

DENTON VACUUM

Enabling Innovation



Integrity® 36 Coating Summary Specification Prepared for:

CallaghanInnovation
BUSINESS TECHNOLOGY SUCCESS

and

KiwiStar Optics
Precision optics design and manufacturing

Lower Hutt 5040
New Zealand

Integrity® 36 Evaporation System Product Specification

CHAMBER

- 36" (91 mm) wide x 42" (106 cm) high x 36" (91 cm) deep
- 304 SS construction; water-cooled via exterior welded 304 stainless steel U-channel
- Full width opening door, two (2) 100 mm viewports w/hinged welding glass holders
- Internal (multi-piece) evaporation plenum
- All required ports and feedthroughs
- Integral sheet metal door "skin"
- One complete set of removable, stainless steel, evaporant shields (multi-piece construction to facilitate removal and reinstallation, with integral handles)
- Removable stainless steel uniformity mask (if required)

PUMPING SYSTEM, VACUUM GAUGING AND PRESSURE/FLOW CONTROL

- CTI Cryogenics CryoTorr® 20 cryogenic pump
- Edwards 80 E2M80 rotary vane dual-stage mechanical pump—53 cfm
- ISO-500 Poppet gate valve
- One MFC mass flow controller
- (2) Full range gauges transmitters (at cryo pump and on main process chamber)
- (1) Pirani gauge transmitters (at mechanical pump)

ELECTRON BEAM EVAPORATION SOURCE & DEPOSITION CONTROL

- One model 274 Telemark (4 pocket,, 25 cc capacity pocket), electron beam guns with center-mounted source location and dedicated cooling water circuit with integral flow rate sensor
- Auto crucible selection and digital sweeps
- 10kW electron beam gun power supply
- Dedicated electro-pneumatic source shutters
- Inficon XTC/3 single layer deposition controller
- Quartz crystal sensor, quantity 1, without shutter

SUBSTRATE FIXTURING

- High reliability rotary feedthrough
- Internal assembly to support samples on:
 - A) Planetary assembly with five (5) 12.5-inch diameter planets
 - B) One 400 mm (16") single plate, single rotation
- One set of insert rings
- Special bottom-driven mask assembly

SYSTEM AUTOMATION:

ProcessPro® Control Software

ProcessPro uses a GE-Fanuc programmable logic controller to drive all system operations. To manage this industrial-grade PLC, Denton developed the ProcessPro HMI (human machine interface). Built on GE's Cimplicity controls platform and operating on a Windows platform, ProcessPro provides users at every level with unique features that enhance productivity and yield.

Users developing new processes will take advantage of ProcessPro's intuitive, Excel-based recipe writing model. They will be fully supported by a comprehensive data-logging capability that allows user to automatically store datalogs in Access databases and send to server designated server locations.

Users in the production environment will find distinct operating modes for production operators, real-time visualization of system operations, full programmability of setpoints and alarms, and an email alert feature that allows the system to send alarm messages to designated individuals by email. Remote diagnostics are also supported, enabling user staff to view the system operation anywhere in the facility, or (with user permission) allowing Denton to remotely access the system to provide software updates and process or operations support including PLC-level diagnostics.

This delivered system includes user licenses for the operating software and the complete, uncompiled code set. While almost all users turn to Denton for ongoing software support, with an uncompiled code set customers can turn to GE for software support or themselves make necessary modification. The Denton ProcessPro package has been in use over a decade, and Denton continues to provide long-time customers with upgrades and support for their ProcessPro configured systems.

Denton's Process Pro® controls system is a state-of-art control software that has been under continuous development at Denton for almost fifteen years. It is a Windows 10 based human-machine interface that links to and drives a highly reliable, industrial grade GE-Fanuc PLC (programmable logic controller). It enables the development and execution of complex deposition profiles.

Key Features

- ProcessPro control software configured for specific system layout, including integration of power supplies, pump controllers and other key, third party supplied components.
- Full, automatic creation of single and multi-layer processes by Excel spreadsheet.
- Full remote setpoint capability:
 - Gas flow rates
 - Total chamber pressure during PID pressure control

- Multiple operation modes:
 - Manual
 - Automatic
 - Maintenance
 - Automatic process sequence generation and editing, and
 - Film program generation and editing.
- Datalogging with on-board or network store of Access database datalog.
- Remote access via system's Ethernet connection; user-controlled remote Denton access for software upgrades and service and process support.
- Programmable email notification of alarms.

Accessed via a Denton designed controls interface built on the Cimplicity® HMI:

- Visual presentation of system configuration and status
 - Active control of process and transport
- Password protected access levels
- Windows 10 operating environment
- Dynamic Data Exchange (DDE)
- Recipe wiring in MS Excel® ; data acquisition through MS Access®
- Remote diagnostics through Ethernet port
- Full disclosure of source code to customer

Process recipes are stored and written in Microsoft Excel, enabling the researcher to program the entire system on or off-line, and with complete control over all process parameters. Datalogging – automatically enabled during deposition – captures complete process data and delivers the output in a Microsoft Access database that can be stored on the system's computer or automatically transferred to a network server.

Users may use the Process Pro Ethernet connection to remotely access the system, or even to give access to Denton engineers in order to provide remote service and process support. ProcessPro is built on the GE Cimplicity HMI product line. Full, un-complied source code is provided to the user. After-sales software support is available from Denton or GE. A WiFi enabled iPad is provided for remote system access.

Process Pro provides in-depth control of the system through a Windows 10 compatible interface. Enables programming and fully automatic deposition of very thin (3-4 nanometer) films; data-logs process parameters during deposition runs. Links to University network via integrated Wthernet port. Includes WiFi-enabled iPad for remote system access.

Heat

- One 9Kw quartz heater assembly – mounted in the process chamber.
- One sheathed thermocouple positioned internally in chamber; PID temperature control system integrated to the system controller.

OPTIONAL SYSTEM COMPONENT:

Ion Source

- KRI END Hall 1000 Ion Source.
- One MFC-controlled gas supplies and full integration to system controller.
- Mounted towards front of plenum plate for easy access and maintenance.

UTILITIES

- Electrical: 208 VAC (+/- 5 %), 50/60 Hz, 3 phase, 80 amp. **(estimated)**
- Panelized control with single entrance protection by a heavy duty disconnect switch with "lockout" provision, provided by DVI.

Note: Electrical main current rating is estimated until final schematics are drawn. Customer must contact Denton Vacuum for final current rating of the system

- Cooling water: 30-35 l/min, 15-25 degrees Centigrade, 3-4 bar differential between supply and return (6 bar maximum inlet pressure);.
- Compressed air: 10-20 l/hr, normal dry shop air, 6-7 bar (system valve operation):
Dew point: maximum of 2 degrees Centigrade
Oil content: 1-5 mg/m³
Foreign particles, size: max of 5 microns. Concentration: max of 5 mg/m³
- Nitrogen: (preferentially evaporated from liquid N2):
0.5 bar (chamber venting, 100 l/cycle, optional)
0.5 bar (loadlock venting, 10 l/cycle, optional)
- Process gas: 5N purity:
0.5 bar (customer supplied)

SYSTEM DOCUMENTATION:

All system documentation is provided in USB thumb-drive format, after configuration and supply of the Integrity 26 system, and includes:

- One operating instruction manual to include preventive maintenance procedures/timetable, troubleshooting guides.
- One set of sub-assembly vendor manuals
- One set of required electrical schematics
- One set of required mechanical drawings

OTHER:

- Acceptance Testing and training (3 days) at Denton Vacuum
- Installation, Acceptance testing and training (3 days) at Customer Site.
- 24 Month Parts and Labor Warranty

Learning and Training Syllabus

Denton Vacuum provides customers organizational maintenance-level training for their vacuum deposition systems. This organizational maintenance includes but, it is not limited to, demonstration, inspection, cleaning, part replacements, handling, servicing and preventive maintenance.

Maintenance training consists of discussion and demonstration of three distinct modules: software controls, system configuration and preventative maintenance.

Software Controls

- ProcessPro
- PLC

System Configuration

System Configuration training consists of demonstrating to customers function and operation of system components and their maintenance.

Schematic Overview

- Mechanical drawings
- Electrical drawings
- Spare Parts

Component Part and Its Function

- Chamber
 - Plates, sidewall, temperature control
- Pumping
 - Valves
- Vacuum Gauging
- Sources
 - Evaporation
 - Sputtering
 - Thermal resistance
- Shutters
- Deposition Monitors and Controllers
- Substrate stages and Fixturing
- System Fluid Temperature Control
- System Control and Automation
 - ProcessPro

Example of Preventative Maintenance (PM) Module Chamber

Cleaning

Vacuum deposition systems operate more efficiently when clean. Scale build-up on the baseplate and chamber walls, for example, should be cleaned off weekly and the surface cleaned with acetone or alcohol using a lint free cloth or paper and solvent. Be sure all debris is vacuumed away.

Inspection

To ensure a proper vacuum seal, inspect chamber seals for nicks, cracks, and other foreign material. Apply a thin coat of vacuum grease to the seals and immediately wipe off the grease to prevent excessive grease build-up. Inspect the sealing surface for nicks or scratches. These must be smoothed out with emery and polished with fine emery or Scotch Brite. Any deposit build-up must be similarly removed and the entire surface wiped clean with acetone or alcohol. Vacuum the baseplate to remove all debris and powder deposits.