Hy-Lok



Ultra High Purity Fittings & Valves

for Semiconductor Applications

Contents

PART I. High Purity Gas Delivery System

PART II. Ultra High Purity Components

1) ZCR Metal Gasket Face Seal Fitting

2) Tube Butt Weld Fitting

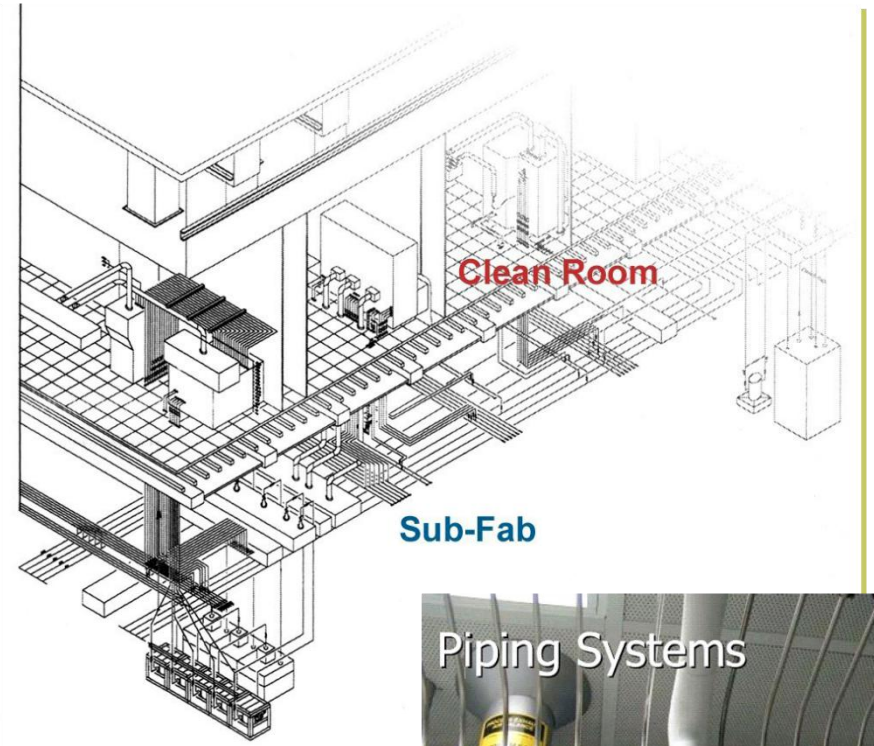
3) Bellows Valve

4) Diaphragm Valve

PART I. Ultra High Purity Gas Delivery System



Gas Delivery System for Semiconductor Application

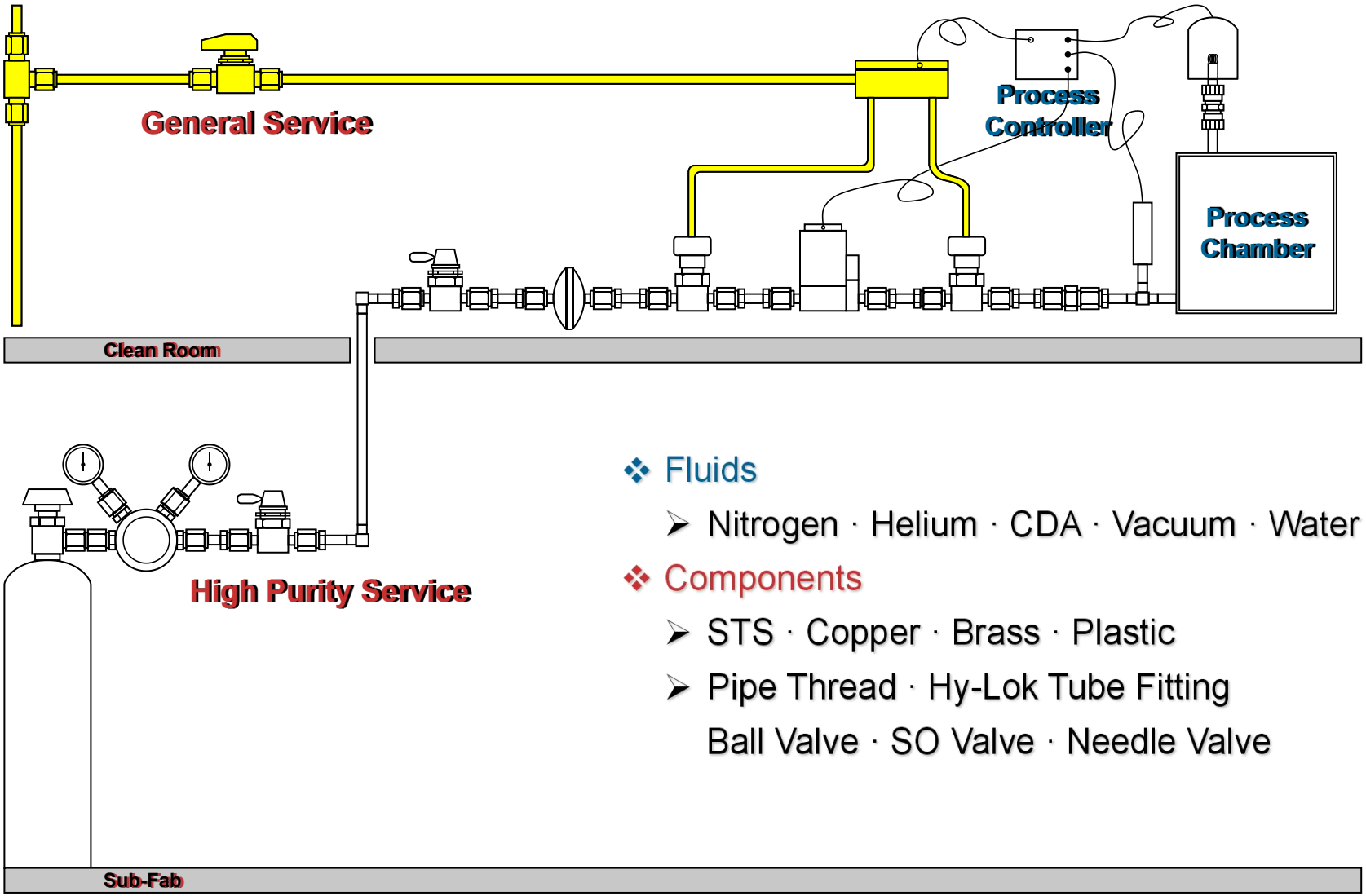






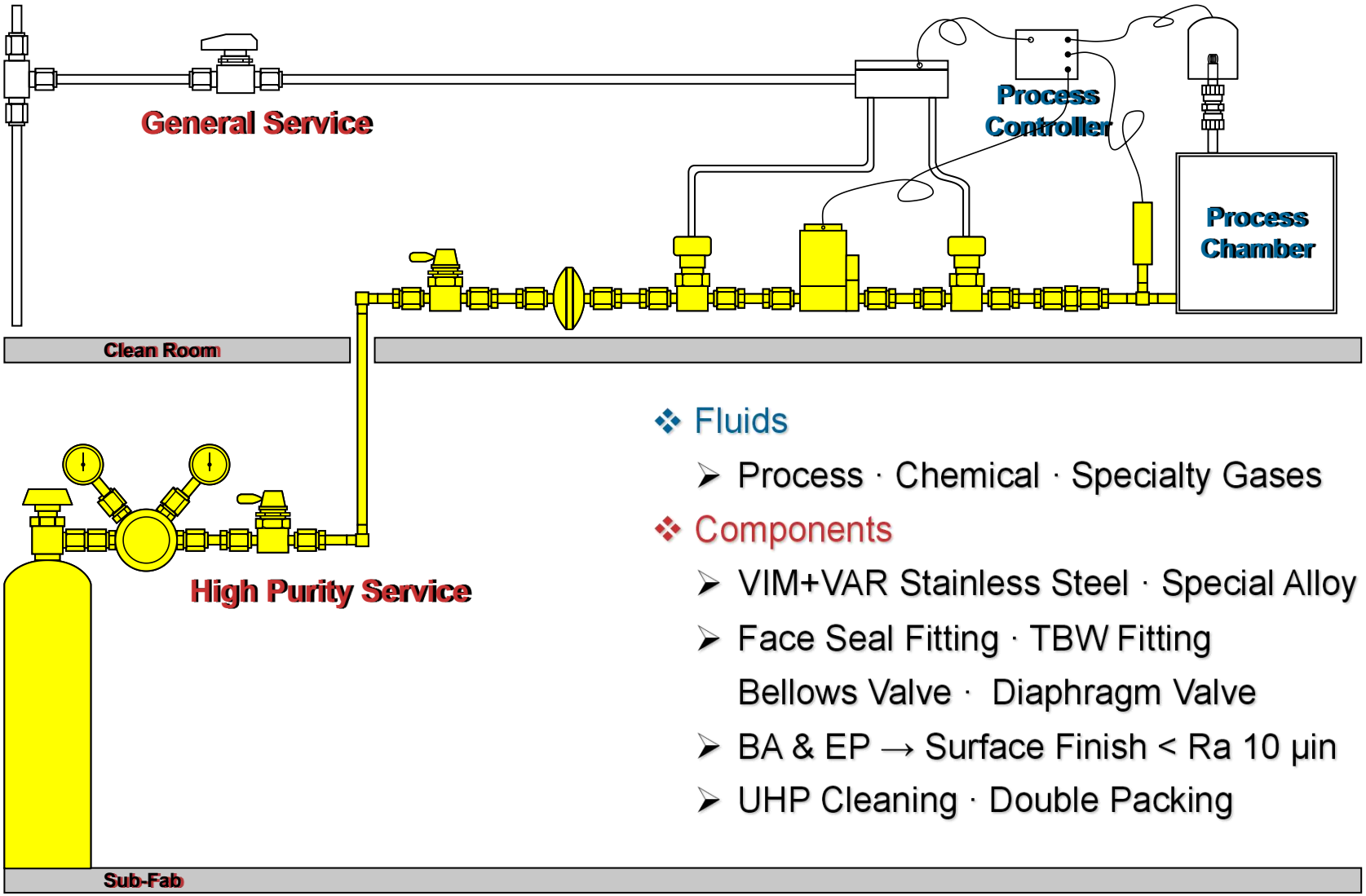


General Service Gas Delivery System



- Fluids
  - Nitrogen · Helium · CDA · Vacuum · Water
- Components
  - STS · Copper · Brass · Plastic
  - Pipe Thread · Hy-Lok Tube Fitting
    Ball Valve · SO Valve · Needle Valve

High Purity Gas Delivery System



- ❖ Fluids
  - ➢ Process · Chemical · Specialty Gases
- ❖ Components
  - ➢ VIM+VAR Stainless Steel · Special Alloy
  - ➢ Face Seal Fitting · TBW Fitting
    Bellows Valve · Diaphragm Valve
  - ➢ BA & EP → Surface Finish < Ra 10 μin
  - ➢ UHP Cleaning · Double Packing

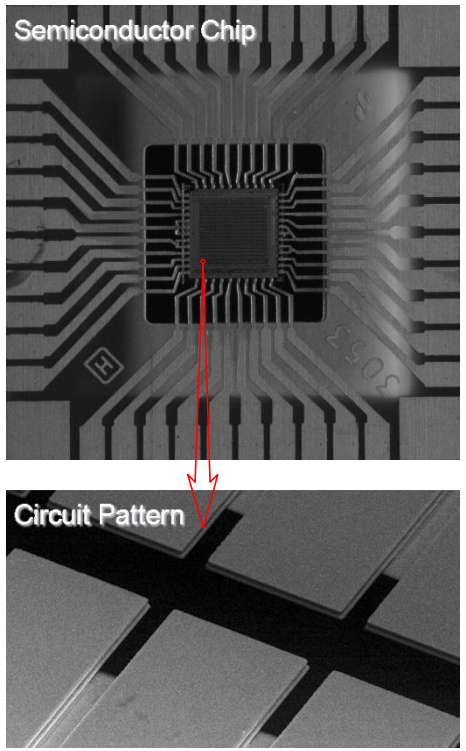
Applications of Ultra High Purity Fitting & Valve



- ❖ Bulk Gas Line
- ❖ Specialty Gas Line
  - ⇨ Toxic · Corrosive · Flammable · etc
- ❖ Gas Supply System
  - ⇨ Gas Cabinet · Gas Manifold Box · Gas Panel
  - ⇨ BSGS (Bulk Specialty Gas System)
  - ⇨ VMB (Valve Manifold Box) · VMP (Valve Manifold Panel)
- ❖ Main Equipment
  - ⇨ CVD · PVD · Etching · Ion Implantation · etc.
- ❖ The Others Gas Delivery Line
  - ⇨ Shop Air · Vacuum System · DI Water System · etc.



Gases used in Semiconductor Manufacturing



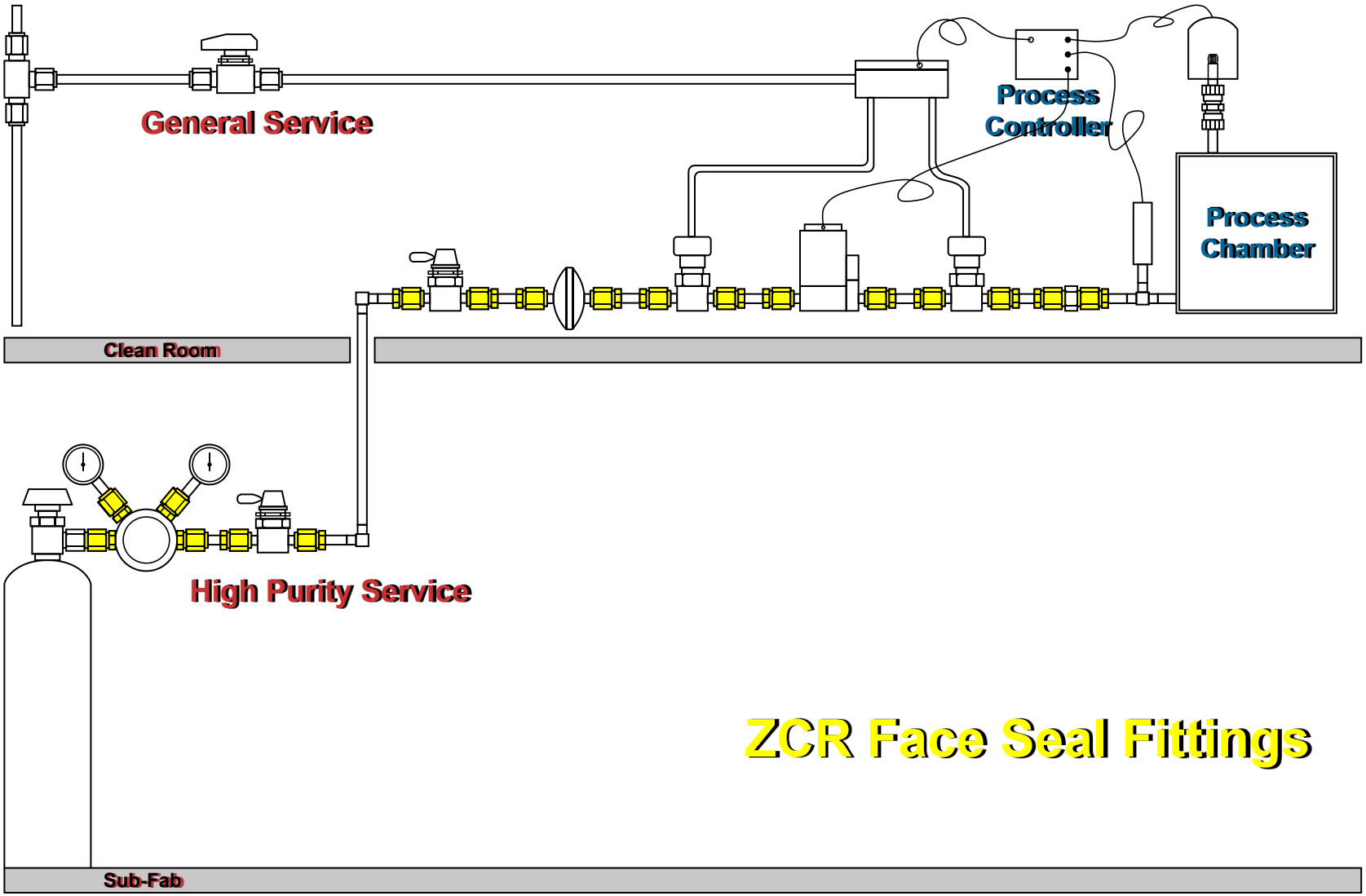
Category	Gases
Bulk Gas	CDA (Clean Dry Air) · Ar · N_2 · He · H_2 · O_2
Toxic	AsH_3 · Cl_2 · B_2H_6 · GeH_4 · PH_3 · SiH_4 · SbH_3
Corrosive	NH_3 · BCl_3 · Cl_2 · SiH_2Cl_2 · HCl · HF · HBr · PCl_5 · $POCl_3$ · $SiCl_4$ · $SiCl_4$ · $SiHCl_3$ · WF_6
Flammable	AsH_3 · B_2H_6 · SiH_2Cl_2 · GeH_4 · H_2 · PH_3 · SiH_4 · $SiHCl_3$ · SbH_3
Pyrophoric	B_2H_6 · SiH_2Cl_2 · PH_3 · SiH_4

PART II. Ultra High Purity Components

1) ZCR Metal Gasket Face Seal Fitting

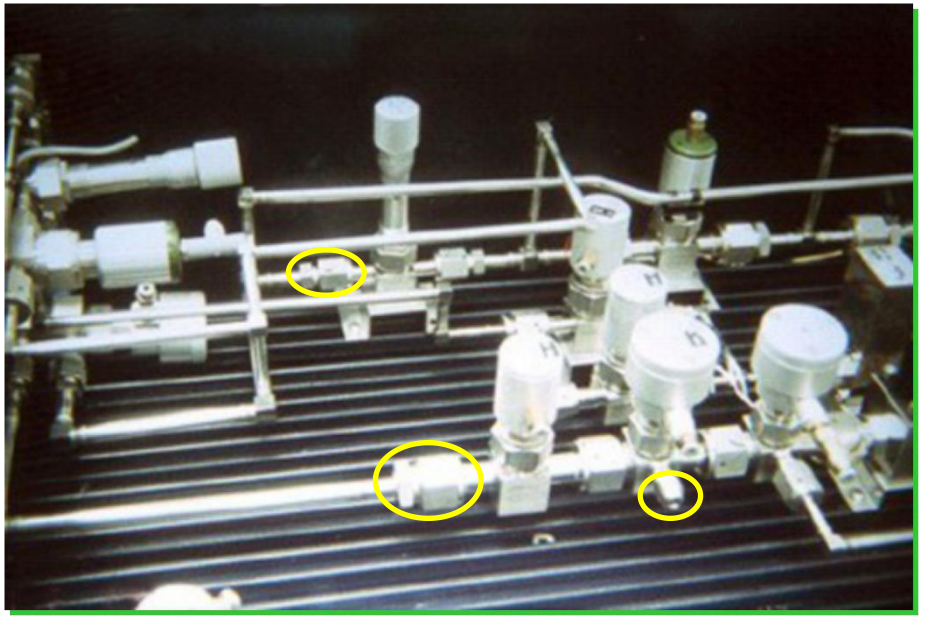


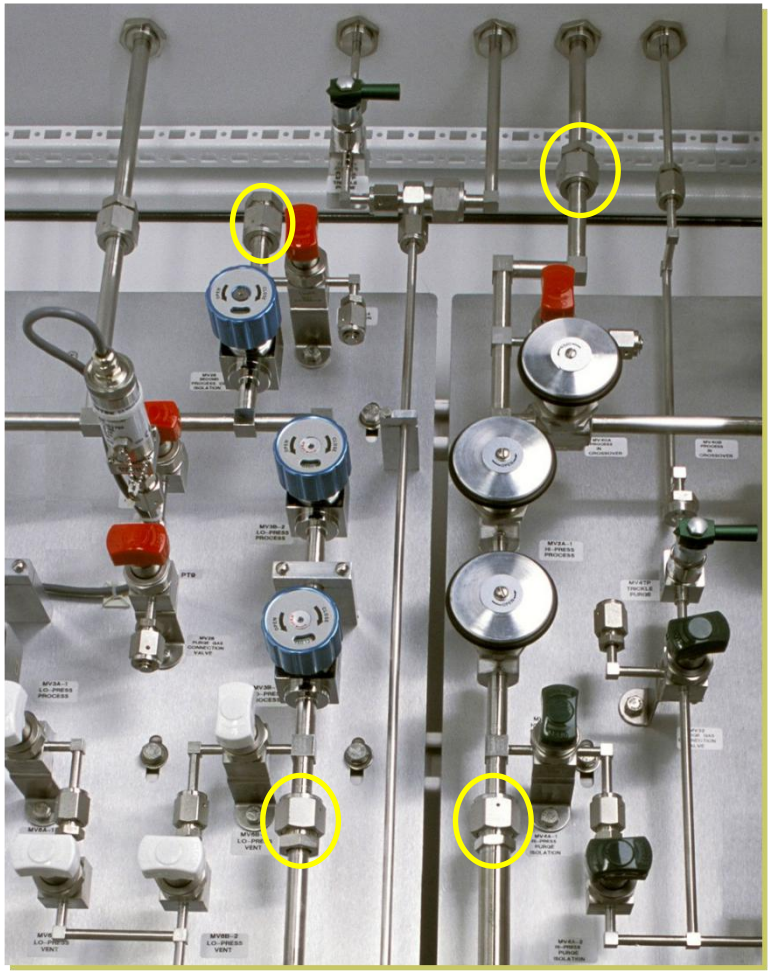
Ultra High Purity Gas Delivery System



ZCR Face Seal Fittings

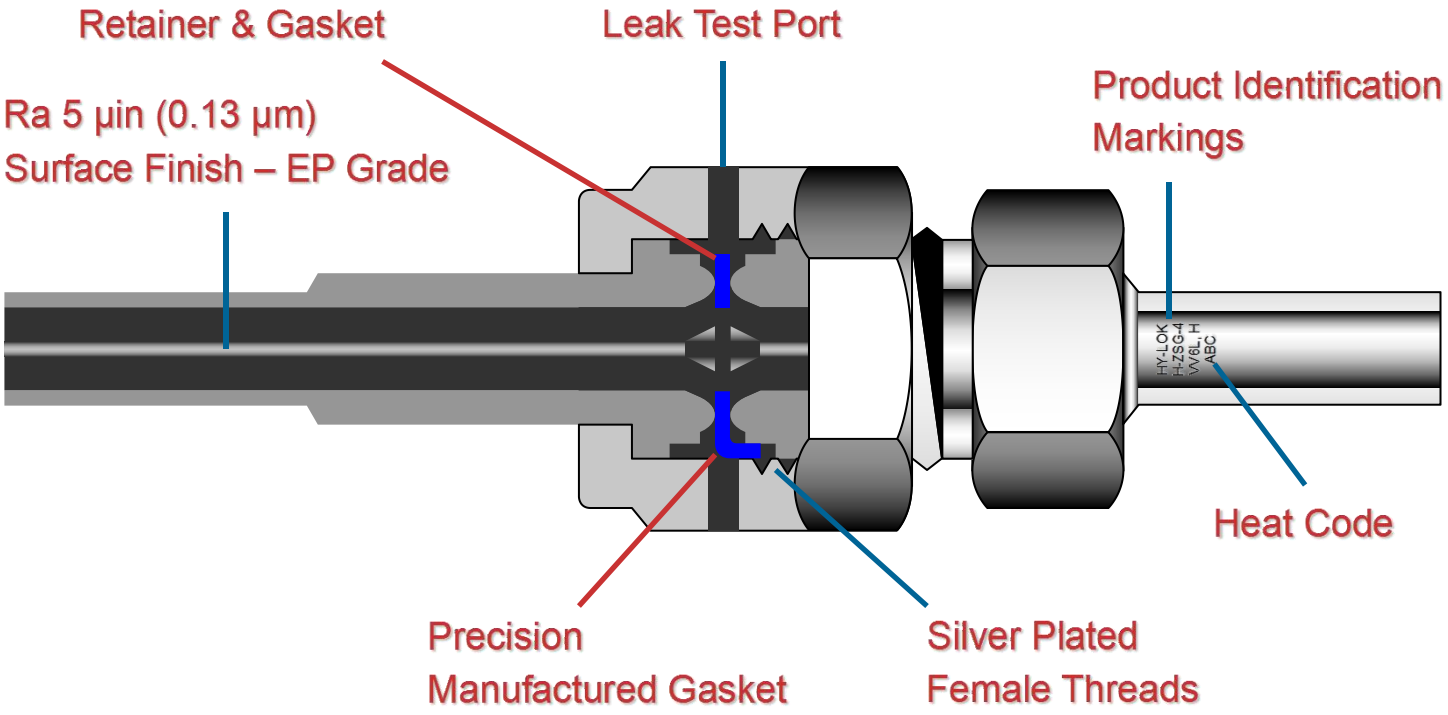
Ultra High Purity Gas Delivery System

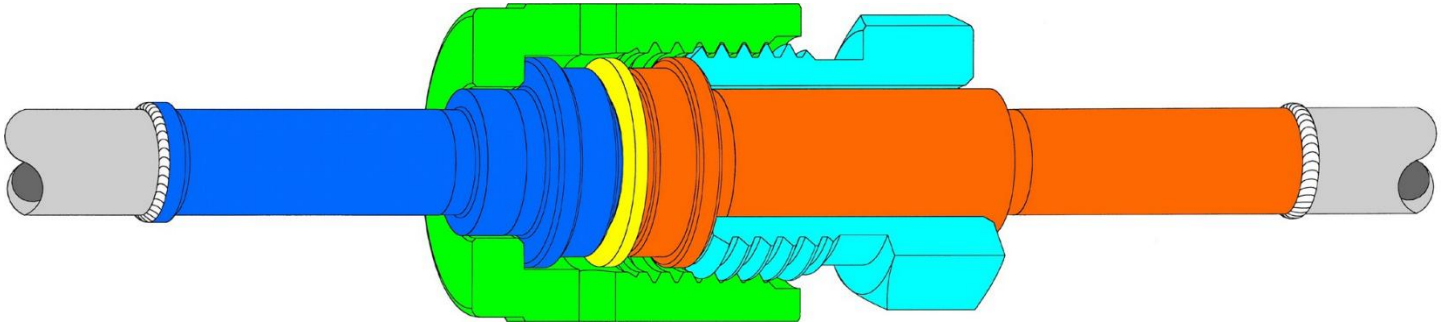




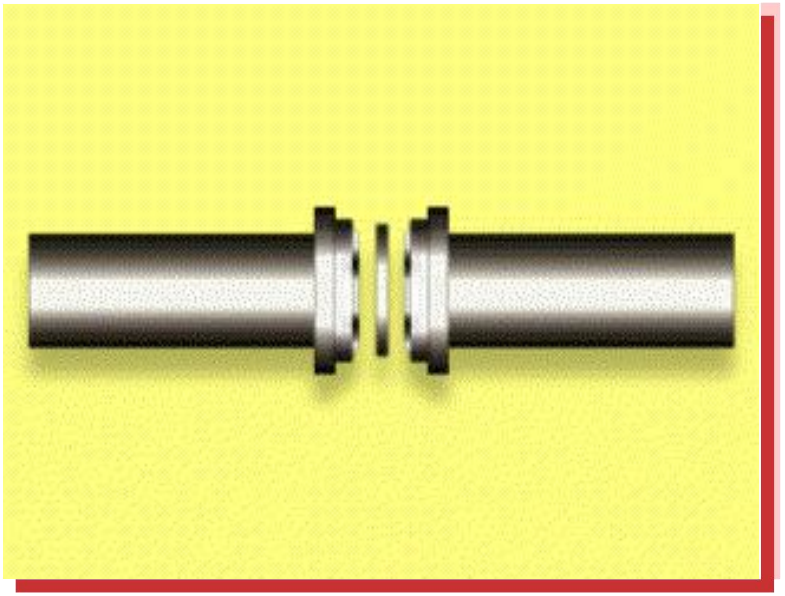
ZCR Face Seal Fittings

ZCR Metal Gasket Face Seal Fitting



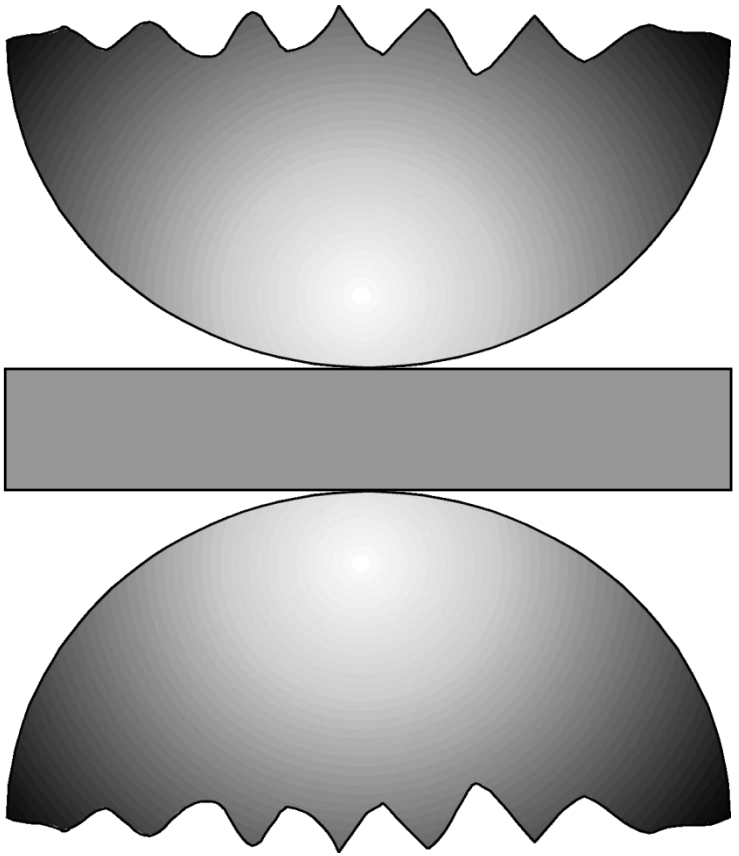


Sealing Mechanism of ZCR Metal Gasket Face Seal Fitting



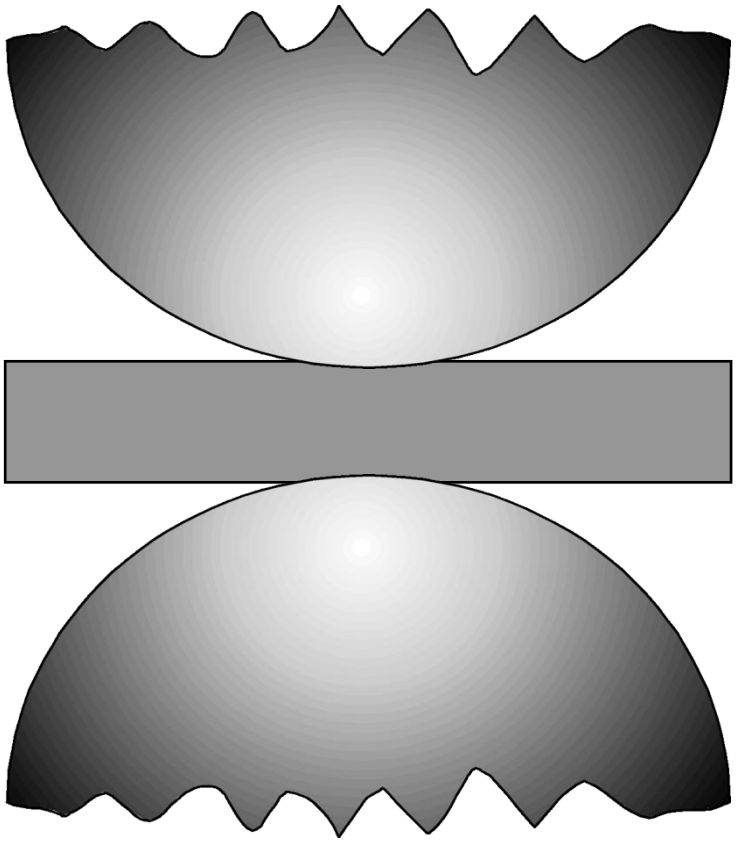
The ZCR seal is formed by compressing a gasket between two highly-polished beads

ZCR Sealing Beads



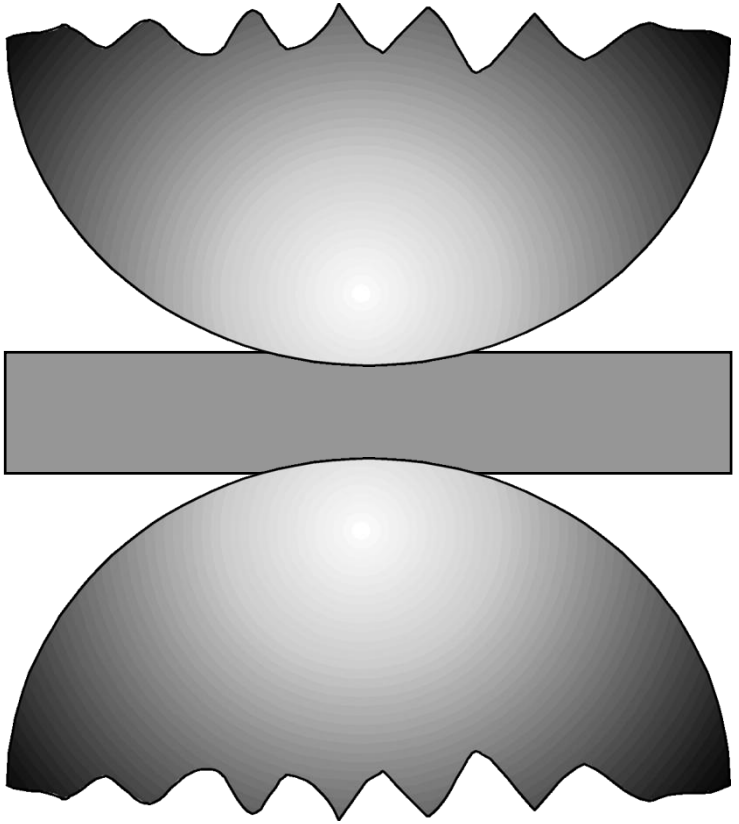
A seal is formed when the beads penetrate into the gasket

ZCR Sealing Beads



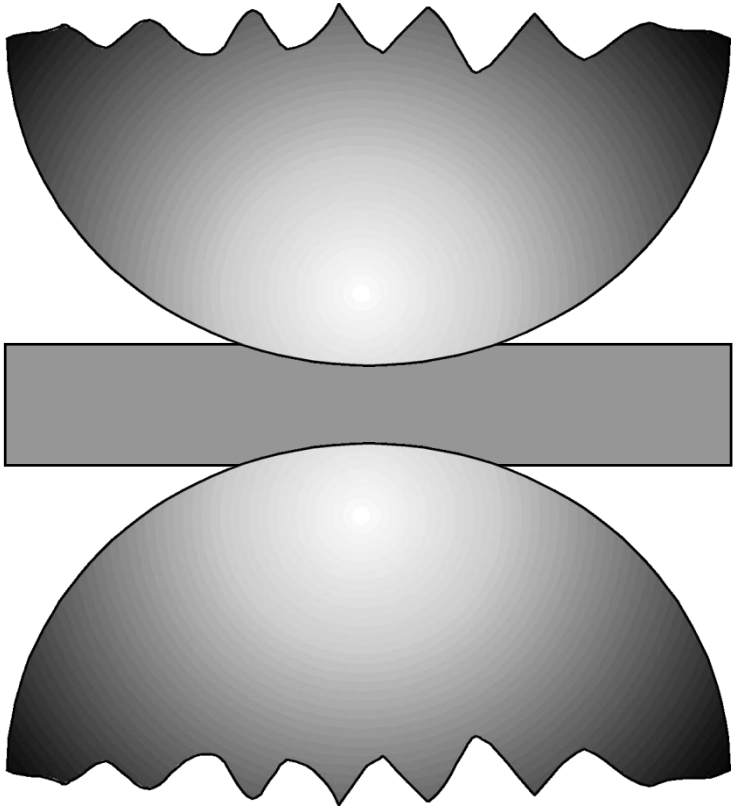
A seal is formed when the beads penetrate into the gasket

ZCR Sealing Beads



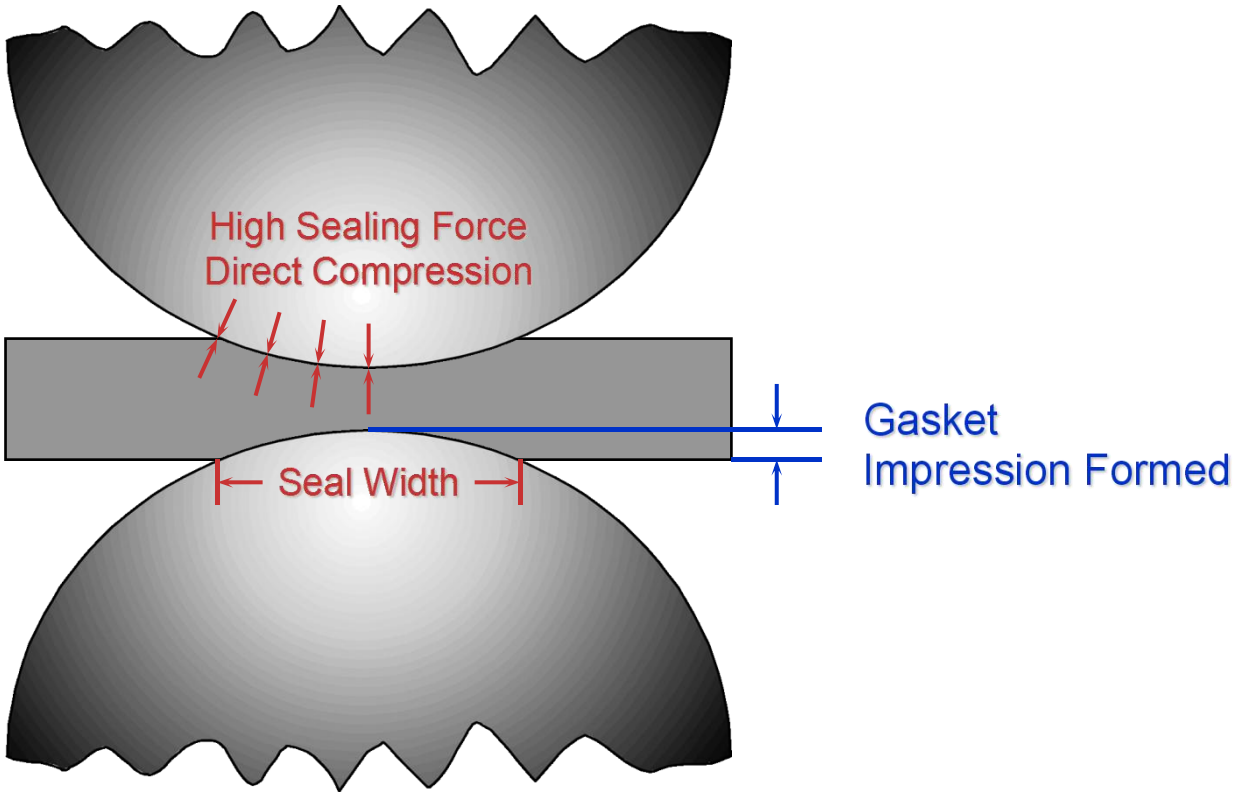
A seal is formed when the beads penetrate into the gasket

ZCR Sealing Beads



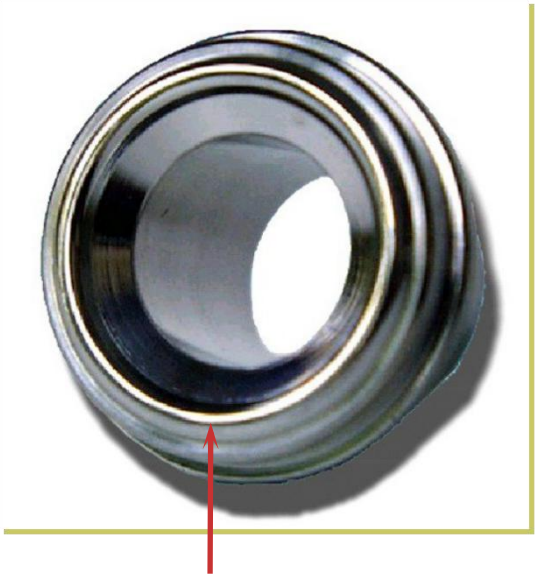
A seal is formed when the beads penetrate into the gasket

ZCR Sealing Beads



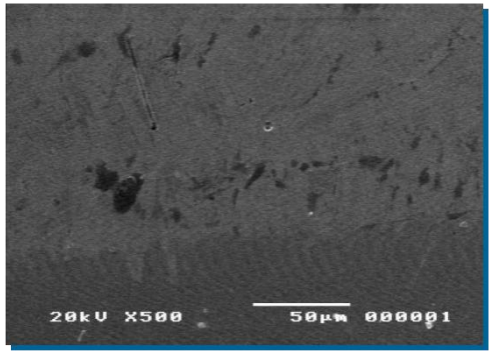
A seal is formed when the beads penetrate into the gasket

ZCR Seal Bead's Surface Finish

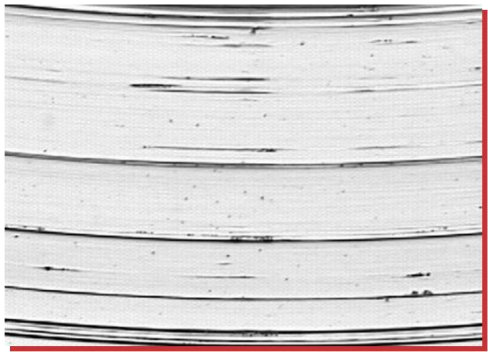


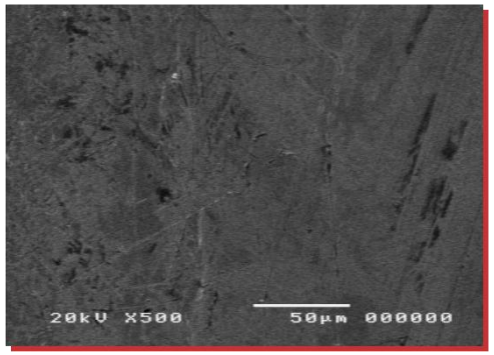
The highly polished bead's surface is critical to sealing formation





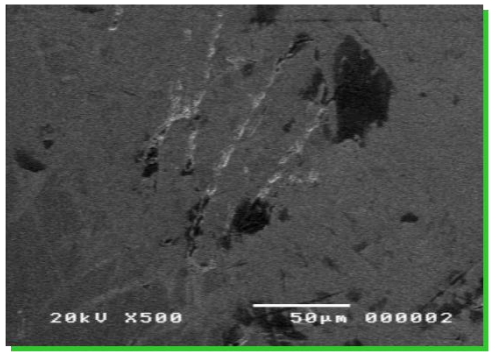
Hy-Lok





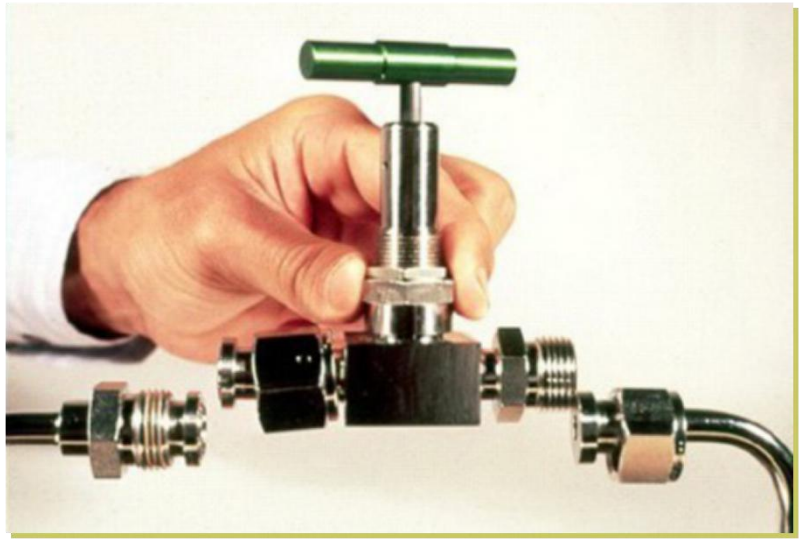
S 社

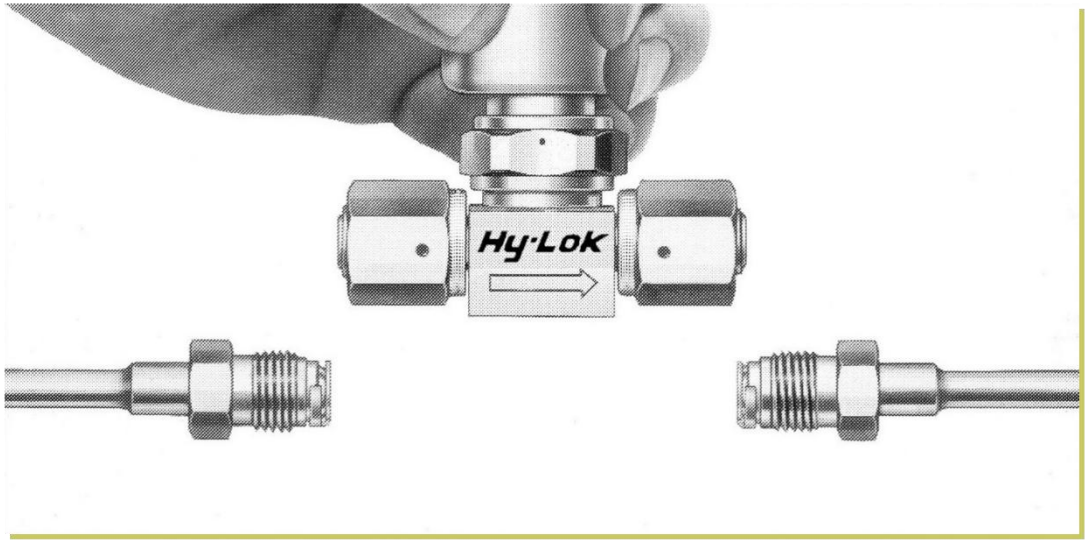




T 社

Zero Clearance Assembly





Components can be easily installed and removed.

Installation Precautions

Always Protect ZCR Seal Bead



Severely Damaged Seal Bead



Seal Bead Protection

Installation Precautions

Never Re-use the ZCR Metal Gasket



The existing bead impression may not align with the seal bead and a leak will occur at the intersection of the two impressions

Installation Precautions

Always Follow the Manufacturer's Installation Instructions



1/8 Turn

0.0069″ Impression



Hy-Lok Recommended Instruction



1/6 Turn

0.0093″ Impression





1/4 Turn

0.0139″ Impression



Installation Precautions

Over-tightening Damages the Seal Bead and Distorts the Gasket



3/8 Turn

0.0208″ Impression



1/2 Turn

0.0278″ Impression



5/8 Turn

0.0347″ Impression



3/4 Turn

0.0417″ Impression









ZCR Metal Gasket Face Seal Fitting Installation Reminders

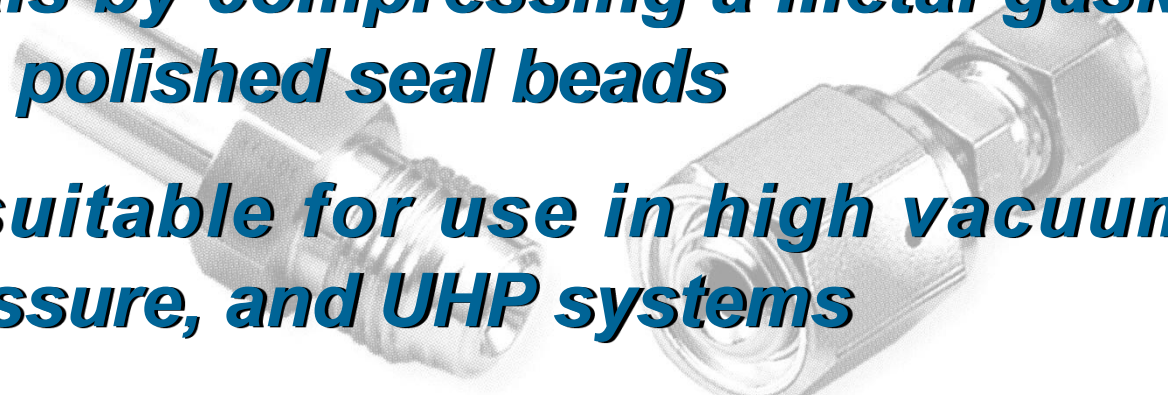


- Always use a back-up wrench
- Always inspect and protect seal bead
- Assembly is 1/8 turn past finger tight
- Always wear gloves for UHP systems
- Never connect two "non-rotatable"
- Never re-use the gasket
- Never let problems go unreported

ZCR Metal Gasket Face Seal Fitting Installation Reminders

The Hy-Lok ZCR Face Seal Fittings:

- Seals by compressing a metal gasket with two polished seal beads
- Is suitable for use in high vacuum, high pressure, and UHP systems
- Is a "zero clearance" assembly
- Is commonly available as end connection on valves, filters, regulators, gauges, etc.

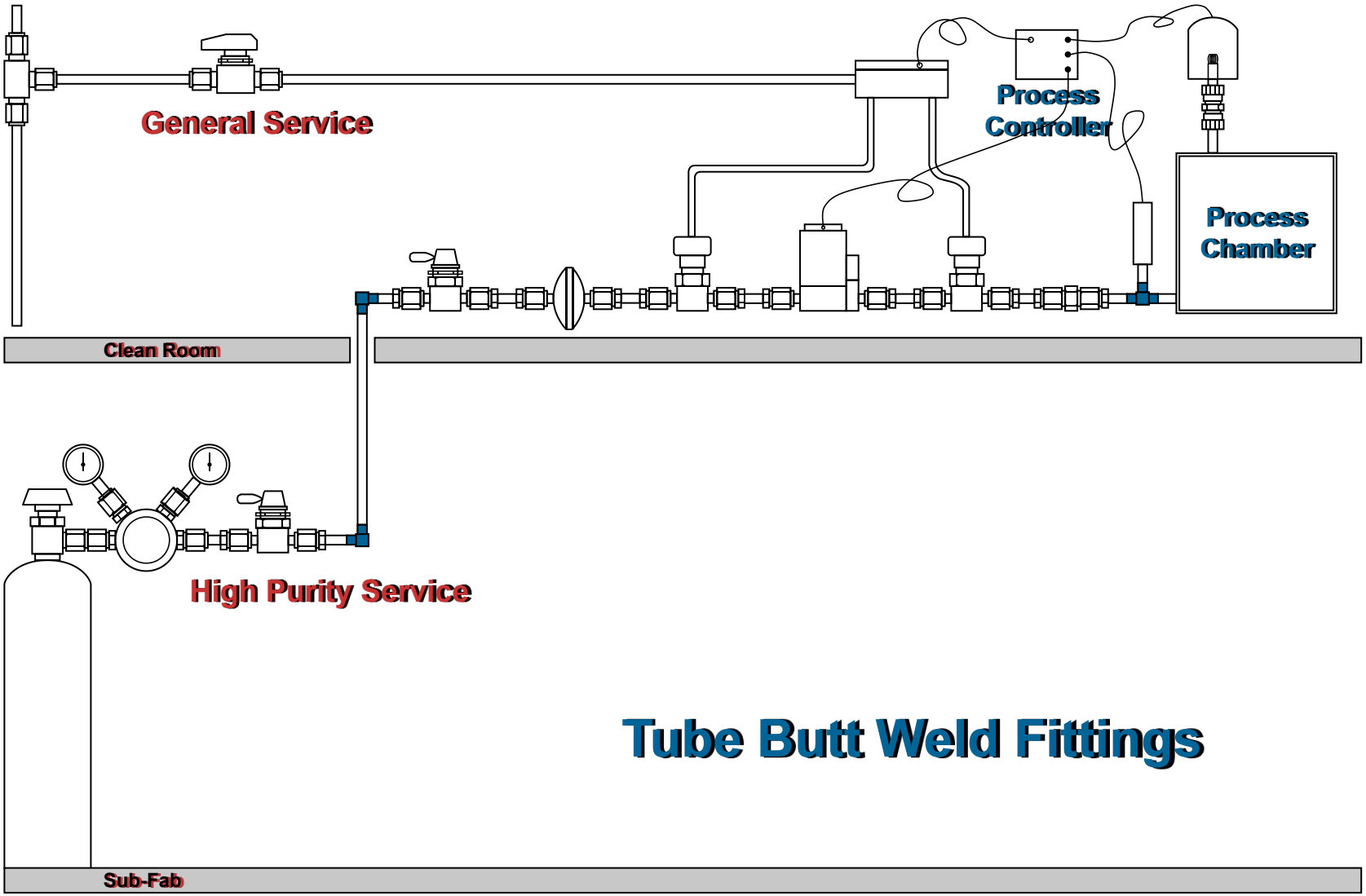


PART III. Ultra High Purity Components

2) Tube Butt Weld Fitting

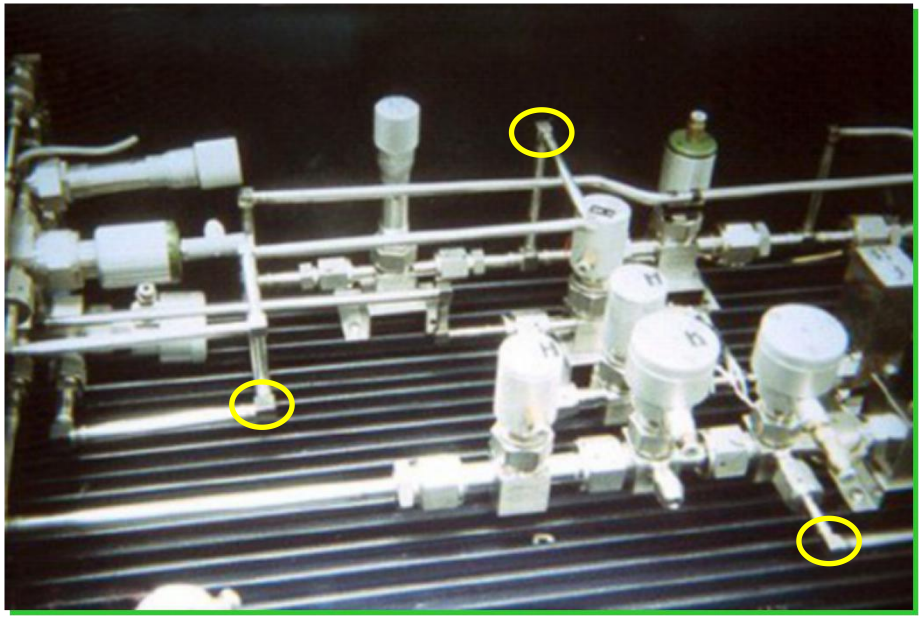


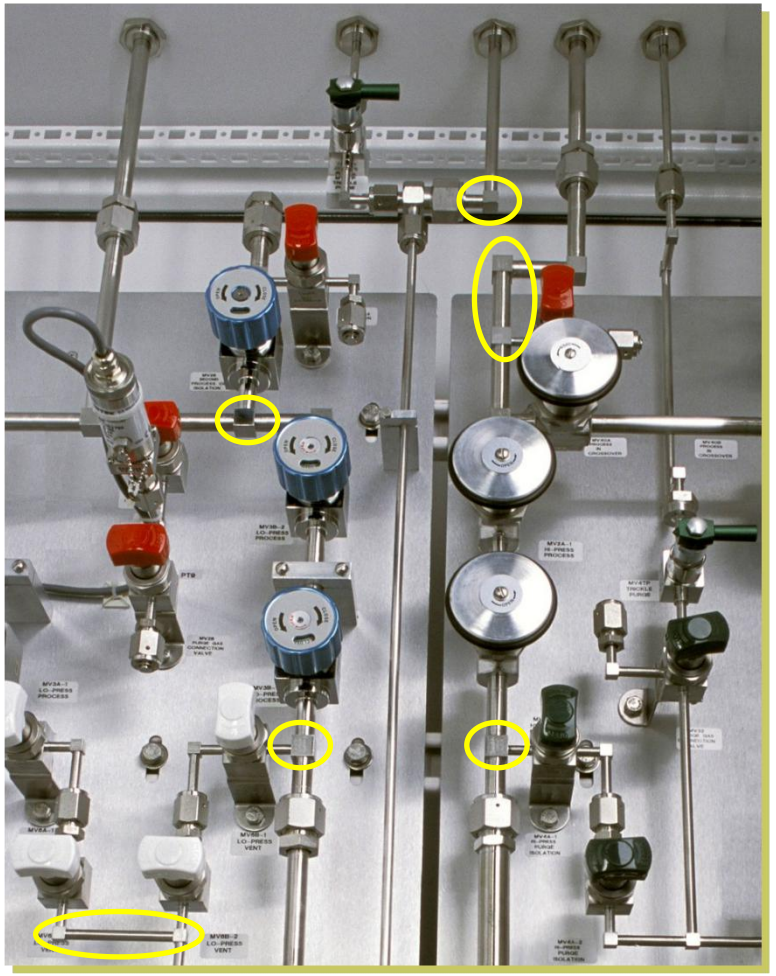
Ultra High Purity Gas Delivery System



Tube Butt Weld Fittings

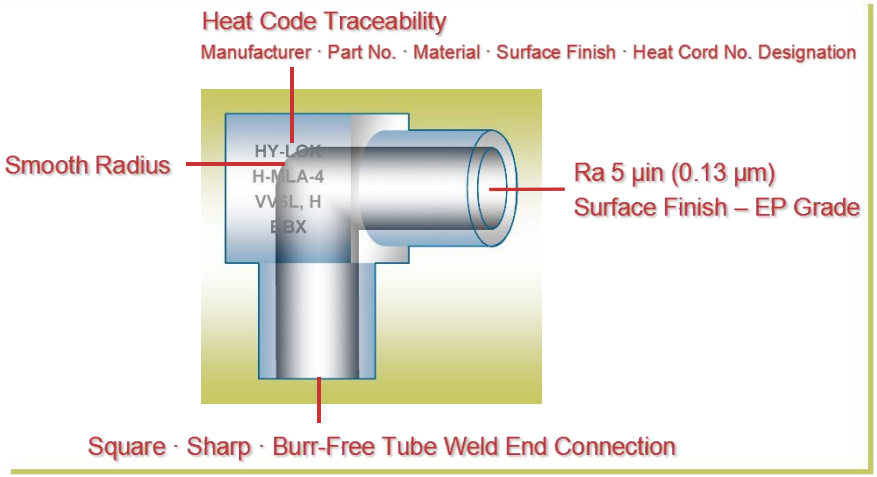
Ultra High Purity Gas Delivery System



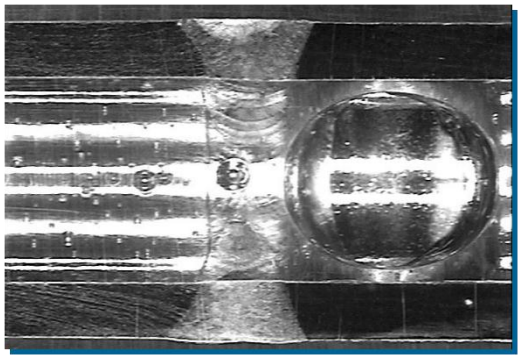


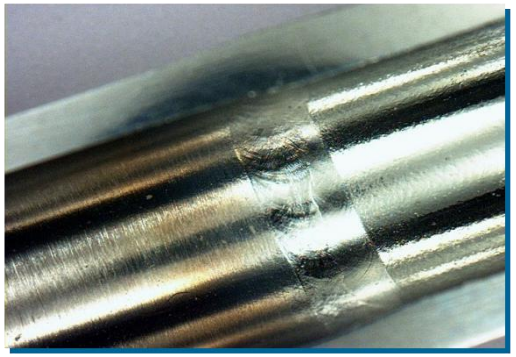
Tube Butt Weld Fittings

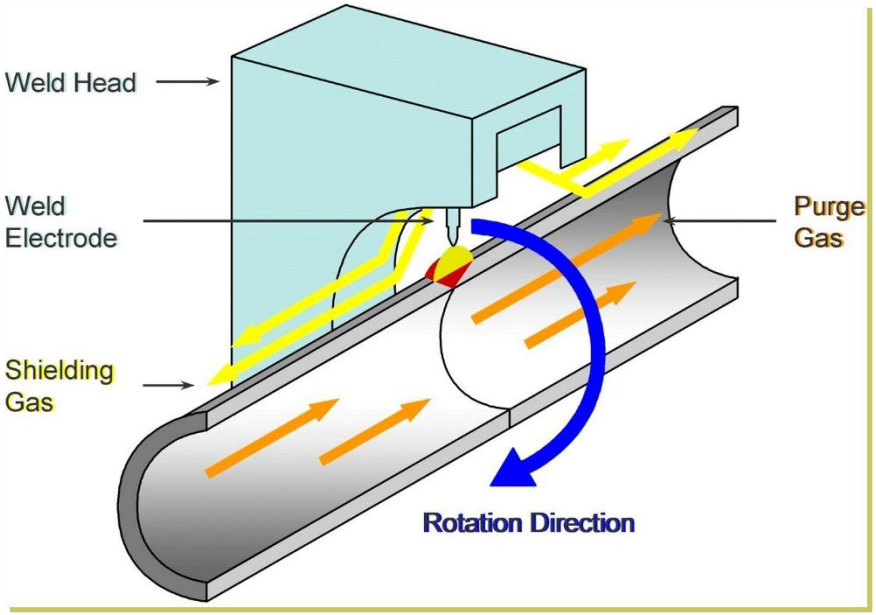
Tube Butt Weld Fitting

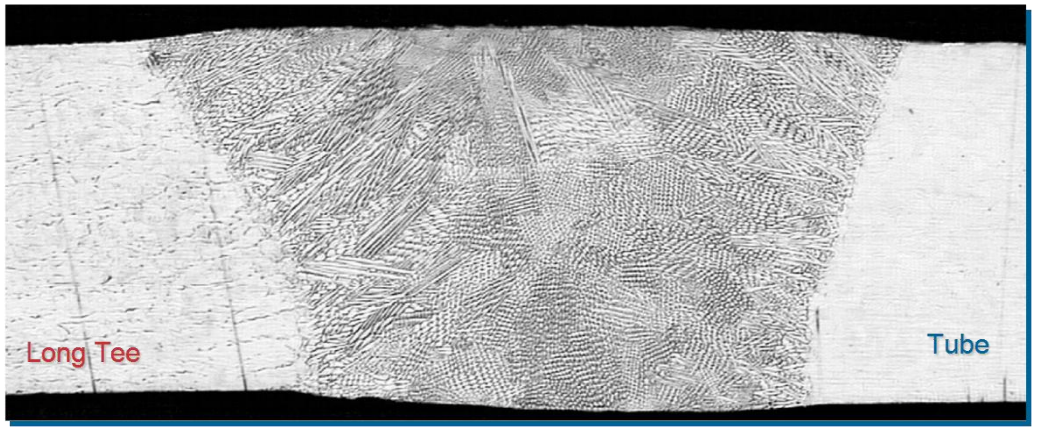


Cross Sectional Configuration of Weld Zone







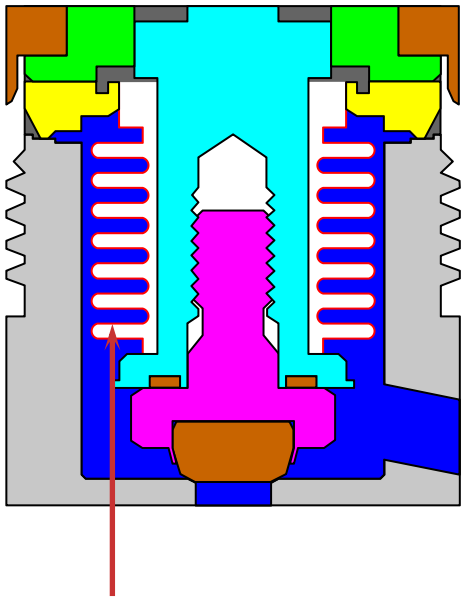


PART III. Ultra High Purity Components

3) Bellows Valve

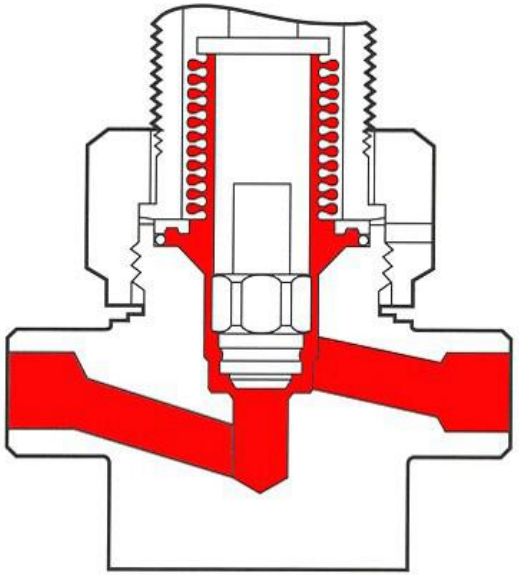


Bellows Valve

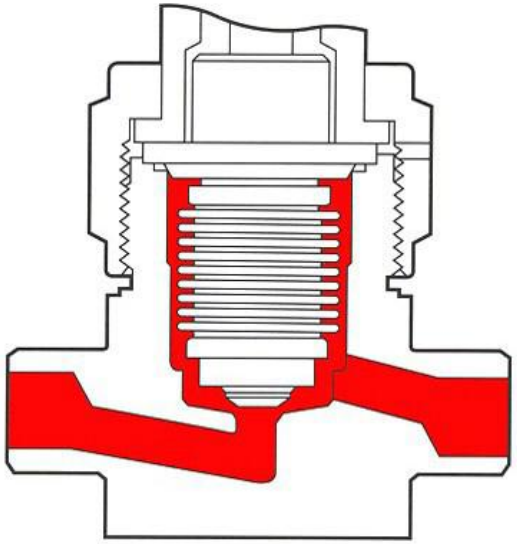


- The bellows valve is a compact valve designed for ultra-pure, toxic, or corrosive gas lines in various types of semiconductor manufacturing facilities.
- The bellows valve offers superior sealing performance, remarkable durability, compactness, ease of cleanliness, and excellent purge characteristics.
- The bellows-sealed valve incorporates a flexible metal bellows seal instead of the stem packing.
- The bellows is welded to the stem providing a very reliable seal.

Bellows Valve Design Comparison



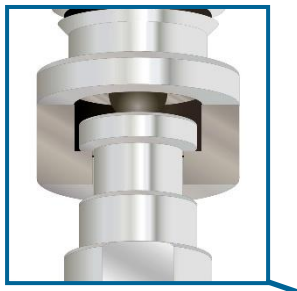
Conventional Bellows Valve



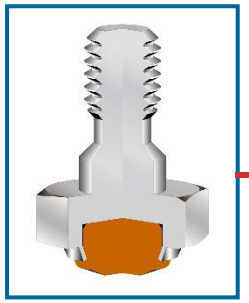
Improved Bellows Valve

- The conventional bellows valve is designed with the system pressure acting on the inside of the bellows. It can generate particles during operation.
- The improved design incorporate an metal bellows, with system pressure on the outside.
- The stem is externally guided, which eliminates internal rubbing and particle generation. Therefore, a valve has long cycle life, good purgeability, and minimal particle generation.

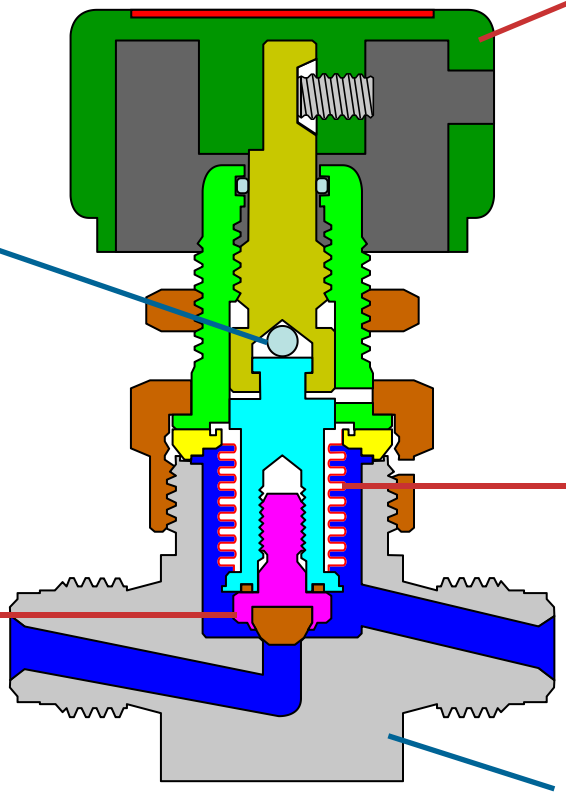
Characteristics of Bellows Valve



- Upper & Lower Stem
  - Ball bearing application between Up and Low Stem
  - Smooth Operation



- Stem Tip Ass'y
  - Non-rotating Stem Tip
  - Excellent Corrosion Resistance
  - Long Cycle Life



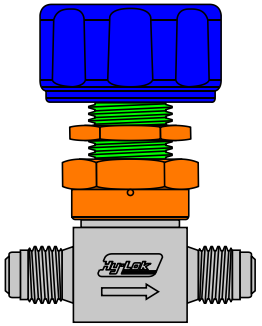
- Round · Toggle Handle & Pneumatic Actuator
- Body
  - Single Vacuum Melt 316L Stainless Steel
  - Variable End Connections



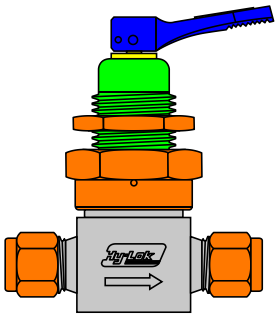
- Bellows Welded Ass'y
  - Precision formed Metal Bellows
  - Long Cycle Life

Characteristics of Bellows Valve

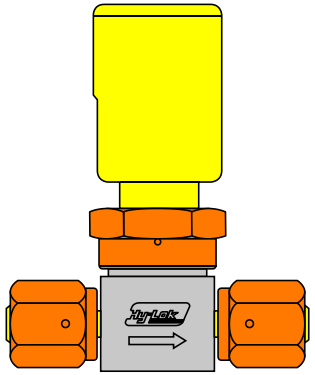
Size	End Connection Type	Handle Type
1/4"	Male ZCR Fitting Female ZCR Fitting Tube Butt Weld Hy-Lok Tube Fitting	Round · Toggle · Pneumatic Actuator
1/2"		
3/4"	Tube Butt Weld Hy-Lok Tube Fitting	Round Handle Pneumatic Actuator (Available)
1"		
1-1/4"		



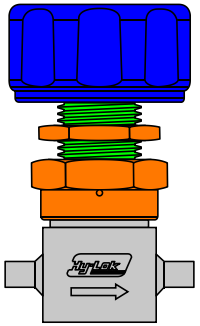
Round Handle
Male ZCR Fitting



Toggle Handle
Hy-Lok Tube Fitting



Pneumatic Actuator
Female ZCR Fitting



Round Handle
Tube Butt Weld

Characteristics of Bellows Valve

Bellows Valve Specification

Series	Orifice Inch (mm)	Cv	Pressure Rating psig (bar)	Temp. Rating ℉ (℃)
BLSV1	0.157 (4.0)	0.30	Round Handle : 500 (34.4) Toggle Handle : 125 (8.60) Normally Open : 400 (27.5) Normally Close : 125 (8.60) Open & Close : 400 (27.5)	-20 ~ 200 (-28 ~ 93)
BLSV2	0.276 (7.0)	0.65		

Bellows Valve Components Classifications

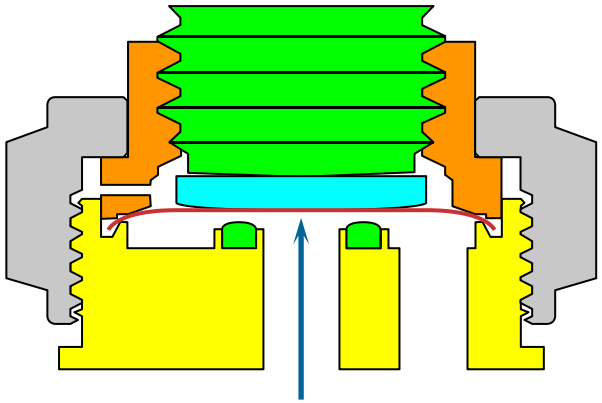
Component	Material	Supplier
Body	ASTM A479 Type 316L VOD STS	DAIDO STEEL (Japan)
Bellows	ASTM A269 Type 321 STS	
Stem Tip Gasket	PCTFE	DAIKIN

PART III. Ultra High Purity Components

4) Diaphragm Valve

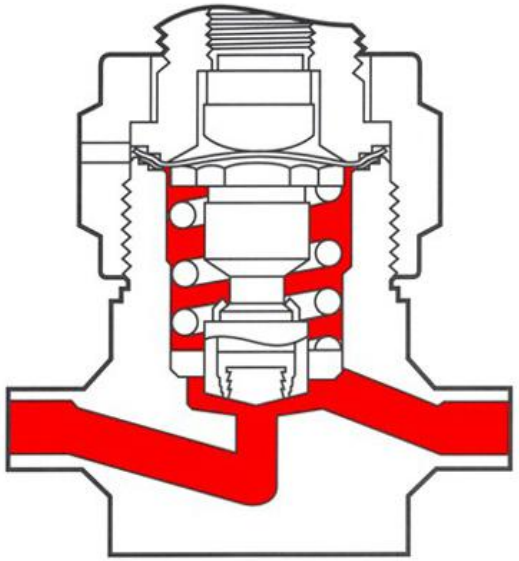


Diaphragm Valve

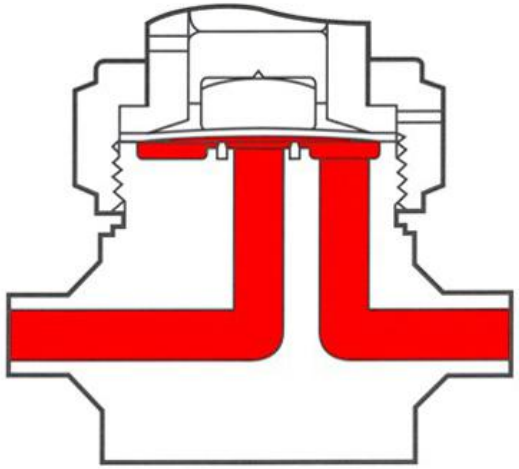


- The diaphragm valve is a packless valve for ultra-pure, toxic, or corrosive gas lines in various types of semiconductor manufacturing facilities.
- The metal diaphragm construction makes the diaphragm valve with superior sealing performance, remarkable durability, compactness, and particle and dead-space free performance.
- Diaphragm valves use metal diaphragms, which flex to open and close the valve, as the seal to atmosphere.

Diaphragm Valve Design Comparison



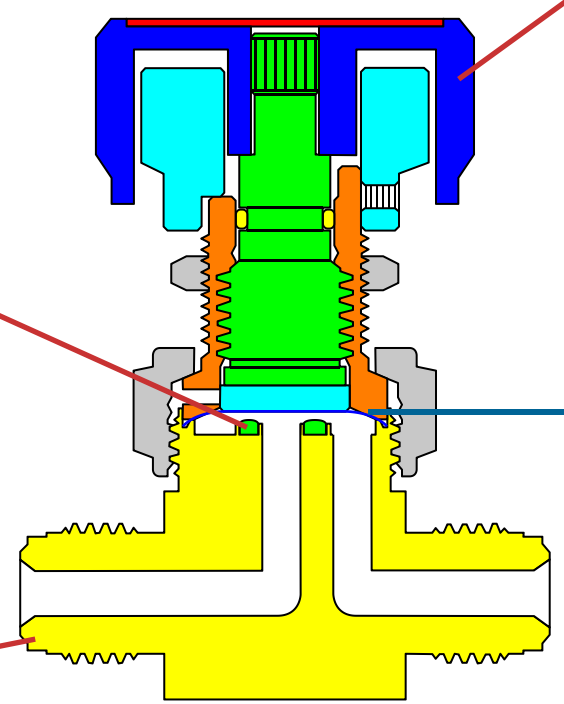
Spring Loaded Diaphragm Valve



Springless Diaphragm Valve

- The conventional design have a stem below the diaphragm for shut-off and a spring to open the valve.
- The newest springless diaphragm valves have no internal stem or spring.
- The diaphragm seals directly against the valve seat and flexes to open.
- The valve is closed by an external spring that limits the shut-off force, to prevent seat damage. This external spring is controlled by an air actuator or a quarter-turn manual handle.

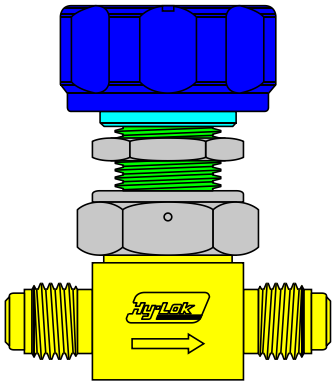
Characteristics of Diaphragm Valve



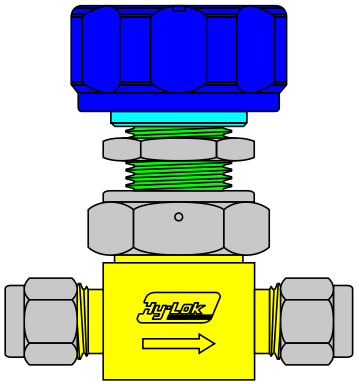
- Handle
  - Quick · Quarter-Turn Operation
  - Open / Close Indicator
- Seat
  - Excellent Corrosion Resistance
  - Minimal Particle Generation
  - Long Cycle Life
- Diaphragm
  - Elgiloy Material for Strength and Corrosion Resistance
  - Long Cycle Life
- Body
  - Double Vacuum Melt 316L Stainless Steel
  - Electro-Polishing Processing
  - Minimum Dead Volume
  - Maximum Flow Capacity

Characteristics of Diaphragm Valve

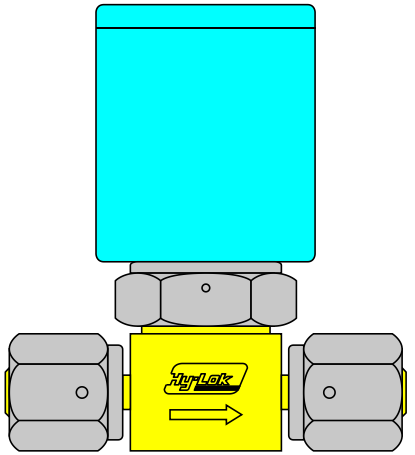
Size	End Connection Type	Handle Type
1/4"	Male ZCR Fitting Female ZCR Fitting Tube Butt Weld Hy-Lok Tube Fitting	Round Handle Pneumatic Actuator
1/2"		



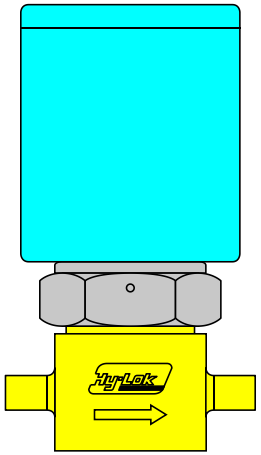
Manual Handle
ZCR Male End



Manual Handle
Hy-Lok Tube End



Pneumatic Actuator
ZCR Female End



Pneumatic Actuator
Tube Butt Weld End

Characteristics of Diaphragm Valve

Diaphragm Valve Specification

Series	Orifice Inch (mm)	Cv	Pressure Rating psig (bar)	Temp. Rating ℉ (℃)
1/4"	0.16 (4.0)	0.27	250 (17)	-10 ~ 150 (-23 ~ 65)
1/2"	0.25 (6.4)	0.70		

Diaphragm Valve Components Classifications

Component	Material	Supplier
Body	ASTM A479 Type 316L VIM+VAR STS	DAIDO STEEL (Japan) SUMITOMO METALS (Japan) Carpenter (USA)
Diaphragm	Elgiloy (Ni-Co Alloy)	Elgiloy Specialty Metals (USA)
Seat	PCTFE	DAIKIN

PART III. Ultra High Purity Components

5) Regulator



Regulator

- The main function of regulator is for converting a high p ressure to low pressure. Regulator is not used for adjus ting the fluid flow, it is only used for adjusting a pressur e.
- Regulator is classified by a variety of types as per servi ce condition, structure and characteristics such as type of gas, working pressure and flux. Single-stage pressur e-reducing type is mainly used in a semiconductor indu stry.



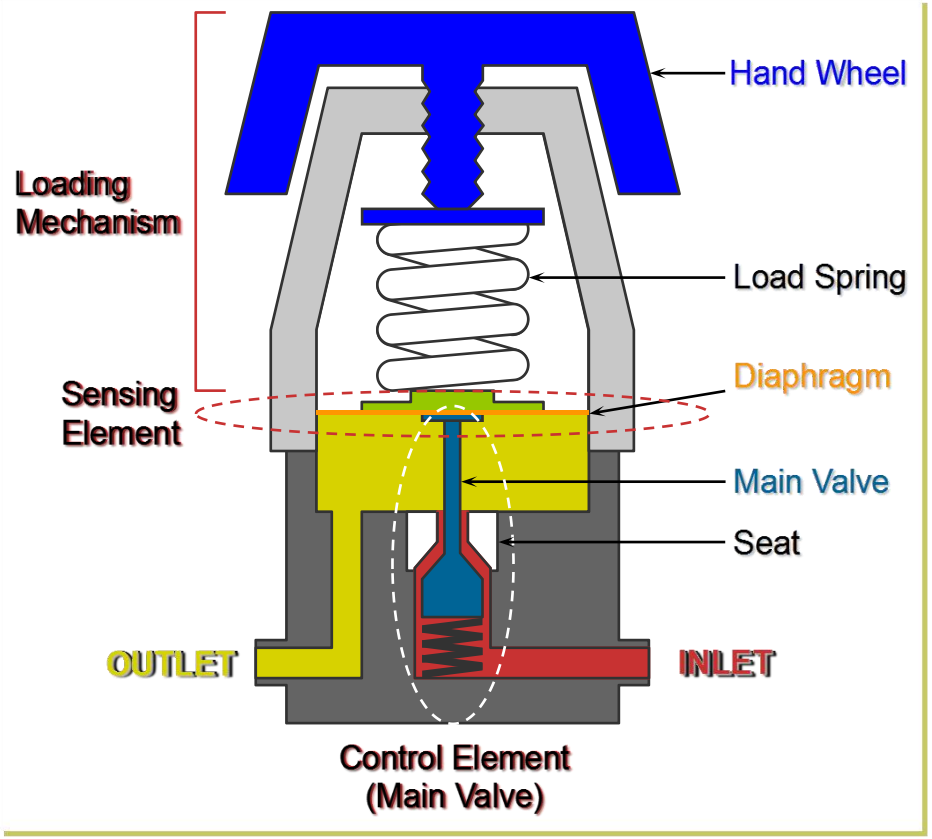
Function of Regulator

High Pressure Cylinder → **Workable Level**

Inlet Pressure (P1) → Outlet Pressure (P2)

Regulator

Construction of Regulator

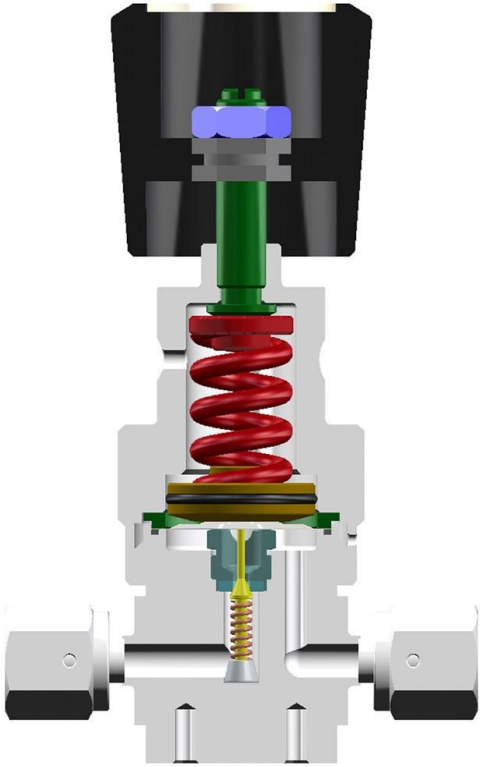


- Regulator is comprised of….
  - For setting outlet pressure
    - ⇨ Load Mechanism (Spring)
  - For Sensing a spring force(load)
    - ⇨ Sensing Element (Diaphragm)
  - For decreasing inlet pressure
    - ⇨ Control Element (Main Valve)

Regulator

HPGR-400S

- Single Stage
- Free Poppet Type
- Metal-to-Metal Body to Diaphragm Seal



Regulator

Regulator Components Classifications

Component	Material	Grade	Remarks
Body	Single Vacuum Melt 316L STS	BA	10 Ra μin
	Double Vacuum Melt 316L STS	EP	5 Ra μin
Diaphragm	Hastelloy C-22	600 psig	
	Elgiloy (Ni-Co Alloy)	3500 psig	
Seat	PCTFE	-40℉ to +140 ℉ (-40℃ to +60 ℃)	