

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:

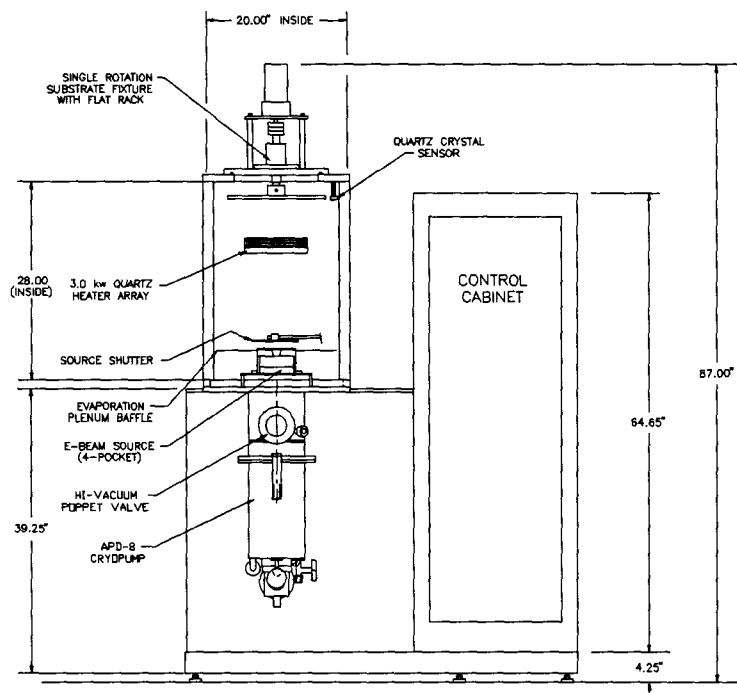
- o The system will be equipped with a hardwired safety interlock system which fully protects operators and maintenance personnel from personnel injury. The following hardwired interlocks will be provided:
 - Electron Beam Gun High Voltage: TT-3 key switch, vacuum safety bellows switch, frame lower-skin 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:

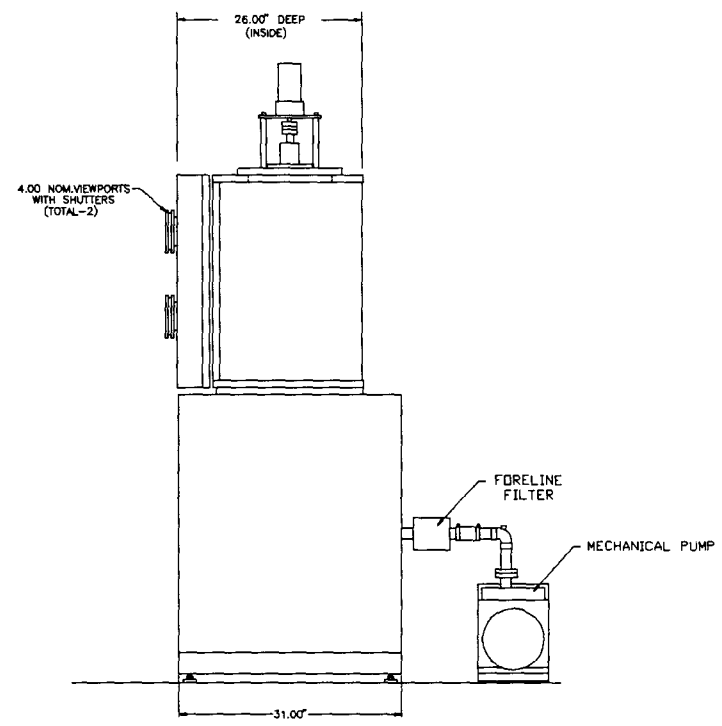
- o Sliding surfaces and pinch points must be fully guarded to prevent injury to operators and maintenance personnel.
- o In the event of a power failure, all moving parts are to come to a complete stop. Upon initiating a restart cycle, all moving parts will proceed to their home position without damage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

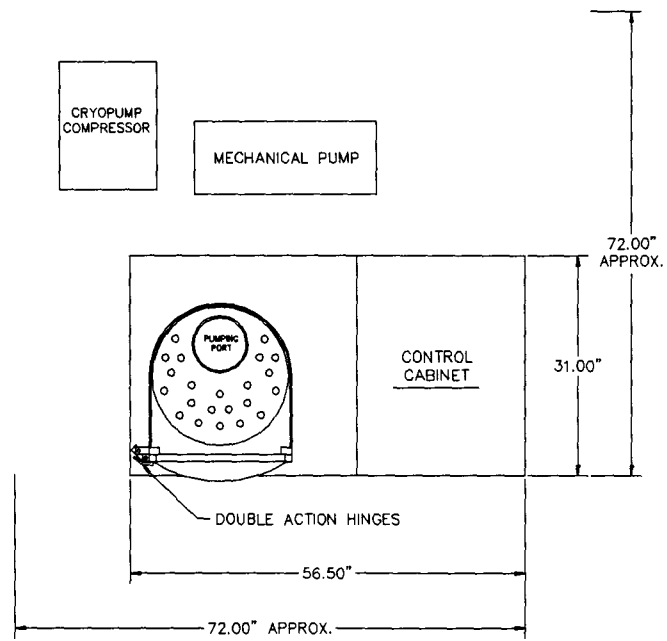


FRONT VIEW
(DOOR REMOVED)



RIGHT SIDE VIEW
(CABINET REMOVED)

<small>WARRANTY: All equipment is warranted for 12 months from date of shipment or 18 months from date of installation, whichever is longer. This warranty is void if the equipment is not installed or operated in accordance with the manufacturer's instructions.</small>		DENTON VACUUM INC. <small>MOORESPRING, NJ</small>
DRAWN: STEVE G. CHECKED: G. APPL:	DATE: 8/9/98 DATE: DATE:	
(FILE: UTAH20\UTAH20GA)		D-0058-190-002 <small>REV 12-1-00</small>



TOP VIEW
TOP PLATE REMOVED

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DRAWN STEVE G. 8/19/98	DATE	
CHECKED	DATE	SJ/20C DEPOSITION SYSTEM FLOOR PLAN
APPL.	DATE	
(FILE: UTAH20\UTAH20FP)		D-0058-190-002
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