frame with removable access covers.
- o The following chamber penetrations will be provided:
 - Baseplate:
 - a) (1) 8.0" diameter penetration (pumping plenum)
 - b) (22) 1.0" diameter penetration
 - Sidewall:
 - a) (6) 2.75" CF
 - Top-plate:
 - a) (1) 12.0" diameter penetration (substrate rotation)
 - b) (2) 1.0" diameter penetration
 - Door:
 - a) (2) 4.0" diameter viewport (shuttered)
 - Pumping Plenum:
 - a) (1) 6" ASA (high vacuum pump)
 - b) (2) 0.75" compression seals (vacuum gauge)
 - c) (1) NW40 (roughing valve)
 - d) (1) 3.50" (high vacuum bellows valve actuator)

1.2 CHAMBER PUMPING SYSTEM:

- o APD Cryogenics AP-8S cryogenic pump, APD HC-4 Displex water-cooled compressor, and 10' hose assembly.
- o Alcatel UT2021 two-stage, rotary vane pump.
- o High conductance, bellows-sealed poppet valve:
 - welded to the chamber's baseplate,
 - all 304SS construction,
 - removable seal plate, and
 - flange mounted bellows and linear actuator.
- o Foreline-mounted absorption trap.
- o 25 mm SS bellows-sealed, electro-pneumatic **roughing valve**.
- o 25 mm bellows-sealed, electro-pneumatic **regen valve**.
- o 0.25" (VCR-4) bellows-sealed, electro-pneumatic **vent valve**.
- o 0.25" (VCR-4) bellows-sealed, electro-pneumatic **cryogenic pump purge valve** with adjustable needle valve.
- o 0.25" electric, **mechanical pump purge valve** (independent operation to facilitate chamber pumping and cryopump regeneration).
- o 0.25" electric, **mechanical pump vent valve** (slaved to mechanical pump status).
- o 0.5" NPT manual **ball valve** (leak checking), mounted on system foreline; KF40 termination.

1.3 VACUUM GAUGING/PROCESS GAS AND PRESSURE CONTROL:

- o MKS Instruments 290C-07 ionization/thermocouple gauge controller, supporting 2 Bayard-Alpert ionization gauges (adjustable sensitivity) and 2 thermocouple gauges, each with 2 user-programmable setpoints.
 - TC1A, TC1B, TC2A, TC2B, IG1, and IG2 setpoints interfaced to discrete PLC digital inputs, and
 - IG1 setpoint interfaced to TT-3 electron beam gun power supply "VAC" interlock.
- o Denton Vacuum DV-23, two-position thermocouple controller (redundant measurement of foreline pressure and mechanical pump stack performance).

1.4 ELECTRON BEAM EVAPORATION SOURCE:

- o (1) Telemark TFI 241-02 (4 x 7 cm³ crucibles; side drive) compact electron beam gun:
 - manual crucible selection,
 - single-piece baseplate plenum (removable) and
 - dedicated cooling water circuit with integral flowrate sensor; hardwired interlock to corresponding TT-3 electron beam gun power supply.

1.4 ELECTRON BEAM EVAPORATION SOURCE (cont.):

- o (1) Telemark TT-3 (3.0 kW) electron beam gun power supply and Telemark X/Y sweep:
 - front panel and remote input control of voltage and filament emission current,
 - visual status/interlock indication,
 - interfaced to a XTC/2 deposition rate controller (for remote layer termination and rate control), and
 - hardwired safety interlocks.
- o Rectangular HV feedthrough covers with full access flange.
- o Filament transformer located in NEMA 4 enclosure.

1.5 EVAPORATION SOURCE SHUTTER:

- o (1) Electro-pneumatic deposition source shutter:
 - interfaced to system PLC for remote open and close operation, and
 - interfaced to XTC/2 deposition rate controller (via system PLC) for automatic layer termination.

1.6 EVAPORATION DEPOSITION CONTROL:

- o (1) Leybold Inficon XTC/2 quartz crystal rate controller:
 - interfaced to the TT-3 e-beam power supply,
 - interfaced to evaporation source shutter, and
 - manual film program edit (via front panel).
- o PLC-enabled, XTC/2 manual-mode, shutter over-ride.
- o (1) water-cooled, single, standard crystal sensor with shutter.

1.7 SUBSTRATE FIXTURING/ROTATION CONTROL:

- o Single rotation, bearing supported feedthrough terminated with a removable (18" diameter) flat substrate rack.
- o High torque, reversible DC, gearmotor and controller:
 - direct drive coupling to rotation feedthrough,
 - variable speed 0-27 RPM (potentiometer adjust), and
 - interfaced to system PLC for on/off operation.

1.8 SUBSTRATE HEAT:

- o (1) 3.0 kW quartz heater array with backside reflector and deposition shield; mounted to baseplate plenum.
- o 208/110 VAC step-down/isolation transformer to minimize glow discharges and feedback from sputter power supply.
- o 3.0 kW PI temperature control system (Omega CN76000 series temperature controller, manual setpoint input).
- o (1) sheathed thermocouple positioned internally in chamber.

1.9 SYSTEM CONTROL AND AUTOMATION:

- o GE-Fanuc 90-30 programmable logic controller (PLC).
- o EEPROM memory backup.
- o Membrane-type operator interface with integral LED status annunciation.
- o Valve control/sequencing, pump operation, and "soft" system interlocks (i.e., non-safety related) controlled by the PLC.
- o The following operating modes provided:
 - AUTOPUMP (automatic loadlock and chamber pumpdown to high vacuum conditions),
 - AUTOVENT (automatic loadlock and chamber venting to atmospheric pressure),
 - MANUAL (permits manual (front panel) system operation and interruption of in-process automatic system sequences), and
 - MAINTENANCE MODE (key-switch selectable from MANUAL mode; permits all MANUAL MODE functionality, "soft" system valve interlocks disabled. All "hard" safety interlocks remain operational).

1.10 UTILITIES:

- o Electrical: 208 VAC, 60 Hz, 3 phase, 5 wire (75 A).
- o Cooling water: 15-20 l/min, 15-25 degrees Centigrade, 3-4 bar differential between supply/return (6 bar max. inlet pressure):
 - foreign particles, size: maximum of 100 microns
 - foreign particles, concentration: maximum of 10/cm³
- o Four circuit water manifold; visual flow indication and temperature indication (return side) on all circuits. Circuits requiring flow "sense" (required for hard-wired safety interlocks) will be equipped with a proximity switch keyed to the integral brass float in specific circuit's sightglass.

1.10 UTILITIES (cont.):

Cooling water circuit designations follow:

- 1: E-beam gun (flow sense/interlock);
 - 2: XTC Crystal Sensor;
 - 3: Cryopump compressor;
 - 4: Spare.
- o Compressed air: 10-20 l/hr, normal dry shop air, 6-7 bar:
 - dew point: maximum of 2 degrees Centigrade
 - oil content: 1-5 mg/m³
 - foreign particles, size: maximum of 5 microns
 - foreign particles, concentration: maximum of 5 mg/m³
 - o Nitrogen: (preferentially evaporated from liquid N₂)
 - 0.5 bar (chamber venting, 300 l/cycle, optional)
 - 2.0 bar (cryopump regeneration, 500 l/regeneration)

1.11 SYSTEM DOCUMENTATION:

- o Three complete sets of operating instruction manuals; to include preventive maintenance procedures/timetable, troubleshooting guides, and fully-costed spare parts listing.
- o One complete set of sub-assembly vendor manuals.
- o Three complete sets of electrical schematics (B-size).
- o One complete set of electrical schematics (AUTOCAD.DWG format).

1.12 MECHANICAL REQUIREMENTS:

- o Equipment will be designed to industrial machine tool standards and where applicable to Delco Electronics Specifications for Industrial and Clean Room Equipment (WEMA-8403, 4/15/87).
- o Commercially purchased components must be new, of industrial quality and demonstrated "best in class" availability.
- o All ferrous or aluminum metals are to have proper finishes to prevent corrosion or oxidation.
- o All pneumatic lines, valves, cylinders and flow controls are to operate at a minimum pressure of 70 psi and a maximum pressure of 110 psi.

1.13 ELECTRICAL STANDARDS:

- o All electrical equipment will be in compliance with JIC Electrical Standards, National Electric Code, and where applicable General Motors ES1 Basic electrical standard.
- o All signal power will be isolated from system power; proper shielding and routing practices will be followed.

1.13 ELECTRICAL STANDARDS (cont.):

- o All electrical, electronic, and optical sensors will be adequately protected from process contamination.
- o Three phase distribution is 208 VAC, 60 cycle (all equipment with three phase inputs must be supplied for this voltage); single phase inputs shall be 110 VAC.
- o All equipment will have panelized control; single entrance protection by a heavy duty disconnect switch. The disconnect switch will have a "lockout" provision to ensure that no electrical power can be delivered to the system during maintenance operations.

1.14 SAFETY STANDARDS:

1.14.1 SAFETY INTERLOCKS:

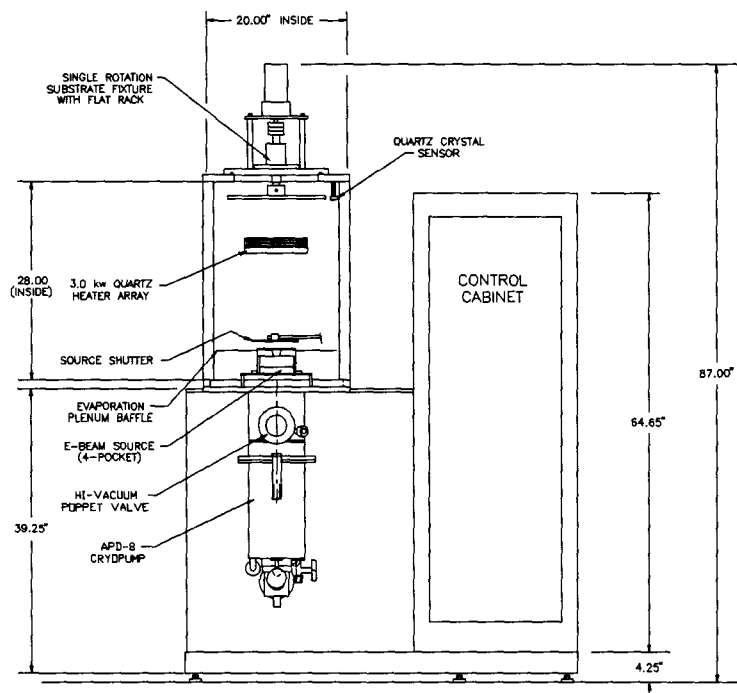
- o The system will be equipped with a hardwired safety interlock system which fully protects operators and maintenance personnel from personnel injury. The following hardwired interlocks will be provided:
 - Electron Beam Gun High Voltage: TT-3 key switch, vacuum safety bellows switch, frame lower-skin switch and chamber door.
 - Electron Beam Gun Filament Emission: TT-3 key switch, ionization gauge (chamber) emission, chamber thermocouple gauge setpoint, and water flowswitch.
 - Heater Power: Vacuum safety bellows switch and chamber door.
- o The status of all hardwired safety interlocks will be displayed to the system operator(s) at all times.
- o All hardwired safety interlocks will be duplicated by PLC "software" interlocks.

1.14.2 MOVING PARTS:

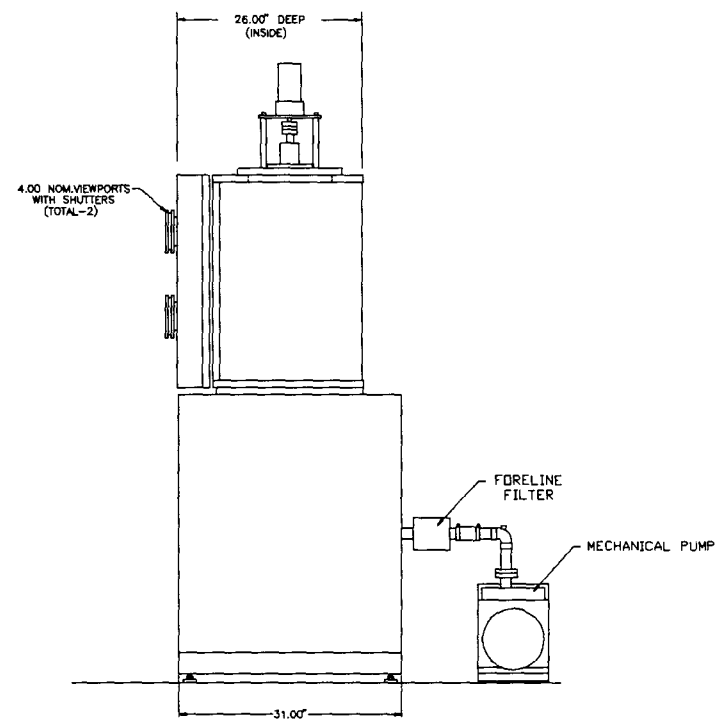
- o Sliding surfaces and pinch points must be fully guarded to prevent injury to operators and maintenance personnel.
- o In the event of a power failure, all moving parts are to come to a complete stop. Upon initiating a restart cycle, all moving parts will proceed to their home position without damage to the equipment or injury to operations and/or maintenance personnel.

1.14.3 POWER SYSTEMS:

- o In the event of an interlock dropout or power failure, all power to internal sources of energy (heat and e-beam power supply) will be interrupted. When power is restored, or an interlock is satisfied, a hard, manual reset of the affected subsystem will be required.
- o High voltage transformers, vacuum feedthroughs and inter-connecting cabling will be enclosed in water-tight enclosures (NEMA 4 rating or better).

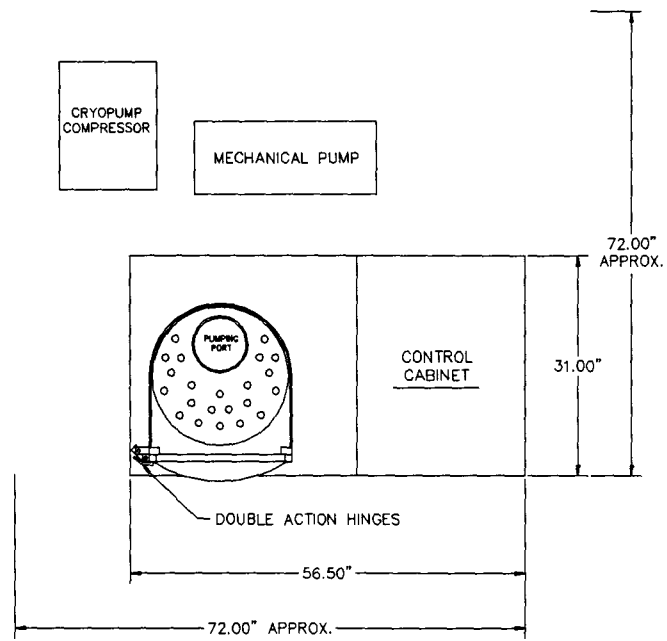


FRONT VIEW
(DOOR REMOVED)



RIGHT SIDE VIEW
(CABINET REMOVED)

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TOP VIEW
TOP PLATE REMOVED

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CHECKED	DATE	SJ/20C DEPOSITION SYSTEM FLOOR PLAN
APPL.	DATE	
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