

# Industrial Vacuum Systems for Semiconductor Manufacturing

## COURSE OUTLINE

Category	Semiconductors
Duration	16 hours

### Activity 1: Introduction to Vacuum Systems

- Review of Semiconductor Manufacturing Process Steps
- Cleanrooms and Vacuum Chambers
- The Role of Vacuum Systems in Semiconductor Tools

### Activity 2: What is a Vacuum?

- Defining Vacuum
- Perfect and Partial Vacuums
- Timeline of Milestones in Vacuum Technology History
- Common Applications of Vacuum Technology
- Vacuum Quality and Ultra-High Vacuum (UHV)
- Pressure Basics
- Pressure Units and Conversions
- Pressure Sensors and Gauges

### Activity 3: Vacuum Systems and the Challenges of UHV

- Vacuum Systems and Their Components - Overview
- Conductance and the Pump Paradox
- Outgassing and Baking
- Selecting the Correct Materials
- Safety Guidelines for your Vacuum System

### Activity 4: Fittings, Flanges, and Connectors

- Tubing Types
- Fittings and Flanges
- KF and CF
- Connectors and Clamps
- Gaskets

Gas Flow Regimes  
Facilitating Conductance  
Symbols

#### **Activity 5: Valves**

Structure and Function  
Throttle Valves  
Manual Valves  
Symbols  
Chambers and Venting

#### **Activity 6: Pumps**

Structure and Function of Pumps  
Roughing Pump  
Cryo-Pump System  
Gas Supply & MFC  
Pump Symbols

#### **Activity 7: Vacuum Procedures**

Rough Pumping  
Rough Pump Start-Up  
Rough Pump Start-Up (Cycle Purge)  
Rate-of-Rise (ROR).

#### **Activity 8: Pump-Down Behavior**

Pump-Down Curves  
Slow Pump / Half-Gate  
Blowers  
Crossover Pressure

#### **Activity 9: Gauges and Sensors**

Absolute Pressure vs Gauge pressure  
Applications of Absolute Pressure and Gauge Pressure  
Pirani Gauges  
UHV Gauges  
Gauge Symbols

**Activity 10: The Mass Flow Controller (MFC)**

- Operating Principle
- Components
- The MFC in the Vacuum System
- Other Applications

**Activity 11: Logarithmic Scales & Scientific Notation**

- Linear vs Logarithmic Scales
- Orders of Magnitude in Vacuum
- Reading and Interpreting Vacuum Values
- Scientific Math in Vacuum
- Exponential Notation, Mantissa and other Logarithm Components
- Rate-of-Rise Calculations

**Activity 12: Helium Leak Detection (HLD)**

- Purpose of HLD
- The Role of Helium
- Detection principles
- HLD Process Flow: Pump down, Helium spray, Leak Rate Measurement, Repair, and Verification

**Additional Hardware Package: Vacuum System Assembly and Maintenance (6+ hours)**

① **Important Note:** *This outline is subject to change.*