CERN 09/03/2014

MDC Vacuum LTD

Presented by Christian GUILLET

CERN 09/03/2014

MDC Vacuum Products Limited is the European subsidiary of:

Insulator Seal

MDC Vacuum Products LLC and ITW in Europe

History

- Established in 1991
- Supplier of high and ultra-high vacuum components
- 100% owned by:
  MDC Vacuum Products, LLC since 2005

MDC Vacuum Products Ltd

- Extensive stock in the UK
- Expanding range of quality components for UHV and high vacuum
- High quality, cost
- Increase support to customers with new sales support team
- Technical staff available over the phone or for site visits

MDC – Europe (Sales & Support)

MDC UK: Logistics Centre

Russia (MSH)

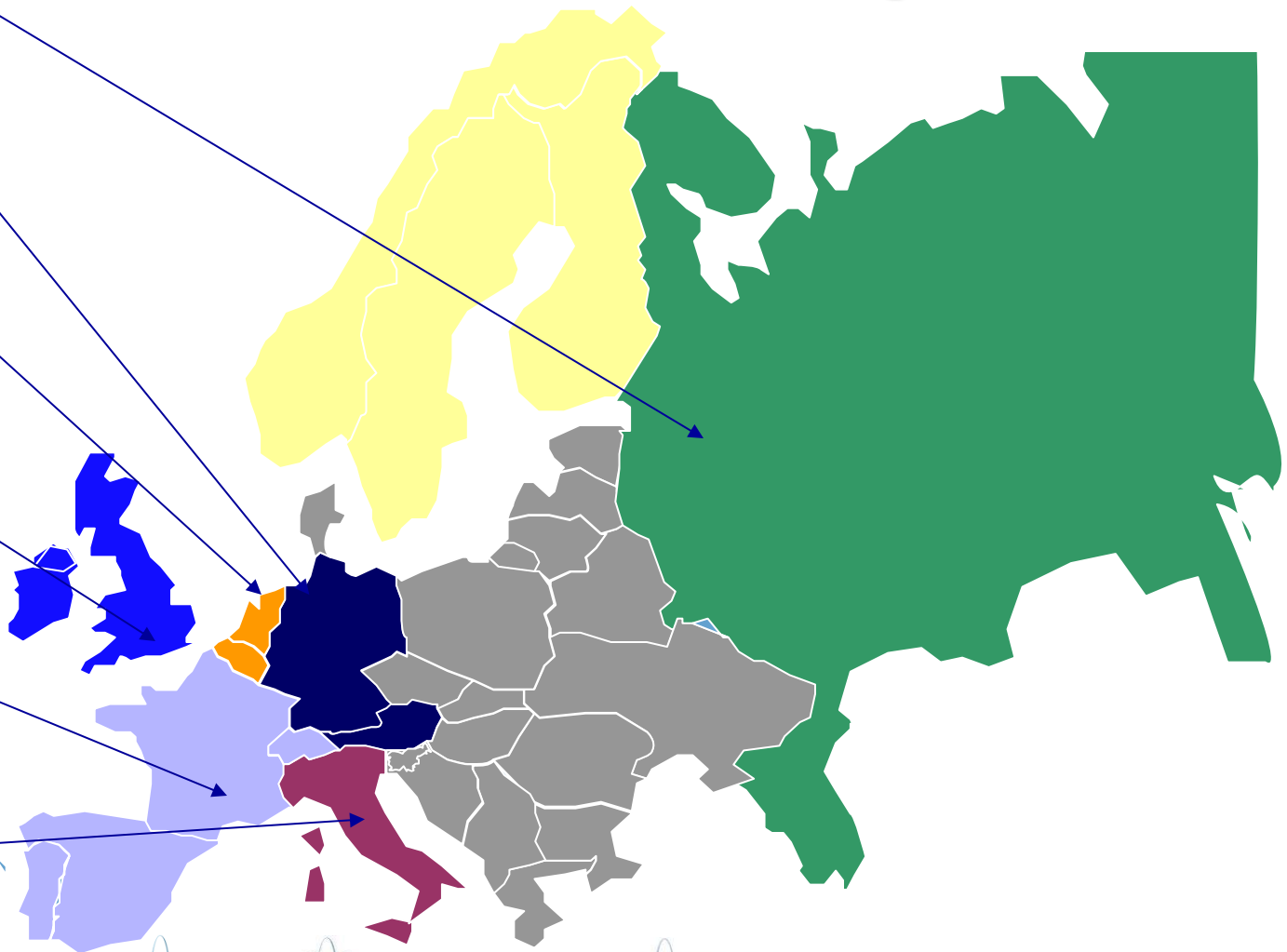
Germany (Dusseldorf)

Benelux (Evatec bv)

UK (Uckfield)

France (Lyon)

Italy (Kenosistec)



Corporate Profile

- A world leader in Vacuum and Ceramic Seal Solutions
- MDC Vacuum founded in 1976
- Privately owned
- Headquartered in Hayward, CA
- Over 200 employees worldwide
- Three business units
- Three manufacturing locations worldwide
- Service 6,000+ customers - Broad range of ind

MDC Solutions

Flanges & Fittings

Feedthroughs

Valves

Vacuum Roughing

Motion & Manipulation

Thin Film Deposition

Viewports & Glass Components

Ceramic Breaks & Feedthroughs

Vacuum Measurement

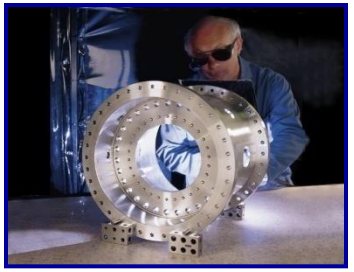
Chambers

Gas Delivery

Bubblers

Complete Solutions

SubSystems



Custom Engineering

Insulator Seal Inc. Division

ISI Capabilities & Products

2014

Agenda

- The ISI Team.
- What We Do?
- Our Capabilities.
- ISI Products.
- Product Applications.
- What's New?
- Summary.

Operational Excellence:
One Block at a Time!

The ISI Team

Outstanding Operating Co.

Four Keys to Success:

1. Emphasis on the People.
2. Focus on the Customer.
3. Attention to Detail in Everything We Do..
4. Focus on Key Growth Initiatives and be an Outstanding Sales & Marketing Organization.

Being the Best is Really About Attitude!

What We Do?

While building relationships with our customers, ISI provides engineering solutions where the joining of dissimilar materials are required resulting in a hermetic seal for corrosive, vacuum, non vacuum, pressure, or temperature applications.

1. We Honor Our Delivery Commitments.
2. We Provide a Quality Product and Stand Behind It!
3. We Offer a Competitive Price.
4. We Add a Little TLC and Big Smile!

ISI strives to be known as a "We Care Company"!

ISI Capabilities Overview

- Vacuum Brazing – Ceramic/Metal & Metal/Metal
- TIG Welding
- Inspection & Electrical Testing
- Hermetic Leak Testing – 2 X 10^{-10} STD atm. cc/sec Helium
- Clean room cleaning and packaging.
- Nitrogen back filled packaging.
- Hydrostatic and He Pressure Testing to 20K psi (1300 bar)

Brazing Furnaces

- (4) Small Vacuum Bell Jar Furnaces
- (3) Medium Vacuum Bell Jar Furnaces
- (2) Large Vacuum Bell Jar Furnaces
- (1) Extra Large Vacuum Furnace
- (1) Electra Blue Air Fire Furnace
- ***Total of (10) Vacuum Furnaces***

Brazing Furnaces

Capabilities:

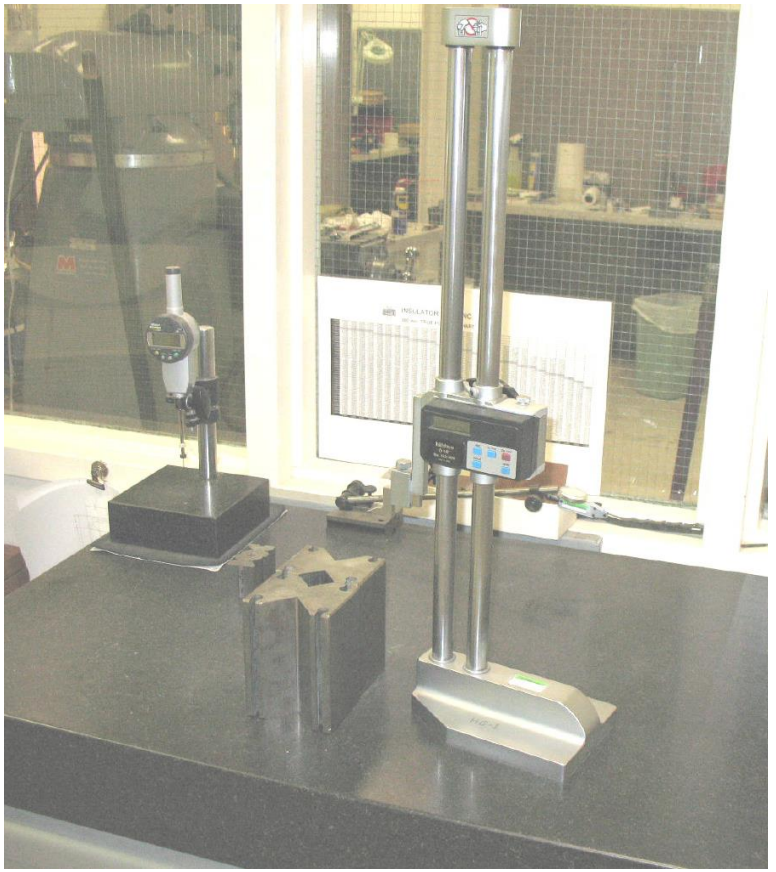
- Max Diameter: 279 mm (11 inches)
- Max Length: 1.2 m (4 feet)
- ***Brazing Temperature: 1120 C***
- ***Assembly Operating Temperature: 900 C***

Welding Equipment

- (2) Miller Synchrowave 250 TIG Welder
- Miller Maxstar 152 Welding Machine
- Pro-fusion Precision Welding Lathe
- Polaris Spot Welder
- EFD 1000XL Solder Machine
- **All welds are verified as hermetic**

Inspection Equipment

- Micro View Video Measuring System
- Brown & Sharpe CMM – Micro Measure III
- Hipotronics Model 300B Hi-Pot Tester & Megohmmeter, 6V DC- 1.2V AC
- Hipotronics Model HD100 Hi-Pot Tester, 40V DC, 20V AC
- ***Hipotronics Model 735-2 Hi-Pot Tester, 35 V AC***



Helium Leak Test

- Inficon UL 1000
- Varian Auto-Test 947 Leak Detector
- Lorimer He (Gas) Pressure Test to 5,000 psi
- Test Spec: 2 X 10^{-10} STD atm. cc/sec Helium

Clean Room

- Class 1000 Clean Room
- Class 100 Laminar Flow Hood
- (2)Vacuum Bake-out Ovens
- Vacuum Packager with inert gas
- (4) Ultrasonic cleaning tanks.

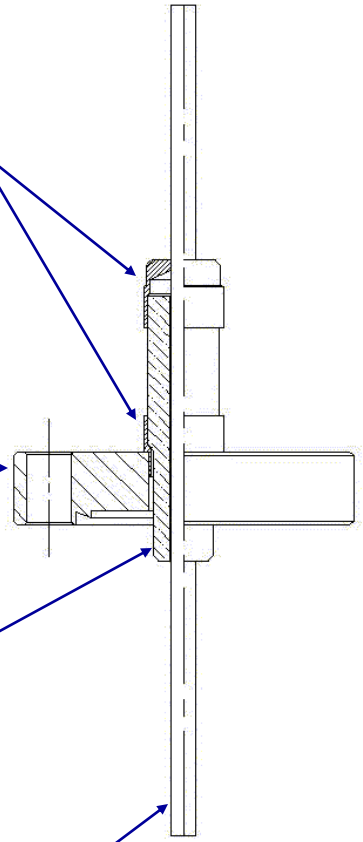
Nitrogen Bagging

Product Types

- Multi-Pin Feedthroughs
- Coaxial Feedthroughs
- Thermocouple Feedthroughs
- Power Feedthroughs
- Electrical Breaks
- Optical Viewports
- Accessories

Anatomy of a Feedthrough

- All electrical feedthroughs can be viewed as variations of this basic design



Expansion-matched cap & sleeve
- Typically Kovar™ or 42%Ni-Fe (Nickel plated for corrosion resistance)
- 70-30 Cu-Ni for cryogenic & nonmagnetic applications

304 Stainless Steel Mount
- May be CF, KF, weldable, threaded, or special

Aluminum Oxide (Al_2O_3, Alumina) Ceramic
- Non-porous, zero outgassing
- Airside glazing helps maintain clean surface

Conductor (OFHC Copper, Molybdenum, Nickel, Stainless Steel)

Conductor Materials

- Copper (Cu):
  - Highest current, soft, easily oxidizes
- Molybdenum (Mo):
  - 1/3 current of Cu, brittle, very high melting point, expensive
- Nickel:
  - ¼ current of Cu, soft, easy to solder
- Steel:
  - 1/40 current of Cu (low current apps only), easy to weld
- Others: Alumel, Chromel, Kovar.

Standard Specifications

- Leak Rate: $< 2x10^{-10}$ std atm cc/s He
- Max use temperature:
  - Most feedthroughs 450° C
  - Fused silica 200° C
  - Kwik-Flanges limited to 150° C
- Heat/Cool Rate: < 25° C/min
- Voltage ratings assume a maximum vacuum side pressure of 10^{-4} Torr

Multi-pin Feedthroughs

Section 1.0 thru 1.6

Multi-pin Feedthroughs

- Definition
  - Two or more conductor pins fitted with air and/ or vacuum side connectors.
  - Primarily used for instrumentation applications requiring low amperage and voltages, designed for signal detection and process control applications.

Multi-pin Feedthroughs

- Features
  - 3 to 35 pins
  - Single and double ended
  - Standard or bake-able connectors
  - Most have voltage rating to 700V and current to 3A
  - Rated to 450 C for Feedthrus, and 125 C for air-side Connectors

Multi-pin Feedthroughs

- Multi-pin Feedthrough types
  - Circular style – 3,5,and 7 pins
    - 500 Volts, 3.5 amps
  - MS Circular Style – 4 to 35 pins, single and double ended
    - 700 Volts, 10 amps
  - High Voltage and High Current
    - To 12KV, and 23 amps

Multi-pin Feedthroughs

- Multi-pin Feedthrough types
  - D-Connector style – 9, 15, 25, and 50 pins
  - Air and Vacuum side connectors

Coaxial Feedthroughs

Section 2.0 thru 2.9

Coaxial Feedthroughs

- Definition
  - Two concentric conductors paths separated and insulated by a dielectric, designed to shield RF energy.
  - Coaxial Feedthroughs can be for instrumentation or power.

Coaxial Feedthroughs

- Features
  - Single and Double Ended connectors
  - Grounded and Floating Shield designs
  - 500V to 20kV and 3A to 15A
  - Air-side Cable connectors
  - Vacuum compatible coaxial cables

Coaxial Feedthroughs

- Coaxial Feedthrough Types offered
  - BNC – bayonet naval connector
  - MHV – miniature high voltage, to 5KV
  - SHV – 5kV thru 20kV power, retracted conductor provides ‘safe’ disconnect
  - SMA – matched impedance to 50 ohms
  - SMB – quick connect version of SMA
  - Type-N – matched impedance to 50 ohms
  - Microdot – smallest coaxial connector
  - Between Series connectors

Thermocouple

Section 3.0 thru 3.5

Thermocouple Feedthroughs

- Definition
  - Device that measures temperature as a function of electromotive force induced when heat is applied to two dissimilar metal wires which are joined at both ends.
  - ISI Thermocouple Feedthrough is not a temperature measuring device, but is used in conjunction with standard thermocouple elements.

Thermocouple Feedthroughs

- Thermocouple Types
  - Base, Refractory, and Noble metals.
  - Miniature
  - Screw Type
  - MS Threaded Connector
  - Push-On Connector
  - Thermocouple-Power combinations

Thermocouple Feedthroughs

- Features:
  - 1-10 pairs (each TC requires a pair of conductors)
  - Air-side connectors included
  - Types K (most common), C, E, J, R/S, T & N available – reference table on website
  - Available with miniature connectors (most common), push-on, screw type (R/S & T), and MS-style circular connectors
  - TC / Power combinations available

Power Feedthroughs

Section 4.0 thru 4.6

Power Feedthroughs

- Definition
  - Feedthroughs for high voltage and/ or high amperage applications.
  - Electrical ratings are determined by various factors, including insulator dielectric strength, geometry and system operating pressure.

Power Feedthroughs

- Features
  - DC to 100 kV
  - RF to 35kW
  - Single and multiple conductor designs
  - Current from 1A to 1000A
  - Solid or water cooled conductors
  - Air-side connectors (Power Boots)

Power Feedthroughs

- Power Feedthrough types
  - Single and multi-pin High Voltage
    - Ratings to 100KV thru extended dielectric insulation
  - Single and multi-pin High Current
    - Significant current capability thru conductors up to 600 amps.
    - Water cooling increases max current to 1000 amps.
  - RF Power – High Frequency applications
    - Non-magnetic materials used to reduce RF coupling, water cooling to increase current capability
    - rated to 35kW

Power Feedthroughs

- PowerBoot – 5kV, 10kV, 20kV, and 70 Amp with Lock-out Connector
  - Very convenient and safe connections. Conductors include radius and shorter length on air-side for power boot engagement.
  - 70 amp power boot fits 0.250” conductor diameter, and can be supplied as a right angle version.

RF Power

Section 5.0 thru 5.2

Electrical Breaks

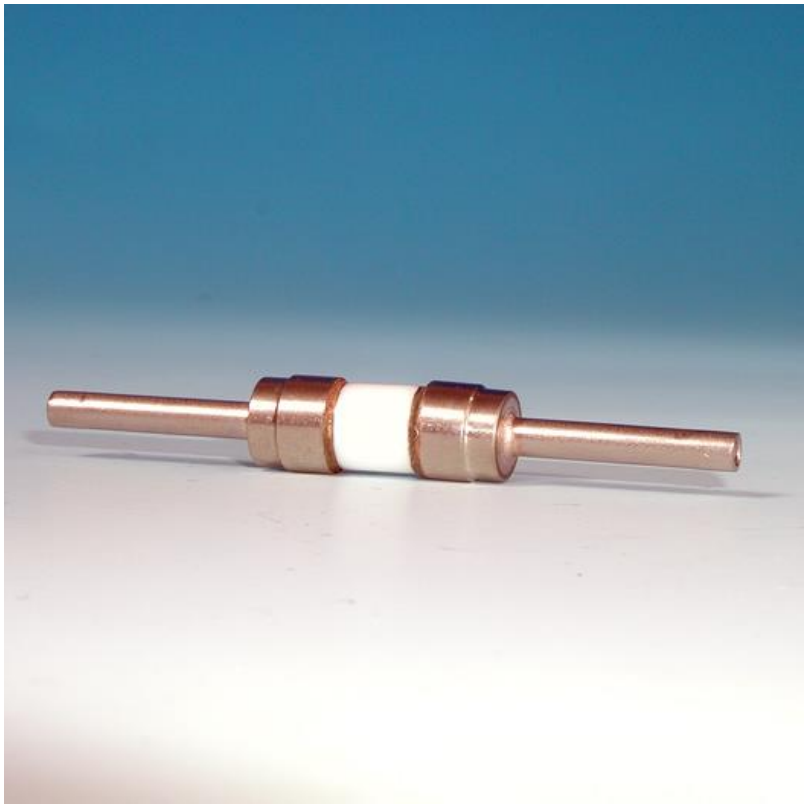
Section 6.0 thru 6.3

Electrical Breaks

- Definition
  - An insulator terminated with weldable metal tubes at both ends. The insulator provides an electrical 'break' in an otherwise continuous tube geometry.
  - Liquid or gas feedthroughs are not electrically isolated. Breaks can be used as liquid or gas feedthrus when electrical isolation is required.
  - Additional Names: Vacuum Breaks, Isolators, Envelopes, Stand-offs

Electrical Breaks

- Features
  - 3kV to 300kV
  - .13” to **11”** inch tube diameters
  - Suitable for orbital welding
  - Suitable for use to 450C, and for cryogenic applications.
  - **Custom Designs for use up to 900C.**



Electrical Breaks

- Types of Electrical Breaks
  - Voltage breaks for standoff.
  - Voltage breaks with gas or liquid flow.
  - Gas line breaks for plasma arrest. Designs include multiple Ids, and bead filled for plasma arrest.

Optical Viewports

Section 7.0 thru 7.2

Optical Viewports

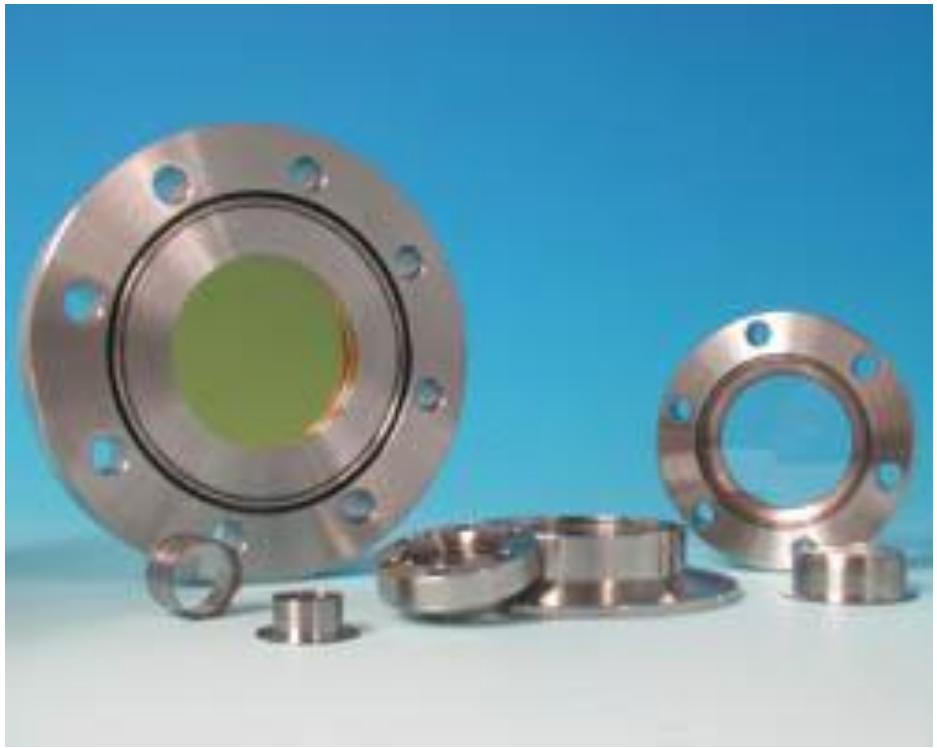
- Definition
  - Viewports are hermetically sealed optical components used to transmit energy in the electromagnetic spectrum. Typically, but not limited to the ultraviolet, visible and infrared regions.

Optical Viewports

- Features
  - .38” to 8” view diameters
  - IR thru EUV material grades
  - Bake out of 450 C for Sapphire, 200 C for Fused Silica

Optical Viewports

- Optical Viewport types
  - Sapphire
    - UV grade single crystal, 90 degree orientation, 50/20 scratch-dig
  - Fused Silica
    - Zero length
    - Domed or Re-entrant



Optical Viewports

- UV, DUV, and EUV grades
  - Due to availability, superior quality and performance in most applications, Fused Silica has replaced Quartz for standard UV, DUV, and EUV viewports.
  - UV viewports are useful for all UV wavelength applications to approximately 200nm.
  - DUV viewports are intended for applications below 200nm.
  - EUV viewports are intended for Argon Fluoride laser applications - provides maximum transmission at 193nm.
  - ISI provides standard 40-20 scratch-dig optical finish. Improved surface of 20-10 scratch-dig can be quoted as a special order.

Optical Viewports

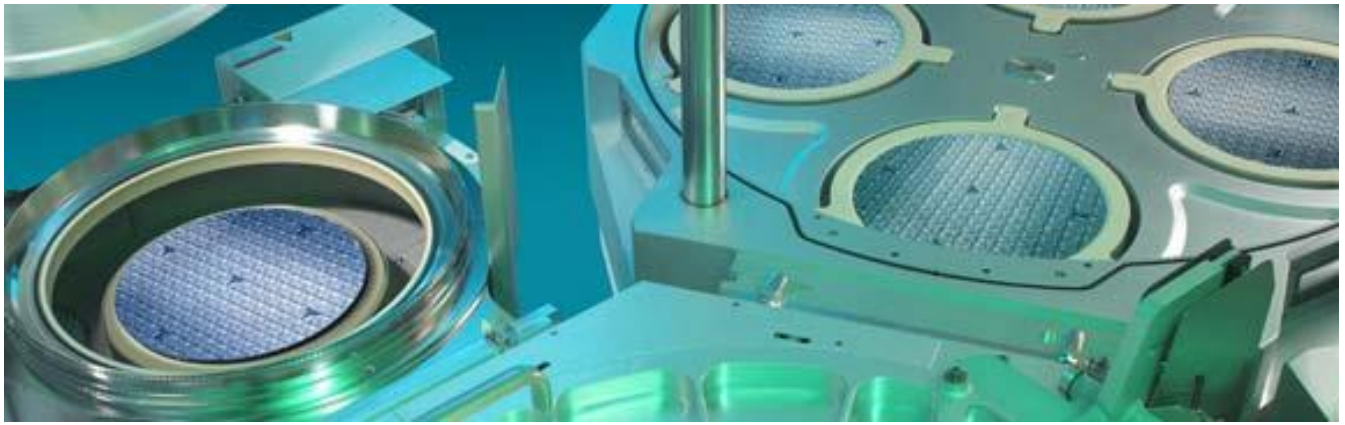
- Anti-Reflective Coatings
  - Enhances overall transmission of optical systems.
    - Sapphire uncoated <= 70%, coated >= 98%
    - Fused Silica uncoated <= 80%, coated >= 99%
  - ISI is partnered with leading Optical lens and coating suppliers to improve coating process for viewport assemblies.

Custom Engineering

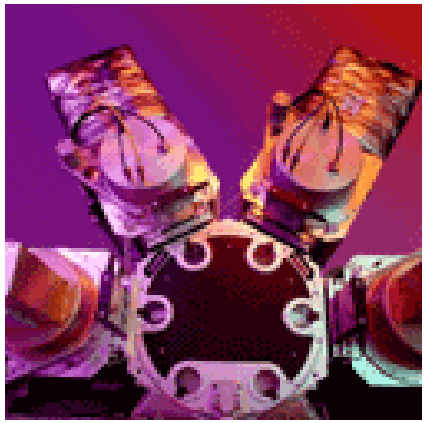
- Insulator Seal has a dedicated manufacturing cell for prototypes and custom engineered assemblies
  - Staffed with Manufacturing Technicians, Design Engineering and Planning resources.
  - Fast-turn prototypes without interrupting the flow of production manufacturing.

ISI Product Applications

Deposition Processes: CVD & PVD



Above: *Novellus CVD (chemical vapor deposition) chambers for semiconductor fabrication.*



Right: *Veeco PVD (physical vapor deposition) system for semiconductor fabrication.*

ISI Product Applications

Deposition for optical components & flat panel displays:

Optical & flat panel display deposition systems from Veeco & Intevac.

ISI Product Applications

Sputtering (PVD)

Hard disk sputtering equipment made by Intevac.

ISI Product Applications

Surface Analysis:

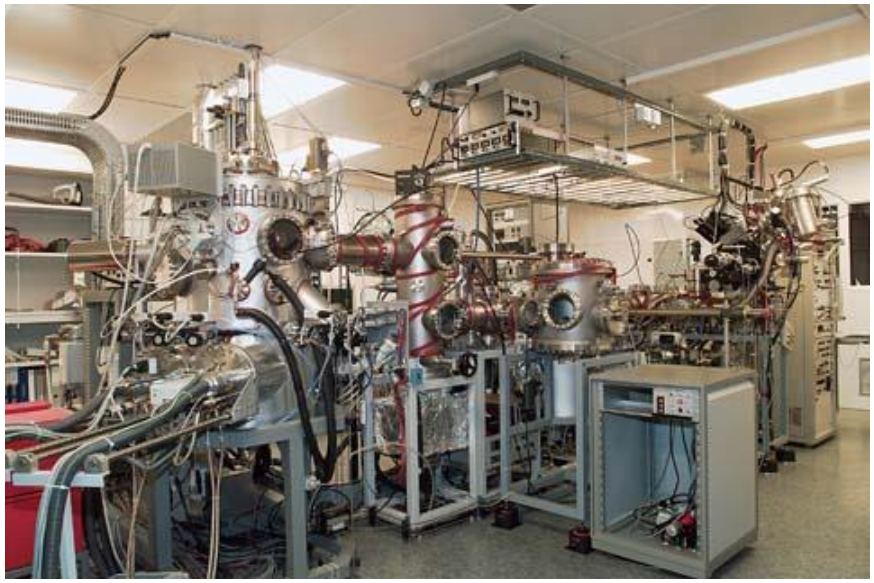
- XPS, SEM, Auger, SIMS, etc.

Surface analysis systems from Physical Electronics.

ISI Product Applications

Basic Research – Physics & Materials

Cyclotron at Rutgers University.



System at Swiss Federal Institute of Technology used in optics materials research.

Recent Accomplishments

- Brazing with New Metals: Inconel 625, 718 & Titanium. (Corrosion Resistant, High Temperature)
- New Braze Alloys: Copper (1083 C)& Palniro 1 (1121C)
- New Ceramic: Aluminum Nitride.
- Vacuum Break ceramic diameter increased from 8” to 11”.

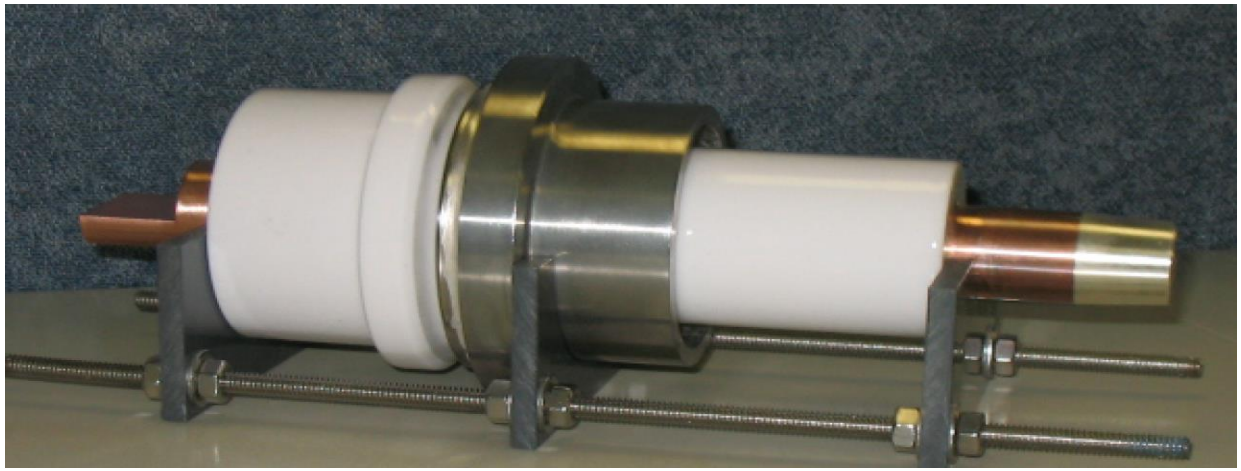
Expanded Capabilities

- ISI has expanded the range for standard breaks.
- Provided Lockheed Martin Space & Science a 4 ft hermetically sealed break with welded, conflat flanges
- NASA and other Design Labs would have occasional requirements.

Expanded Capabilities

- Developed and tested high temperature break assembly capable of withstanding 100 cycles at 1000 C for Fuel Cell Industry.
- Introduced Inconel 625 as alternative metal for high temperature applications.
- Increased capability to braze at 1121 C.

Expanded Capabilities



- Developed and tested high pressure terminal gland assembly capable of withstanding 3100 psi for Nuclear Coolant Reactor Pump Industry.
- Capable of meeting 20KV AC.
- Introduction into the Nuclear Industry

Accessories – In Vacuum

Section 9.0 thru 9.10










Accessories

- Definition
  - An assortment of components which complement ISI standard product line.
  - Many provide connectivity for air-side or in-vacuum use.

Accessories

- Types
  - Power Boot high-voltage connectors
  - Air-Side connectors
  - Vacuum-Side connectors
  - Vacuum-Ready coaxial cables
  - Air-Side coaxial cables
  - Various ceramic insulators and standoffs
  - Standard vacuum mount hardware

Major Markets

Current

- Semiconductor
- Medical
- Laser
- Analytical Systems
- National Labs and Universities

Expanding

- Aerospace
- Defense
- Oil - Downhole
- Solar
- Homeland Security
- Nuclear

Aerospace Application

- Dedicated cell production for Aerospace Relay Housings.
- Torque testing required up to 70 in-lb.
- Implemented new and improved braze alloys.
- Technology applicable to other Aerospace Applications.

Aerospace Market

- Market: Aerospace – Aircraft & Turbine Engines
- Area of Focus: High temperature or environmental extremes requiring temperature sensing.
- Product Examples: Junction Box and Thermocouple Assemblies.

Nuclear Market

- Market: Nuclear Power – Reactors, Aircraft Carriers, & Submarines.
- Area of Focus: High temperature or environmental extremes requiring high reliability.
- Product Examples: Terminal Glands for Coolant Pumps & High pressure feedthroughs.

Defense Market

- Market: Defense – Weapons, Missiles, & Power.
- Area of Focus: High temperature or environmental extremes requiring high reliability.
- Product Examples: Actuators, Igniters, Capacitor Covers.

Medical Imagery Market

- Market: Medical Imagery.
- Area of Focus: High temperature or environmental extremes requiring high reliability.
- Product Examples: Feedthroughs or break assemblies for X-ray Tubes.

Summary –Key Points

- ISI can provide higher operating temperature assemblies, up to 900 C.
- ISI can provide custom vacuum breaks up to 11” in diameter and 4’ in length.
- ISI can sell to non-vacuum markets & applications:
  - Aerospace, Nuclear, Fuel Cell, Medical

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Thank you

Any questions?