O P E R A T I N G M A N U A L

Standard, Compact, Dual

Sensors

IPN 074–156

INFICON

O P E R A T I N G M A N U A L

Standard, Compact, Dual Sensors

IPN 074-156K

INFICON Instruments for Intelligent Control™

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Using the table below, please circle the appropriate rank for each aspect.
In the Importance column, please indicate the importance of each aspect.

Manual Title _____

Part # (see Title Page) 074-_____

Aspect	Very Dissatisfied	Dissatisfied	No Opinion	Satisfied	Very Satisfied	Importance (ranked from 1 to 5, where 1 is low and 5 is high)
Found everything I needed	VD	D	NO	S	VS	
Easy to read	VD	D	NO	S	VS	
Easy to use	VD	D	NO	S	VS	
Relevant to my work	VD	D	NO	S	VS	
Accurate information	VD	D	NO	S	VS	
Well-written	VD	D	NO	S	VS	
Well-organized	VD	D	NO	S	VS	
Technical Enough	VD	D	NO	S	VS	
Helped me solve problems	VD	D	NO	S	VS	

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NOTE: These instructions do not provide for every contingency that may arise in connection with the installation, operation or maintenance of this equipment. Should you require further assistance, please contact INFICON.

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Chapter 6

Crystal Sensor Emulator IPN 760-601-G1

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Chapter 1
Sensor Specifications

1.1 Definition of Notes, Cautions and Warnings

Before using this manual, please take a moment to understand the Cautions and Warnings used throughout. They provide pertinent information that is useful in achieving maximum instrument efficiency while ensuring personal safety.

NOTE: Notes provide additional information about the current topic.

HINT: Hints provide insight into product usage.

CAUTION

Failure to heed these messages could result in damage to the instrument.

WARNING

Failure to heed these messages could result in personal injury.

WARNING - Risk Of Electric Shock

Dangerous voltages are present which could result in personal injury.

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1.2 How to Contact Customer Support

If you need assistance with your sensor, please read this Operating Manual before contacting Customer Support. If you can not find the answer in this manual, decide whether:

- Your sensor functions, but it does not work for your application — request Application Assistance.
- Your sensor functions, but you need to know how to use it — request Technical Support.
- Your sensor does not function (it's broken) — request Repair Services.
- You need to order parts — request Order Services.

When you contact Customer Support, please have the following information readily available:

- The Lot Identification Code for your sensor. For the location of the Lot Identification Code, see the side surface of the sensor head.
- A description of your problem.
- An explanation of any corrective action that you may have already attempted.
- The exact wording of any error messages that you have received.

To contact Customer Support. refer to the contact list located at the front of this manual. Or, contact your sales office. Or, see the www.inficon.com website.

1.2.1 Returning Your Sensor to INFICON

Do not return any component of your sensor to INFICON without first speaking with a Customer Support Representative. You must obtain a Return Material Authorization (RMA) number from the Customer Support Representative.

If you deliver a package to INFICON without an RMA number, your package will be held and you will be contacted. This will result in delays in servicing your sensor.

Prior to being given an RMA number, you will be required to complete a Declaration Of Contamination (DOC) form if your sensor has been exposed to process materials. DOC forms must be approved by INFICON before an RMA number is issued. INFICON may require that the sensor be sent to a designated decontamination facility, not to the factory. Failure to follow these procedures will delay the repair of your sensor.

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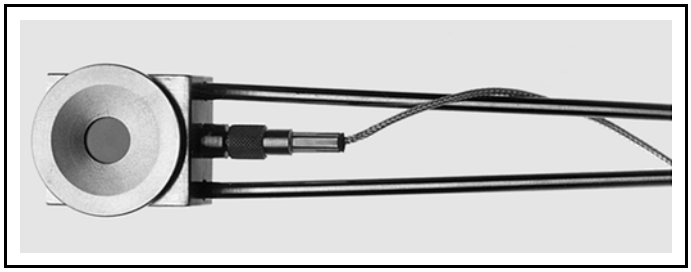
1.3 Specifications for the Standard Crystal Sensor (IPN 750-207-G1)

Figure 1-1 Standard Sensor



Maximum bakeout temp with no water: . . . . 130 °C

Maximum operating isothermal environment temperature with minimum water flow:. . . . . 400 °C

Size
(maximum envelope without shutter): . . . . . 1.063 in. x 2.42 in. x 0.69 in. (27 mm x 61.47 mm x 17.53 cm)

Water tube and coax length:. . . . . Standard 30 in. (762 mm), 1/8 in. (3.175 mm) O.D. seamless stainless steel

Crystal exchange:. . . . . Front loading; self-contained package for ease of exchange

Mounting: . . . . . Two #4-40 tapped holes on the back of the sensor body.

1.3.1 Installation Requirements

Feedthrough	2 pass water 3/16 in. (4.8 mm) O.D. tubing with Microdot® coax connector
Other	1. Customer to provide vacuum-tight braze joints or connectors for the water tubes. 2. XIU or Oscillator to match specific controller.
Water Flow Rate	Minimum water flow 150-200 cc/min, 30 °C max.
Water Quality	Coolant should not contain chlorides as stress corrosion cracking may occur. Extremely dirty water may result in loss of cooling capacity.

CAUTION

Do not allow water tubes to freeze. This may happen if the tubes pass through a cryogenic shroud and the fluid's flow is interrupted.

1.3.2 Materials

Body and Holder	304 type stainless steel
Springs, Electrical Contacts	Au plated Be-Cu
Water tubes	S-304, 0.125 in. (3.175 mm) O.D. x 0.015 in. (0.381 mm) wall thickness x 30 in. (762 mm) long seamless stainless steel tubing
Connector (Microdot)	Stainless steel, Teflon® and glass insulated
Insulators	>99% Al_2O_3
Wire	Teflon insulated copper
Braze	Vacuum process high temperature Ni-Cr alloy
Crystal	0.550 in. (13.97 mm) Diameter

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1.3.3 Unpacking Instructions

The sensor and accessories are packaged in a single cardboard carton with rigid foam insert.

Carefully remove the packaged accessories before removing the sensor.

1.3.4 Inventory

In addition to the basic transducer, the complete shipping package includes the following:

Qty	IPN	Description
1	074-156	Operating Manual—Standard, Compact and Dual Sensors
1	008-010-G10	Assembly, Sensor Crystal 6MHz (10 pieces)
1	750-037	Spring Tube Bender Kit
1	008-007	Crystal Snatcher
1	750-191-G1	Molybdenumdisulfide in Alcohol

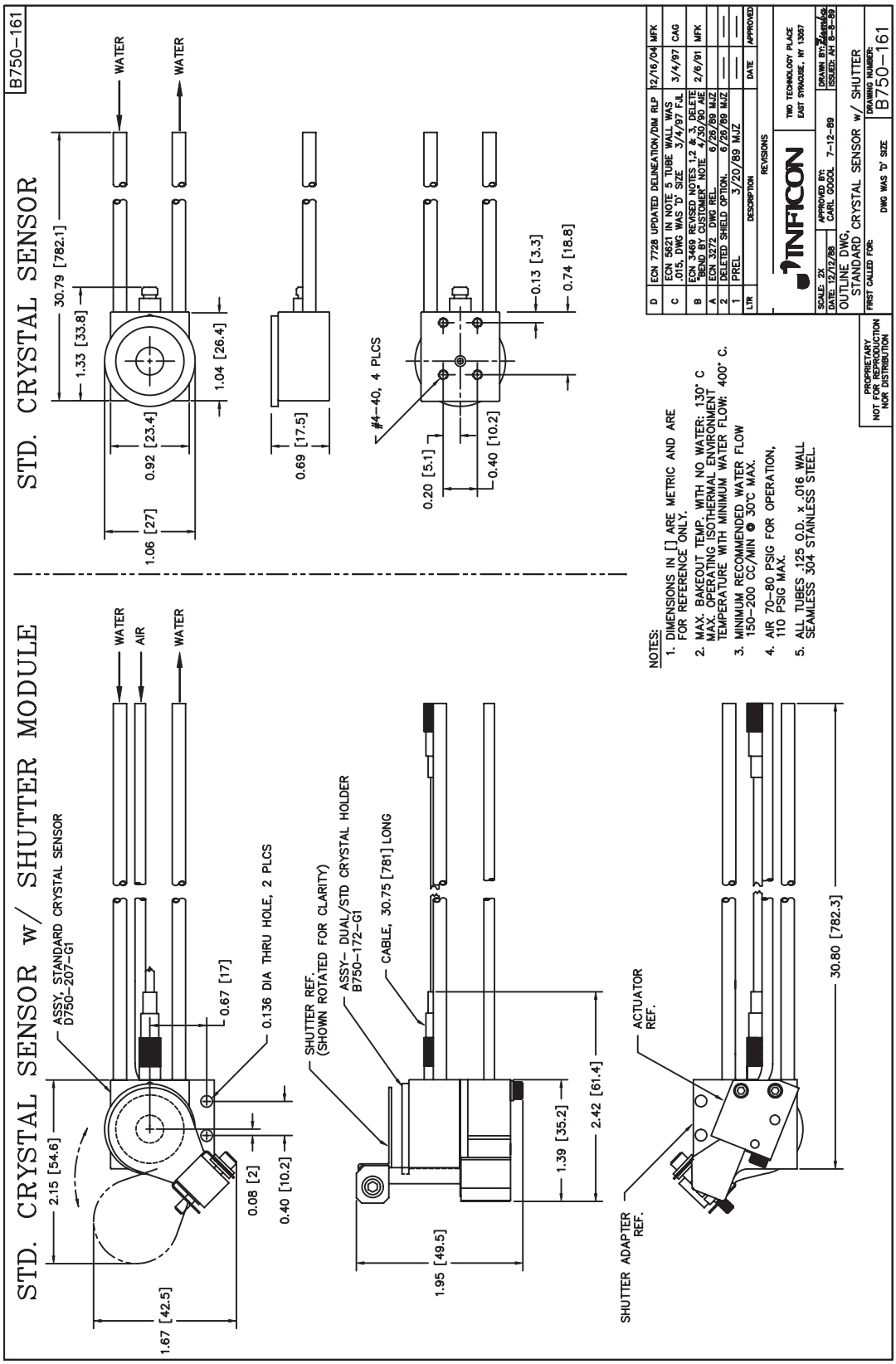

Figure 1-2 750-161 Standard Crystal Sensor with Shutter

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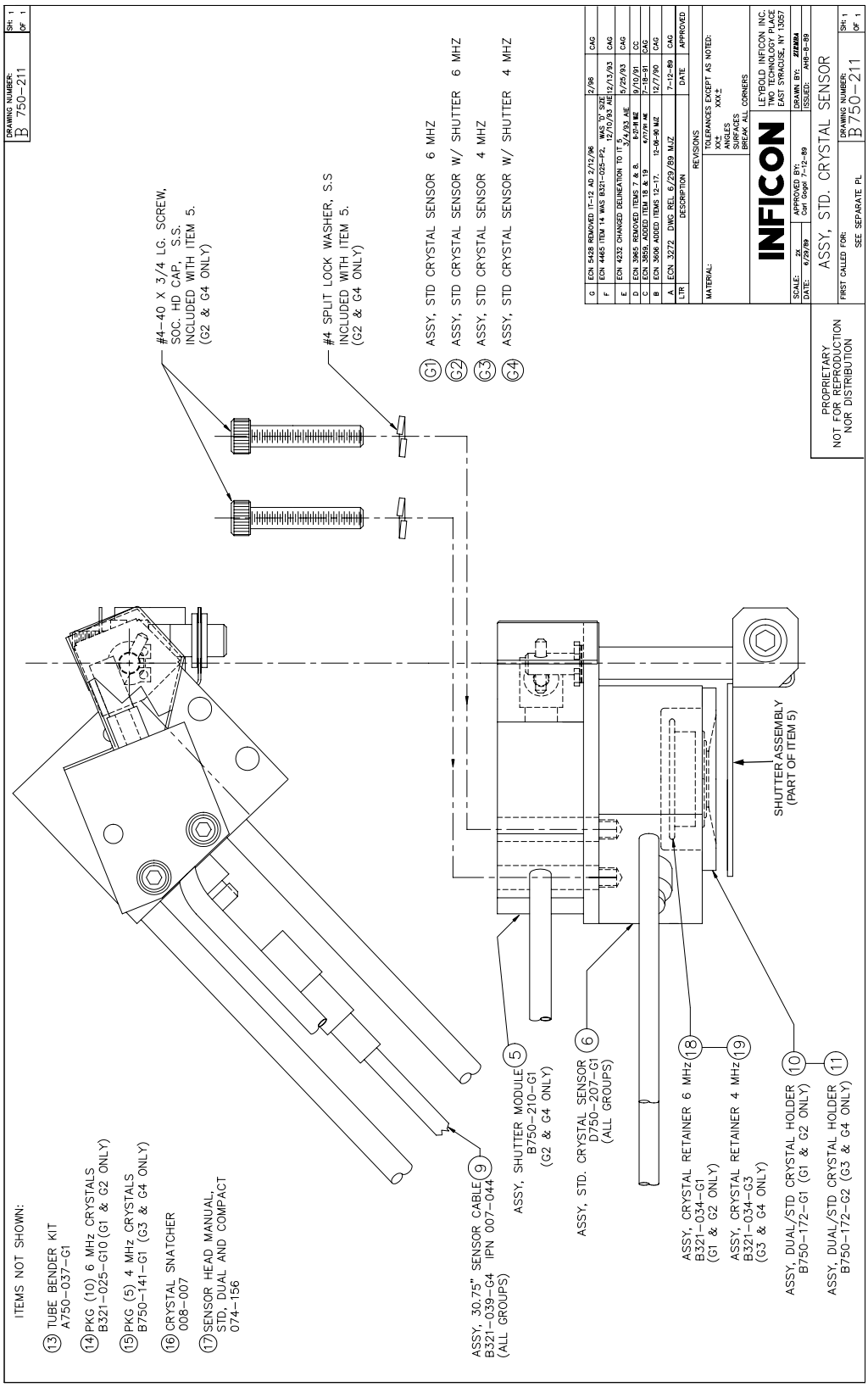

Figure 1-3 750-211 Assembly, Standard Crystal Sensor

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1.4 Maintenance

The maintenance requirements apply to the Standard, Compact and Dual crystal sensors.

1.4.1 Crystal Sensor: Replacing the Spring Contact

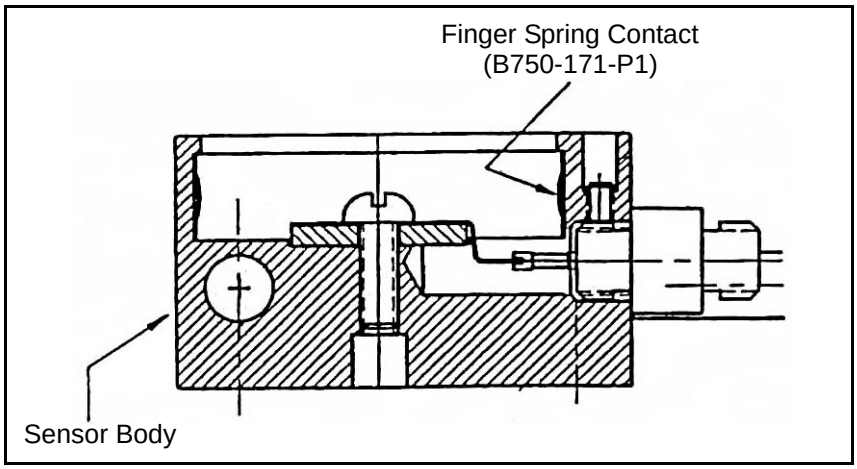
The spring contact (IPN 750-171-P1) that retains the crystal holder assembly in the crystal sensor must be replaced when it begins to exhibit reduced holder retention or when the sensor has been subjected to an environment exceeding the 130 °C temperature specification. Our studies indicate that subjecting the spring contact to 4000 holder extractions reduces the magnitude of the extraction force one pound. The 4000 extractions represent the recommended life expectancy of the spring and subsequently it should be replaced.

Replacing the finger contact. (See Figure 1-3 and Figure 1-4.)

1. Extract the crystal holder assembly (item #10 of Figure 1-3).
2. Remove the finger spring contact with a pair of tweezers. (See Figure 1-4.)
3. Insert the new finger spring contact, allowing it to expand and conform to the inner diameter of the sensor assembly as shown in Figure 1-4.

   NOTE: The finger springs are formed and heat treated to a diameter that is larger than the diameter of its groove to aid in assembly and retention.
4. Run your finger along the inner lip of the sensor assembly to verify that the spring contact is contained in the recess provided and that the spring has not overlapped onto itself. This will ensure that the spring contact will not be damaged during holder installation.
5. Insert the crystal holder assembly.

Figure 1-4 Spring Contact Replacement



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1.5 Troubleshooting

A useful tool for diagnosing sensor head problems is the DVM (Digital Volt Meter). Disconnect the short oscillator cable from the feedthrough and measure the resistance from the center pin to ground. If the reading is less than 1-2 megohms the source of the leakage should be found and corrected. Likewise, with the vacuum system open, check for center conductor continuity, a reading of more than 1Ω from the feedthrough to the transducer contact indicates a problem. Cleaning contacts or replacing the in-vacuum cable may be required.

Another useful diagnostic is to continuity-test the sensor head without a crystal. Install the ceramic retainer into the crystal holder without a crystal and place into the sensor body. The DVM should measure 1Ω or less from the center pin of the feedthrough to ground. Replacing the in-vacuum cable or reforming the leaf springs may be required.

A very useful tool for rapidly evaluating the cause of a persistent "Crystal Fail" is the optional 760-601-G1 Crystal Sensor Emulator. It is designed to rapidly replace various sensor components to validate proper operation and thereby eliminate them as being possibly defective. This tool utilizes a packaged crystal at 5.5 MHz and has connectors that allow the direct connection of either BNC or Microdot RF cables, or it may be directly plugged into the Standard, Compact, or Dual transducers of the 750 series. The use of the Crystal Sensor Emulator will sometimes identify problems not readily diagnosed with a DVM. See Chapter 6 for more information on the Crystal Sensor Emulator.

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Table 1-1 Symptom - Cause - Remedy Chart

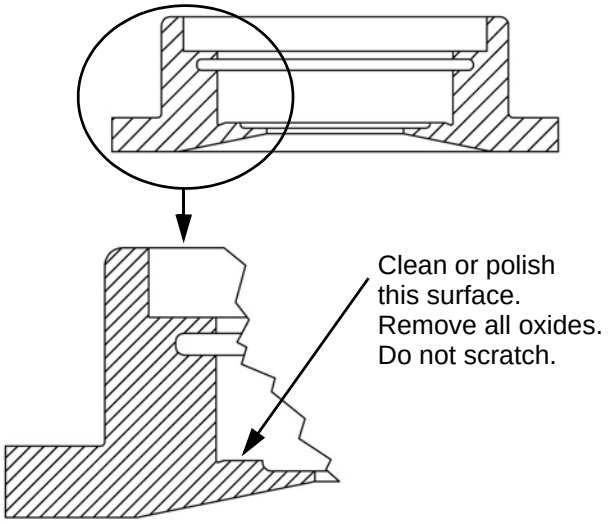
SYMPTOM	CAUSE	REMEDY
Large jumps of thickness reading during deposition.	Mode hopping due to damaged crystal.	Replace the crystal.
	Crystal is near the end of its life.	Replace the crystal.
	Scratches or foreign particles on the crystal holder seating surface.	Clean or polish the crystal seating surface on the crystal holder. See illustration below.
		
	Uneven coating.	Square sensor to source. See section 2.3.1 on page 2-5.
	Particles	Remove source of particles.

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Table 1-1 Symptom - Cause - Remedy Chart (continued)

SYMPTOM	CAUSE	REMEDY
Crystal ceases to oscillate during deposition before it reaches its “normal” life	Crystal is being hit by small droplets of molten material from the evaporation source.	Use a shutter to shield the sensor during initial period of evaporation; move the sensor further away.
	Damaged crystal.	Replace the crystal.
	Built-up material on edge of crystal holder is touching the crystal.	The crystal cover can not have a build up of blown in deposition material. This material may create an unreliable connection to the crystal. Removal of the deposition material is a maintenance necessity. Do not allow seat to get roughened by the removal process.
	Material on crystal holder is partially masking the full crystal area.	Clean the crystal holder.

NOTE: Crystal life is highly dependent on process conditions of rate, power radiated from source, location, material, and residual gas composition.

Crystal does not oscillate or oscillates intermittently (both in vacuum and in air).	Damaged crystal.	Replace the crystal.
	Existence of electrical short or poor electrical contacts.	Check for electrical continuity and short in sensor cable, connector, contact springs, and the connecting wire inside the sensor; check for electrical continuity in feedthroughs.

NOTE: Contact spring shape should be observed as part of a routine maintenance inspection. Insufficient bends or deformities in the spring contacts in the sensor body are common “crystal problems". Lift each spring up approximately 60°. See section 4.1.6 on page 4-2.

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Table 1-1 Symptom - Cause - Remedy Chart (continued)

SYMPTOM	CAUSE	REMEDY
Crystal oscillates in vacuum but stops oscillation after open to air.	Crystal was near the end of its life; opening to air causes film oxidation, which increases film stress.	Replace the crystal.
	Excessive moisture accumulation on the crystal.	Turn off cooling water to sensor before opening it to air; flow hot water through the sensor when the chamber is open.
Thermal instability: large changes in thickness reading during source warm-up (usually causes thickness reading to decrease) and after the termination of deposition (usually causes thickness reading to increase).	Crystal not properly seated.	Check and clean the crystal seating surface of the crystal holder. See illustration on see page 1-10.
	Excessive heat input to the crystal.	If heat is due to radiation from the evaporation source, move sensor further away from source and use sputtering crystals for better thermal stability; if the source of crystal heating is due to a secondary electron beam, change regular sensor to a sputtering sensor
	No cooling water.	Check cooling water flow rate (refer to see page 1-4).
	Heat induced from electron flux.	Use sputtering head for DC or RF sputtering.

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Table 1-1 Symptom - Cause - Remedy Chart (continued)

SYMPTOM	CAUSE	REMEDY
Poor thickness reproducibility.	Erratic source emission characteristics	Move sensor to a different location; check the evaporation source for proper operating conditions; insure relatively constant pool height and avoid tunneling into the melt.
		Use multiple sensor option if available on controller.
	Material does not adhere to the crystal.	Check the cleanliness of the crystal's surface; evaporate an intermediate layer of proper material on the crystal to improve adhesion. Use silver or gold coated crystals, as appropriate.

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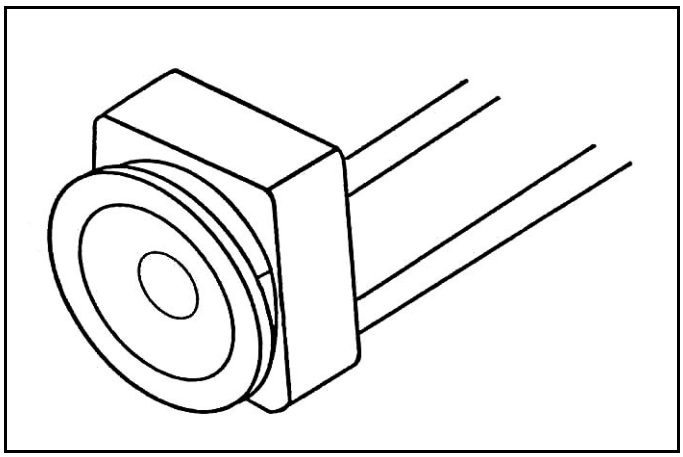
1.6 Specifications for the Compact (Vertical) Crystal Sensor (IPN 750-209-G1)

Figure 1-5 Compact (Vertical) Sensor



Maximum bakeout temp with no water. . . . . 130 °C

Maximum operating isothermal environment temperature with minimum water flow . . . . . 400 °C

Size
(maximum envelope without shutter) . . . . . 1.11 in. x 1.06 in. x 1.06 in.
(28.19 mm x 26.92 mm x 26.92 mm

Water tube and coax length . . . . . Standard 30 in. (762 mm), 0.125 in. (3.175 mm) O.D. seamless 304 stainless steel

Crystal exchange . . . . . Front-loading, self-contained package for ease of exchange

Mounting . . . . . Two #4-40 tapped holes on the back of the sensor body

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1.6.1 Installation Requirements

Feedthrough	2 pass water 0.187 in. (4.75 mm) O.D. with Microdot coaxial connector
Other	1) Customer to provide vacuum-tight braze joints or connectors for the water tubes. 2) XIU or Oscillator to match specific controller.
Utilities	Minimum water flow 150-200 cc/min, 30 °C max. (Do not allow to freeze.)
Water Quality	Coolant should not contain chlorides as stress corrosion cracking may occur. Extremely dirty water may result in loss of cooling capacity.

CAUTION

Do not allow water tubes to freeze. This may happen if the tubes pass through a cryogenic shroud and the fluid's flow is interrupted.

1.6.2 Materials

Body and Holder	304 Type stainless steel
Springs	Au plated Be-Cu
Water tubes	S-304, 0.125 in. (3.175 mm) OD x 0.015 in. (.381 mm) wall thickness
Connector (Microdot)	Stainless steel, Teflon and glass insulated
Insulators	>99% Al_2O_3
Wire	Teflon insulated copper
Braze	Vacuum process high temperature Ni-Cr alloy
Crystal	0.550 in. (13.97 mm) diameter

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1.6.3 Unpacking and Inventory

Refer to section 1.3.3 on page 1-5 and section 1.3.4 on page 1-5.

1.6.4 Maintenance

Refer to section 1.4 on page 1-8.

1.6.5 Troubleshooting

Refer to section 1.5 on page 1-9.

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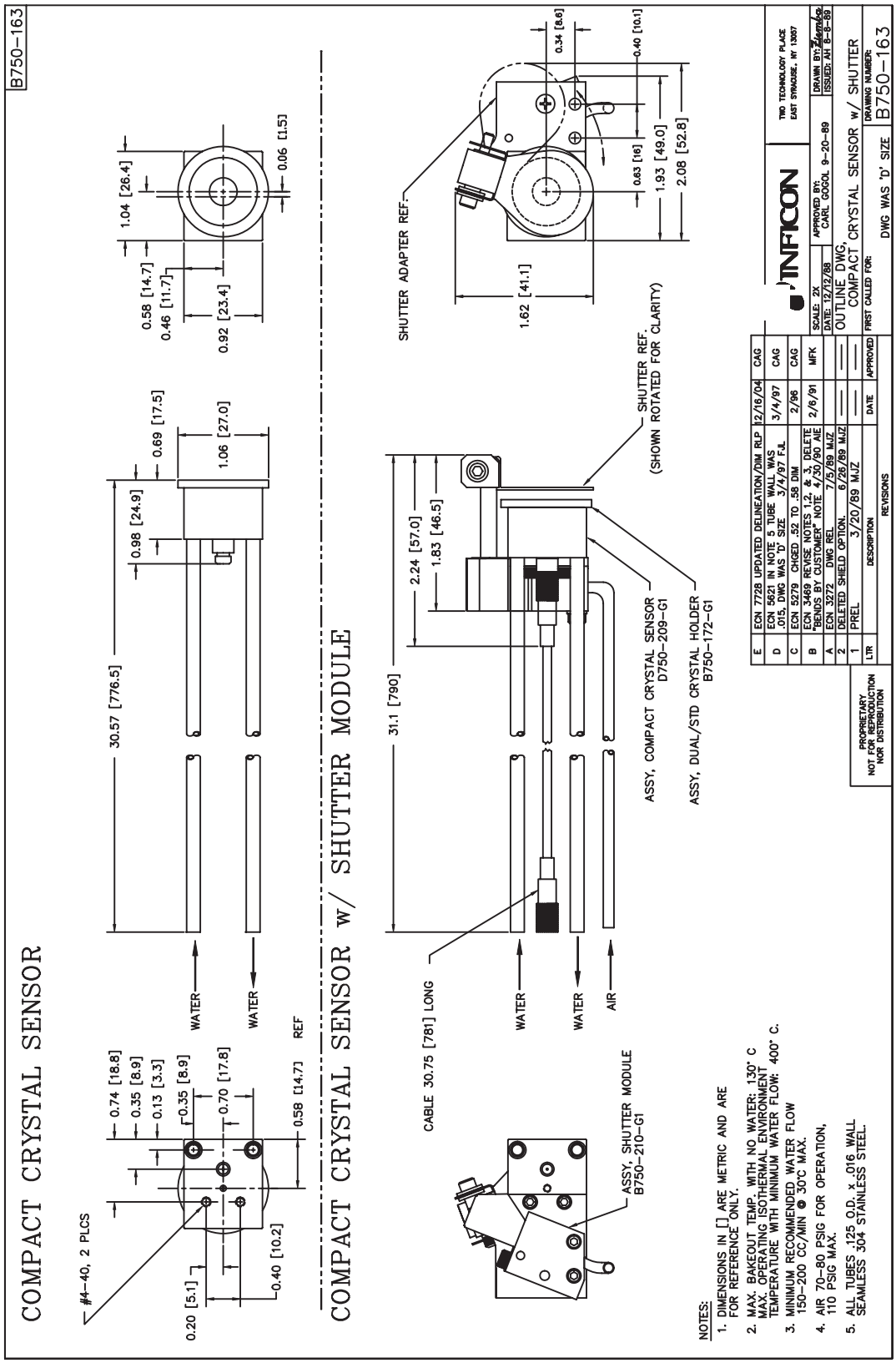

Figure 1-6 750-163 Compact Crystal Sensor with Shutter

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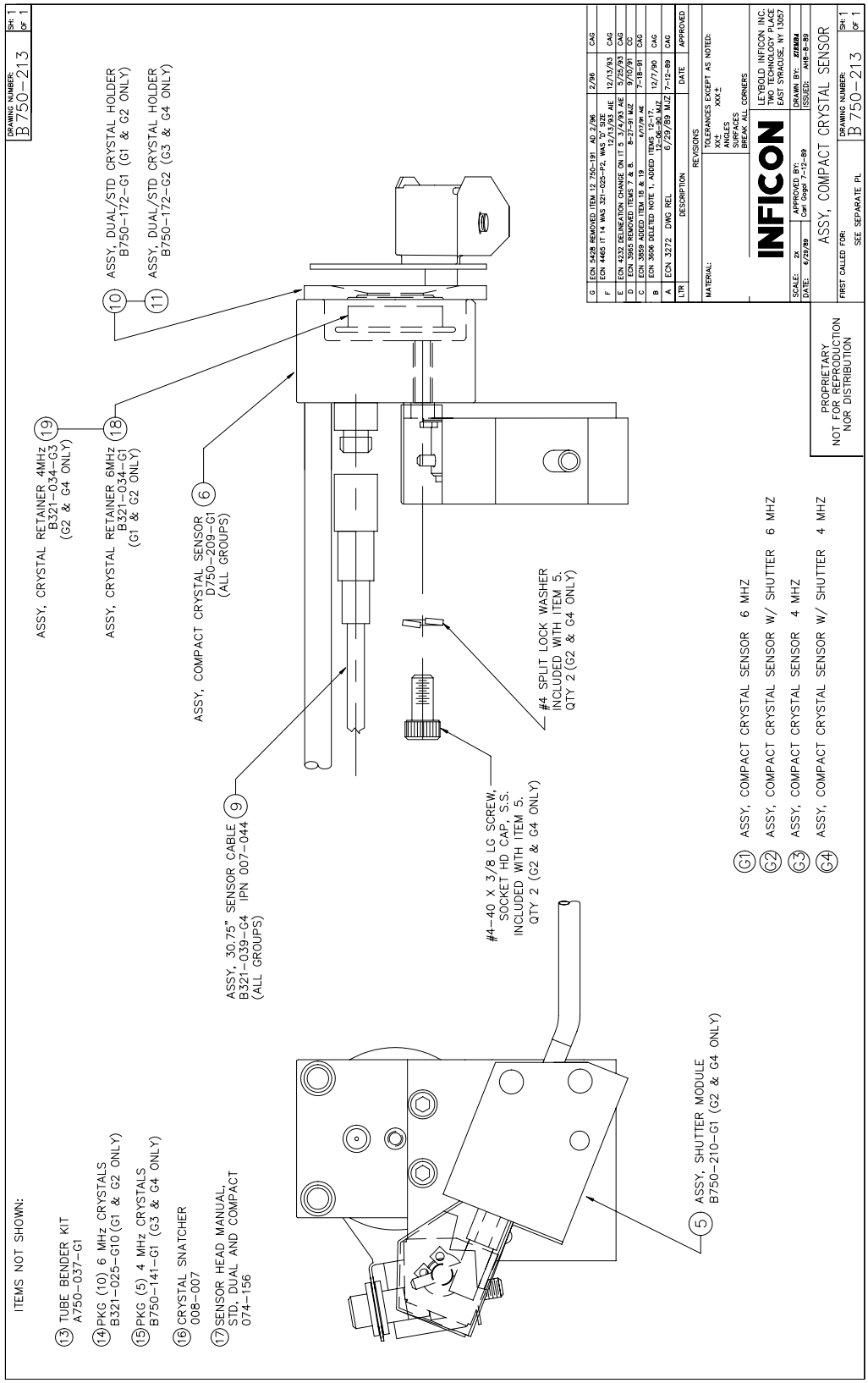

Figure 1-7 750-213 Assembly, Compact Crystal Sensor

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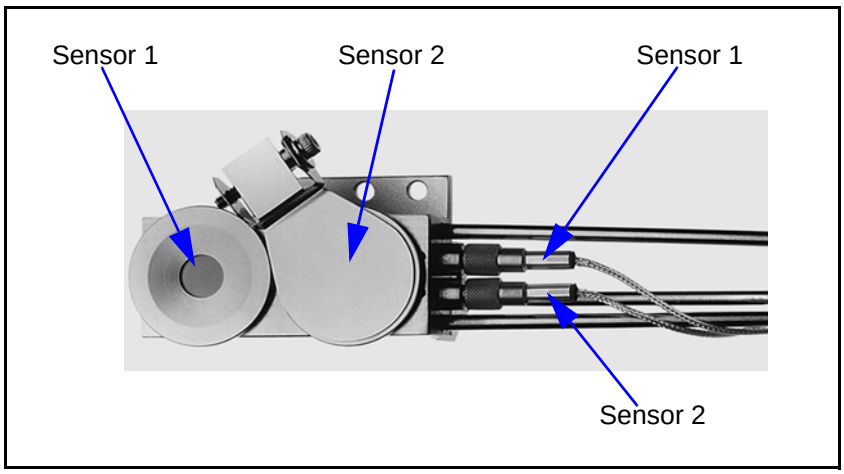
1.7 Specifications for the Dual (Switchable) Crystal Sensor (IPN 750-212-G2)

Figure 1-8 Dual (Switchable) Crystal Sensor



Maximum bakeout temp with no water . . . . . 130 °C

Maximum operating isothermal environment temperature with minimum water flow . . . . . 400 °C

Size
(maximum envelope without shutter) . . . . . 1.54 in. x 3.23 in. x 1.95 in. (39.12 mm x 82.04 mm x 49.54 mm)

Water tube and coax length . . . . . Standard 30 in. (762 mm)

Crystal exchange . . . . . Front-loading, self-contained package for ease of exchange. Shutter flips up to ease access to the holders.

Mounting. . . . . Two #4-40 tapped holes on the back of the sensor body

1.8 Installation Requirements

Feedthrough	Qty. (1) 2 3/4 in. (69.85 mm) ConFlat® with 2 Microdot, 2 pass water and air, or Qty. (2) 1 in. (25.4 mm) bolt with 2 pass water and Microdot.
Other	1) Customer to provide vacuum-tight braze joints or connectors for the water tubes 2) Valve assembly for air—IPN 750-420-G1 (see section 3.1 on page 3-1). 3) Two oscillators designed to interface with the deposition controller. 4) For automatic operation, the deposition process controller must be designed for the implementation of this feature.
Utilities	1) Minimum water flow 150-200 cc/min, 30 °C max (Do not allow to freeze.) 2) Air, 80 PSIG (5.5 bar) [552 kPa] very low volume, maximum 110 PSIG (7.6 bar) [760 kPa]
Water Quality	Coolant should not contain chlorides as stress corrosion cracking may occur. Extremely dirty water may result in loss of cooling capacity.

CAUTION

Do not allow water tubes to freeze. This may happen if the tubes pass through a cryogenic shroud and the fluid's flow is interrupted.

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1.9 Materials

Body and Holder	304 Type stainless steel
Springs	Au plated Be-Cu
Water tubes	S-304, 0.125 in. (3.175 mm) OD x 0.015 in. (0.381 mm) Wall thickness seamless stainless steel tubing
Connector (Microdot)	Stainless steel, teflon and glass insulated
Insulators	>99% Al_2O_3
Wire	Teflon insulated copper
Other mechanical parts	304 or 18-8 stainless steel
Braze	Vacuum process high temperature Ni-Cr alloy
Crystal	0.550 in. (13.97 mm) diameter

1.9.1 Unpacking and Inventory

Refer to section 1.3.3 on page 1-5 and section 1.3.4 on page 1-5.

1.9.2 Maintenance

Refer to section 1.4 on page 1-8.

1.9.3 Troubleshooting

Refer to section 1.5 on page 1-9.

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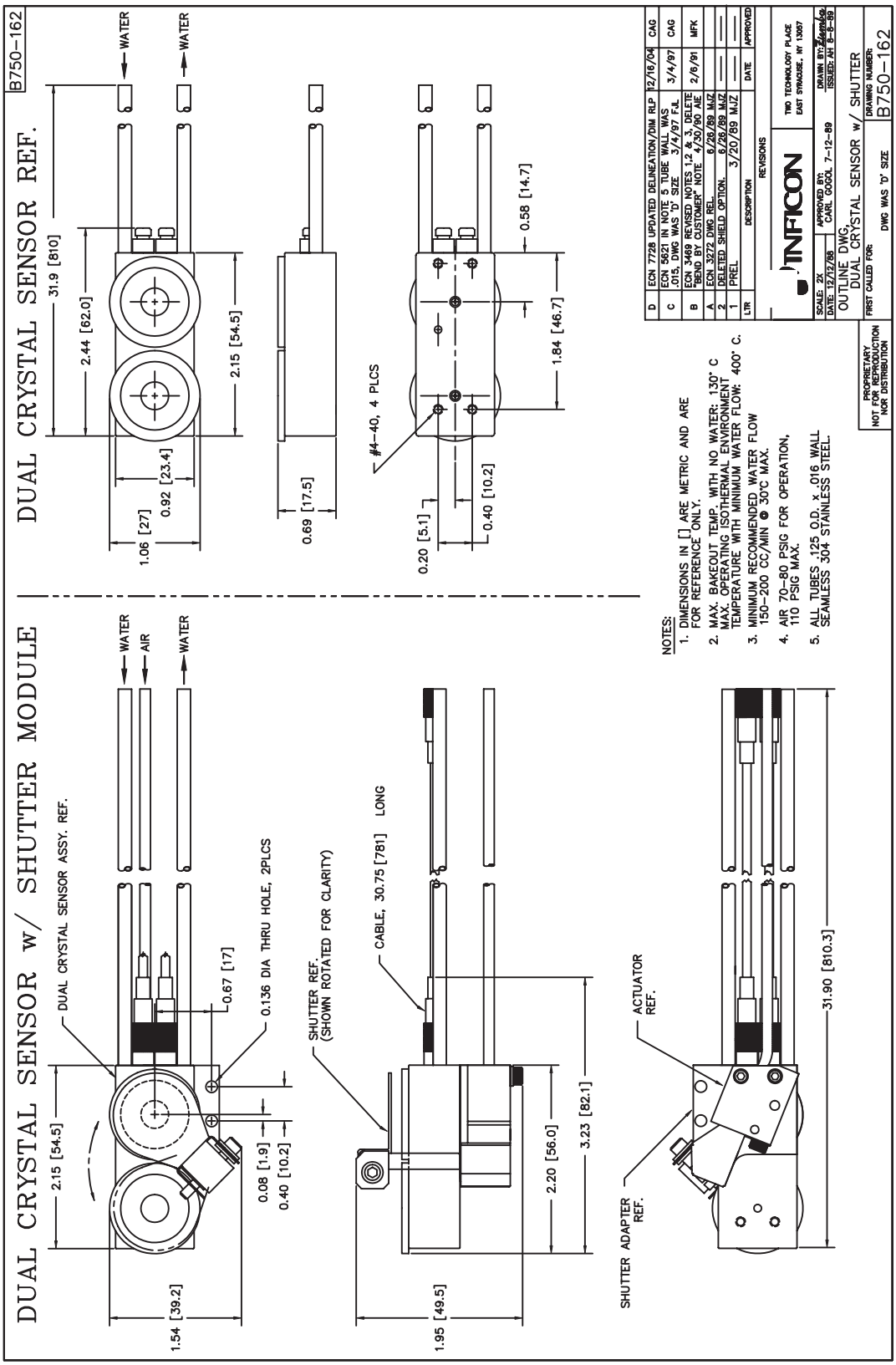

Figure 1-9 750-162 Dual Crystal Sensor with Shutter

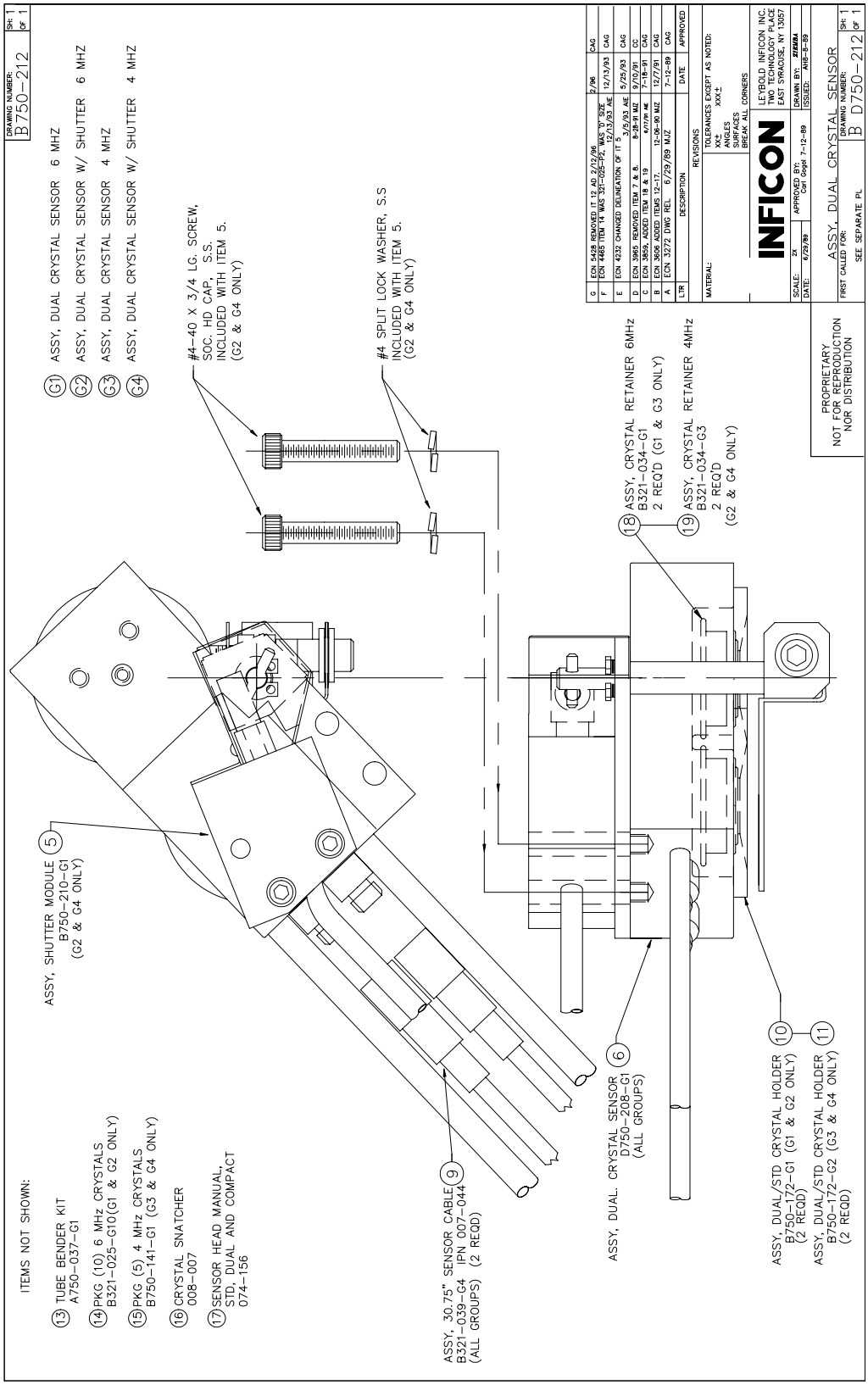

Figure 1-10 750-212 Assembly, Dual Crystal Sensor

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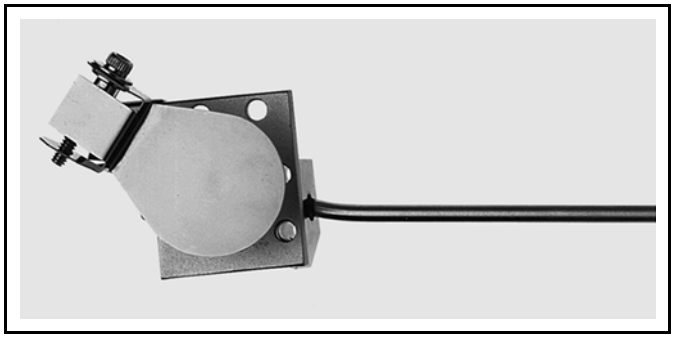
1.10 Specifications for the Shutter Module (IPN 750-210-G1)

Figure 1-11 Shutter Assembly Module



Temperature	130 °C (400 °C if properly attached to water cooled sensor)
Air Tube	S-304, 0.125 in. (3.175 mm) dia. x 0.015 in. (0.381 mm) wall thickness seamless stainless steel
Materials	300 series stainless steel
Pressure	80 PSIG (5.5 bar) [552 kPa], maximum 110 PSIG (7.6 bar) [760 kPa]
Shutter	Pneumatically operated. Shutter swings out of way for easy crystal exchange.
Braze	Vacuum process high temperature. Ni-Cr alloy

1.10.1 Maintenance

The Shutter module should be dismantled and lubricated approximately every 2000 strokes at areas specified on INFICON drawing 750-210, shown in Figure 1-12 on page 1-25. Failure to lubricate may significantly reduce life of operation or cause assembly to become totally inoperative.

NOTE: Sparingly use the molybdenum disulfied or use Fomblin™ E25 (perfluorinated polyether), if appropriate for your process.

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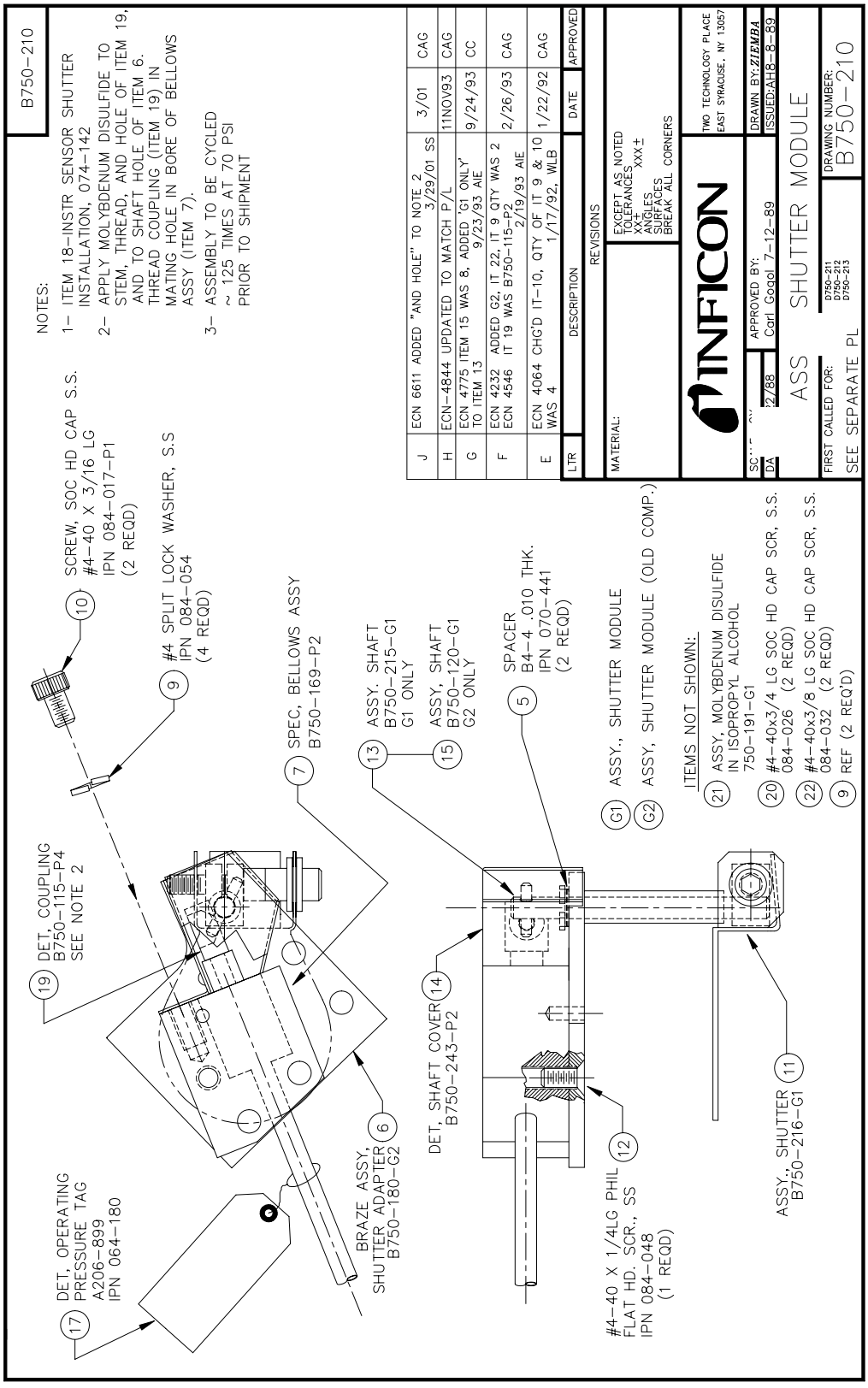

Figure 1-12 750-210 Assembly, Shutter Module

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Chapter 2
Sensor Installation

2.1 Introduction

A choice of sensor type must be determined by the type of process to be performed, the type of material to be evaporated, and the physical characteristics of the process chamber.

CAUTION

The sensor head, water tube, cable, etc., should be clean and grease free when installed in the vacuum chamber. These parts should be handled while wearing clean nylon gloves. If parts do become contaminated, clean them thoroughly using a suitable solvent to avoid outgassing.

2.2 Pre-installation Sensor Check

Prior to installing the sensor in the vacuum system, you should make certain that it is in proper working condition by following the appropriate procedure.

2.2.1 IC/5 Deposition Controller

1. Connect the in-vacuum sensor head cable to the feedthrough or a coax adapter (Microdot/BNC).
2. Connect one end of the 6 in. (152.4 mm) XIU cable (IPN 755-257-G6) to the BNC connector or the feedthrough.
3. Connect the other end of the 6 in. (152.4 mm) XIU cable to the connector of the XIU/5 (IPN 760-600-G1).
4. Connect one end of the XIU/5 cable (IPN 600-1039-Gxx) to the mating connector of the XIU/5.
5. Connect the other end of the XIU/5 cable to a sensor channel at the rear of the controller.
6. Install the crystal as instructed by section 4.2 on page 4-3.
7. Connect power to the controller and set the power switch to ON. Set density at 1.00 gm/cc, and zero thickness. The display should indicate 0 or +/-.001 KÅ. Crystal life should read from 0 to 5%.

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8 Breathe heavily on the crystal. A thickness indication of 1.000 to 2.000 KÅ should appear on the display. When the moisture evaporates, the thickness indication should return to approximately zero.

If the above conditions are observed, you can assume the sensor is in proper working order and may be installed.

2.2.2 Applies to Sensor Installation with an IC-6000 or XTC Deposition Controller

1 Connect the in-vacuum sensor head cable to the feedthrough or coax adapter (Microdot/BNC).

2 Connect one end of the 6 in. (152.4 mm) OSC cable (IPN 013-070) to the receptacle on the feedthrough.

3 Connect the other end of the 6 in. (152.4 mm) OSC cable to the receptacle marked XTAL on the oscillator (IPN 013-001).

4 Connect the end of the oscillator source/sensor cable (IPN 013-067) to the remaining BNC receptacle on the oscillator.

5 Connect the other end of the OSC source/sensor cable to the receptacle marked OSC on the rear panel of the controller.

6 Install the crystal as instructed by section 4.2 on page 4-3.

7 Connect power to the controller and set the power switch to ON. Set density at 1.00 gm/cc and zero the thickness. The display should indicate 0 or ±0.001KÅ. Crystal life should read from 0 to 4%.

8 Breathe heavily on the crystal. A thickness indication of 1.000 to 2.000 KÅ should appear on the display. When the moisture evaporates, the thickness indication should return to approximately zero.

If the above conditions are observed, you can assume the sensor is in proper working order and may be installed.

2.2.3 Applies to Sensor Installation with an IC/4 or IC/4 PLUS Deposition Controller

1 Connect the in-vacuum sensor head cable to the feedthrough or a coax adapter (microdot/BNC).

2 Connect one end of the 6 in. (152.4 mm) XIU cable (IPN 755-257-G6) to the BNC connector or the feedthrough.

3 Connect the other end of the 6 in. (152.4 mm) XIU cable to the connector of the XIU (IPN 755-252-G1).

4 Connect one end of the 15 ft. (4572 mm) XIU cable (IPN 755-258-G15) to the mating connector of the XIU.

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5 Connect the other end of the XIU cable to a sensor channel at the rear of the controller.

6 Install the crystal as instructed by section 4.2 on page 4-3.

7 Connect power to the controller and set the power switch to ON. Set density at 1.00 gm/cc, and zero thickness. The display should indicate 0 or ±001. Crystal life should read from 0 to 3%.

8 Breathe heavily on the crystal. A thickness indication of 1.000 to 2.000 KÅ should appear on the display. When the moisture evaporates, the thickness indication should return to approximately zero.

If the above conditions are observed, you can assume the sensor is in proper working order and may be installed.

2.2.4 Applies to Sensor Installation with an XTC/2 or XTC/C Deposition Controller, or XTM/2 Deposition Controller

1 Connect the in-vacuum sensor head cable to the feedthrough or a coax adapter (microdot/BNC)

2 Connect one end of the 6 in. (152.4 mm) XIU cable (IPN 755-257-G6) to the BNC connector or the feedthrough.

3 Connect the other end of the 6 in. (152.4 mm) XIU cable to the connector of the XIU (IPN 575-302-G1).

4 Connect one end of the “XX” long XIU cable (IPN 757-303-GXX) to the mating connector of the XIU.

5 Connect the other end of the XIU cable to a sensor channel at the rear of the controller.

6 Install the crystal as instructed by section 4.2 on page 4-3.

7 Connect power to the controller and set power switch to ON. Set density at 1.00 gm/cc, and zero thickness. The display indicate 0 or ±.001. Crystal life should read from 0 to 4%.

8 Breathe heavily on the crystal. A thickness indication of 1.000 to 2.000 KÅ should appear on the display. When the moisture evaporates, the thickness indication should return to approximately zero.

If the above conditions are observed, you can assume the sensor is in proper working order and may be installed.

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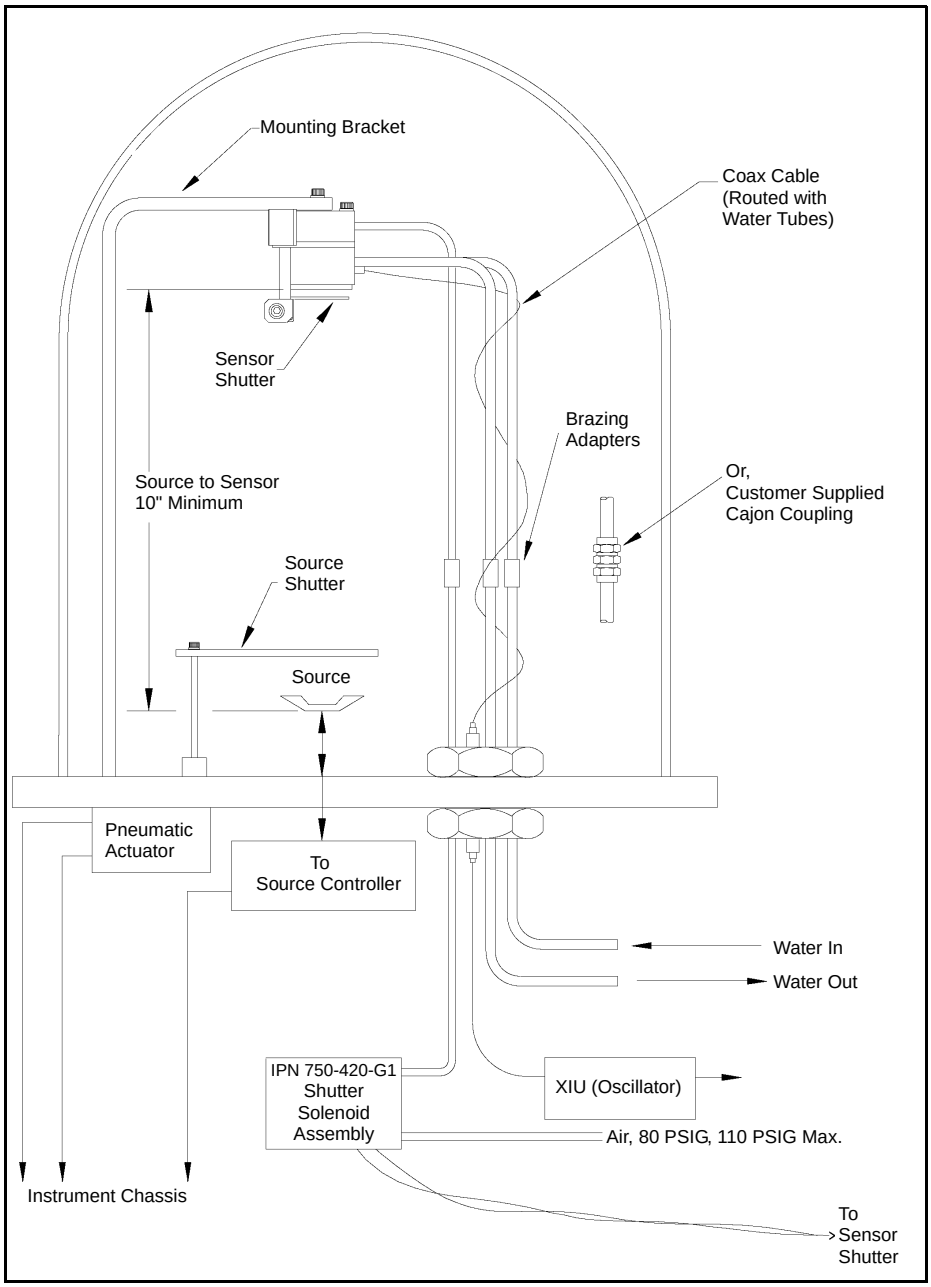
2.3 General Guidelines

Figure 2-1 shows the typical installation of an INFICON water-cooled crystal sensor in the vacuum process chamber. Use the illustration and the following guidelines to install your sensors for optimum performance and convenience.

Figure 2-1 Typical Installation



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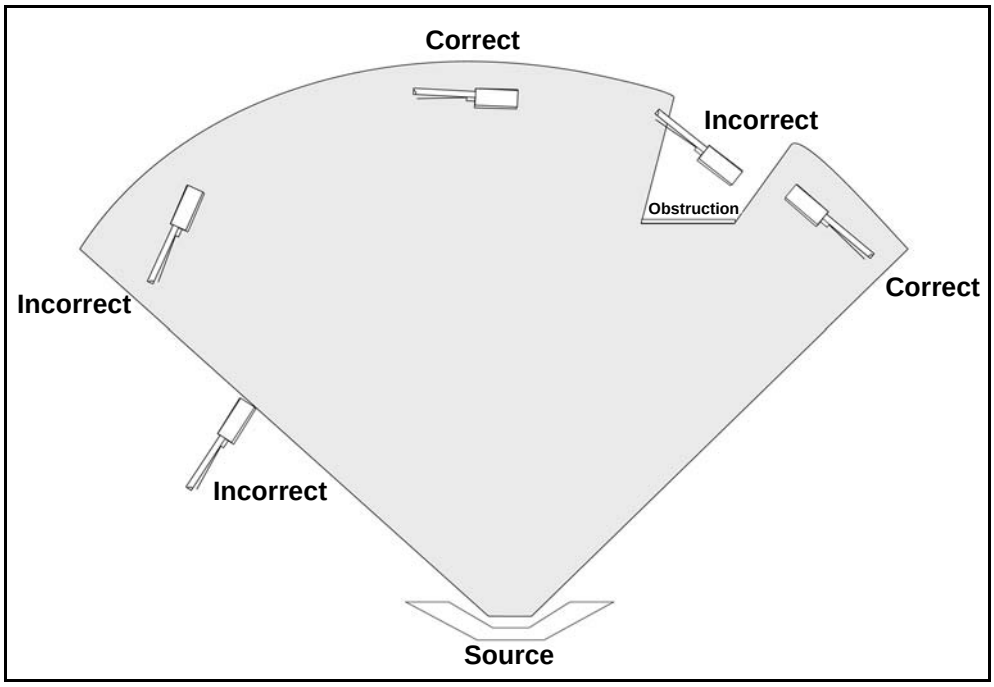
2.3.1 Crystal Sensor Installation

Generally, install the sensor as far as possible from the evaporation source (a minimum of 10 in. or 254 mm) while still being in a position to accumulate thickness at a rate proportional to accumulation on the substrate. Figure 2-2 shows proper and improper methods of installing sensors.

NOTE: For best process reproducibility, rigidly support the sensor so that it cannot move during maintenance and crystal replacement.

Figure 2-2 Sensor Installation Guidelines



To guard against spattering, use a source shutter to shield the sensor during the initial soak periods. If the crystal is hit with a minute particle of molten material, it may be damaged and stop oscillating. Even in cases when it does not completely stop oscillating, it may immediately become unstable, or shortly after deposition begins instability may occur.

Plan the installation to insure that there are no obstructions blocking a direct path between the sensor and the source.

Install sensors in such a manner that the center axis of the crystal is aimed directly at the source to be monitored. Verify that the angle of the sensor location (with reference to the source) is well within the evaporant stream. If the sensor is not square to the source, the coating on the crystal will be tapered and short crystal life can result.

NOTE: In many cases installing multiple sensors to monitor one source can improve thickness accuracy for the product. The rules are the same as for a single sensor installation, but the locations chosen should be quality locations as defined above. Consult your controller's manual for more information regarding the availability of this feature. A technical description may be found in the 39th Annual Conference Proceedings, Society of Vacuum Coaters, *Reducing Process Variation Through Multiple Point Crystal Sensor Monitoring*, J. Kushneir, C. Gogol, J. Blaise, pp19-23, ISSN 0737-5921 (1996).

Assemble the sensor mounting bracket on the process system. With the bracket in place, temporarily position and attach the sensor head as outlined in the general guidelines above. Next, temporarily install the feedthrough. You may now form, measure, and mark the sensor tubes.

NOTE: Use the Tube Bender Kit, IPN 750-037-G1, provided with the sensor to form the tubes.

CAUTION

Do not form the sensor tubes: too near the sensor body; with the sensor mounted; or using the sensor body as a leverage point. Doing so stresses the tube's braze joints and may result in their failure.

Build the Sensor/Feedthrough Assembly. Remove the sensor and the feedthrough, cut the water cooling tubes and air tubes to the proper length and connect them directly to the feedthrough or use vacuum rated couplings.

CAUTION

To prevent damage to the feedthrough or sensor during brazing, insure that at least one inch of water tube is left between the sensor and the flame.

After cutting the water and air tubes, verify that they are clear of metal particles by forcing compressed air through the tubing. Torch brazing is acceptable for connecting the sensor to the feedthrough water tube.

Vacuum rated connectors, such as CAJON®, are recommended for use between the sensor and the feedthrough to speed maintenance. If brazing adapters are to be used, attach them to the sensor water-cooling tubes prior to connection to the feedthrough. Make connections as follows:

1 Clean the water tube and adapter surfaces with solvent, if necessary.

2 Apply brazing flux to surfaces being joined.

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3 Braze the connections using a flame temperature appropriate for the brazing material being used.

CAUTION

Excessive application of brazing material, or excessive heat due to brazing, may result in blockage of the water tube.

4 Verify that each joint is not blocked by blowing compressed air through the cooling tubes.

5 Thoroughly clean the braze joint and helium leak test before installing the sensor and feedthrough into the process chamber.

With all water tube connections installed, install the sensor and feedthrough assembly into the process system and secure all retaining hardware. Shield the coaxial cable from heat radiating from the evaporant source of the substrate heater. You can do this very simply, if your process allows, by wrapping aluminum foil around the cable and water tubes. Connect the external water tubes from the feedthrough to your water supply system and flow controller. INFICON recommends using detachable couples (Swagelok® or equivalent) for external water tube connections. Apply water pressure and verify the water connections.

Because of geometric factors, variations in surface temperature, and differences in electrical potential, the crystal and substrates often do not receive the same amount of material. If you want the thickness indication on the unit to represent the thickness on the substrates, calibration is required to determine the tooling.

Refer to the instrument operating manual for calibration procedures.

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2.4 Installing the Compact and Standard Sensors

The Compact and Standard sensors may be installed in any appropriate location within the vacuum system. Two tapped holes are provided on the back of each sensor body for attaching to the system. The cable length from the sensor to the feedthrough is 30 in. (762 mm). It is not recommended that this distance exceed 40 in. (1016 mm).

2.5 Sensor Shutter Function Check

Temporarily connect an air supply (70-80 PSIG (4.8-5.5 bar) [480-552 kPa], 110 PSIG (7.6 bar) [760 kPa] maximum) to the actuator air tube and test operation (10-15 cycles). When actuated, shutter movement should be smooth, rapid, and complete, and should retract completely from the crystal opening. When deactivated, the shutter should completely cover the crystal opening. Repositioning of the shutter may be required to achieve optimum on/off positioning. If operation is impaired, lubricate the moving parts in the area shown on DWG 750-210, refer to Figure 1-12 on page 1-25, with molybdenum disulfide or equivalent. If the function check was successful, proceed to section 2.6 if required; prior to making the appropriate pneumatic, water, and coax cable connections. Use a suitable feedthrough assembly.

WARNING

Do not exceed the maximum pressure rating of 110 PSIG (7.6 bar) [760 kPa]. Connection to excessive pressure may result in personal injury or equipment damage.

2.6 Installing Sensor Shutters on Existing Equipment

Installation of sensor shutters on existing equipment requires a sensor shutter module assembly (B750-210-G1 - refer to section 1.10 on page 1-24). This sensor shutter module assembly may be installed on either the standard crystal sensor (750-207-G1 - refer to section 1.3 on page 1-3) or the compact crystal sensor (750-213-G1 -refer to section 1.6 on page 1-14).

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2.6.1 Installation of Shutter Module on Standard Crystal Sensor

Reference INFICON drawings 750-211 (Figure 1-3 on page 1-7) and 750-210 (Figure 1-12 on page 1-25).

1. Remove the shutter assembly to provide easier pneumatic shutter installation.
2. Rotate the shutter module until the holes through the actuator assembly of the shutter module coincide with the #4-40 tapped holes in the rear side of the standard crystal sensor assembly.
3. Secure the shutter module to the standard crystal sensor assembly utilizing the #4-40 x 3/4 in. (19 mm) hardware provided with the shutter module.
4. Hold the sensor with the crystal opening facing upward. Mount the shutter assembly onto the shaft assembly. Do not tighten the shutter assembly.
5. Position the shutter assembly so that it is directly over the center of the crystal opening. Tighten the shutter assembly cap screw. Make certain that the shutter assembly, when activated, does not block deposition of the evaporant stream onto any portion of the crystal.

2.6.2 Installation of Shutter Module on Compact Crystal Sensor

Reference INFICON drawings 750-210 (Figure 1-12 on page 1-25) and 750-213 (Figure 1-7 on page 1-18).

1. Remove the shutter assembly to provide easier module installation.
2. Position the holes of the braze assembly shutter adapter over the #4-40 tapped holes in the rear of the compact crystal sensor.
3. Secure the shutter module with the #4-40 x 3/8 in. (9.53 mm) stainless steel hardware provided with the shutter module.
4. Hold the sensor with the crystal opening facing upward. Mount the shutter assembly onto the shaft assembly. Do not tighten the shutter assembly.
5. Position the shutter assembly so that it is directly over the center of the crystal opening. Tighten the shutter assembly cap screw. Make certain that the shutter assembly, when activated, does not block deposition of the evaporant stream onto any portion of the crystal.

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Chapter 3
Installation of the Solenoid Valve Assembly

3.1 Introduction

The solenoid valve assembly and the feedthrough should be installed at the same time. The same valve assembly is used for both the 1 in. (25.4 mm) and the 2 3/4 in. (69.85 mm) feedthroughs. However, if the assembly is to be used with the 2 3/4 in. (69.85 mm) feedthrough, you will need to modify the valve bracket as follows.

See Figure 3-2 on page 3-4.

1. Align the score line on the valve assembly bracket over the edge of a table or other square edge.
2. Using pliers, grasp the part of the bracket extending over the edge and push down. The assembly will break along the score line. Use a file to smooth any rough edges which occur along the break.

3.2 Installation with 1 Inch Bolts

If you are installing the solenoid valve assembly for utilization with a dual sensor, you will need two 1in. (25.4 mm) bolts. (IPN 002-042 — see Figure 5-1 on page 5-2.) Use the first as is; on the second, one water tube must be plugged, the other must have a fitting adapter (IPN 007-133) soldered to it. (This part is only available from INFICON and is included with the IPN 750-420-G1 Solenoid Valve.)

If you are installing the solenoid valve assembly for utilization with any other sensor, you will need only one 1" bolt feedthrough (IPN 750-030-G1, see Figure 5-2 on page 5-3.)

Follow the steps below:

1. Ensure that the o-ring is in place on the bolt. Insert the 1 in. (25.4 mm) bolt such that the hexagonal shaped end of the bolt is on the vacuum side of the chamber.
2. Add the Bracket.
3. Add the Washer.
4. Add the Nut.
5. Tighten the feedthrough nut.
6. Add the air fitting to the tube which has the female thread adapter installed.
7. Connect the 1/8 in. (3.175 mm) air tube from the valve to the just installed fitting.
8. Attach the valve's intake (normally closed (NC) port) to the 80-90 PSIG (5.5-6.2 bar) [552-621 kPa] source of air.

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3.3 Installation with 2 3/4 Inch Feedthrough

If you are installing the solenoid valve assembly with a dual sensor, a 2 3/4 in. (69.85 mm) feedthrough inclusive of two coaxial feedthroughs (IPN 002-080, see Figure 5-4 on page 5-5) is required. All other shuttered sensors utilizing 2 3/4 in. (69.85 mm) feedthroughs require only a single coaxial feedthrough. The second coaxial feedthrough is not used, and should be protected from damage as a result of process material. Follow the steps below:

1. Install the Feedthrough.
2. Add the valve bracket (modified) to the desired location utilizing two of the flange's 1/4 in. (6.35 mm) clamp bolts.
3. Tighten the flange bolts.
4. Install the air fitting to the female thread adapter.
5. Connect the 1/8 in. (3.175 mm) air tube from the valve outlet to the feedthrough fitting.
6. Attach the valve's NC intake (normally closed port) to the 80-90 PSIG (5.5-6.2 bar) [552-621 kPa] source of air.

NOTE: Maximum temperature for the shutter control valve assembly is 105 °C for bakeout and operation.

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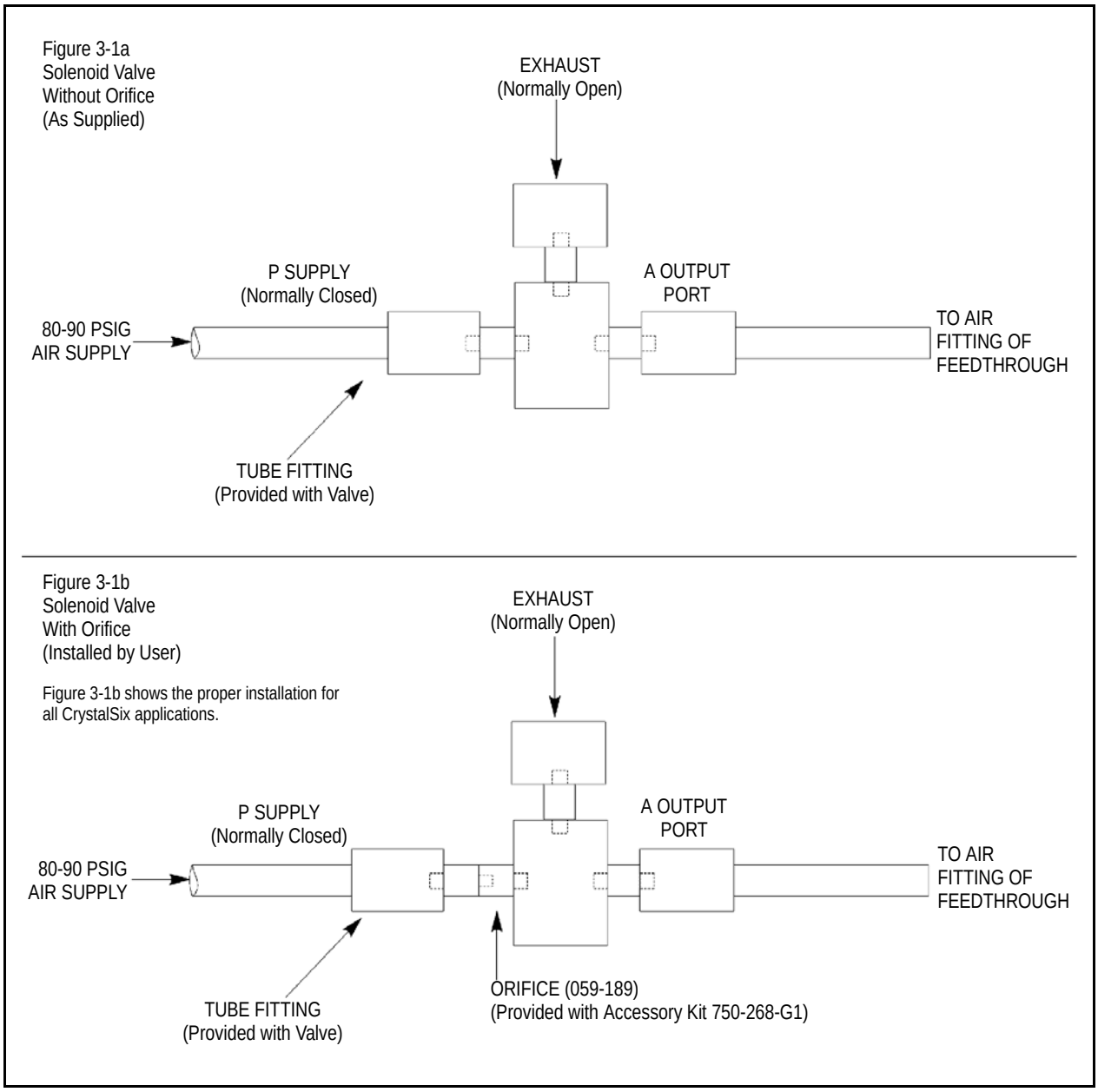
3.4 Electrical and Pneumatic Connections

3.4.1 Electrical

To complete installation of the assembly, make electrical connections where indicated in Figure 3-3 on page 3-5 to either 24 V(ac) or V(dc). Current required is approximately 70 mA.

Figure 3-1 Miniature Pneumatic Solenoid Tube Connections



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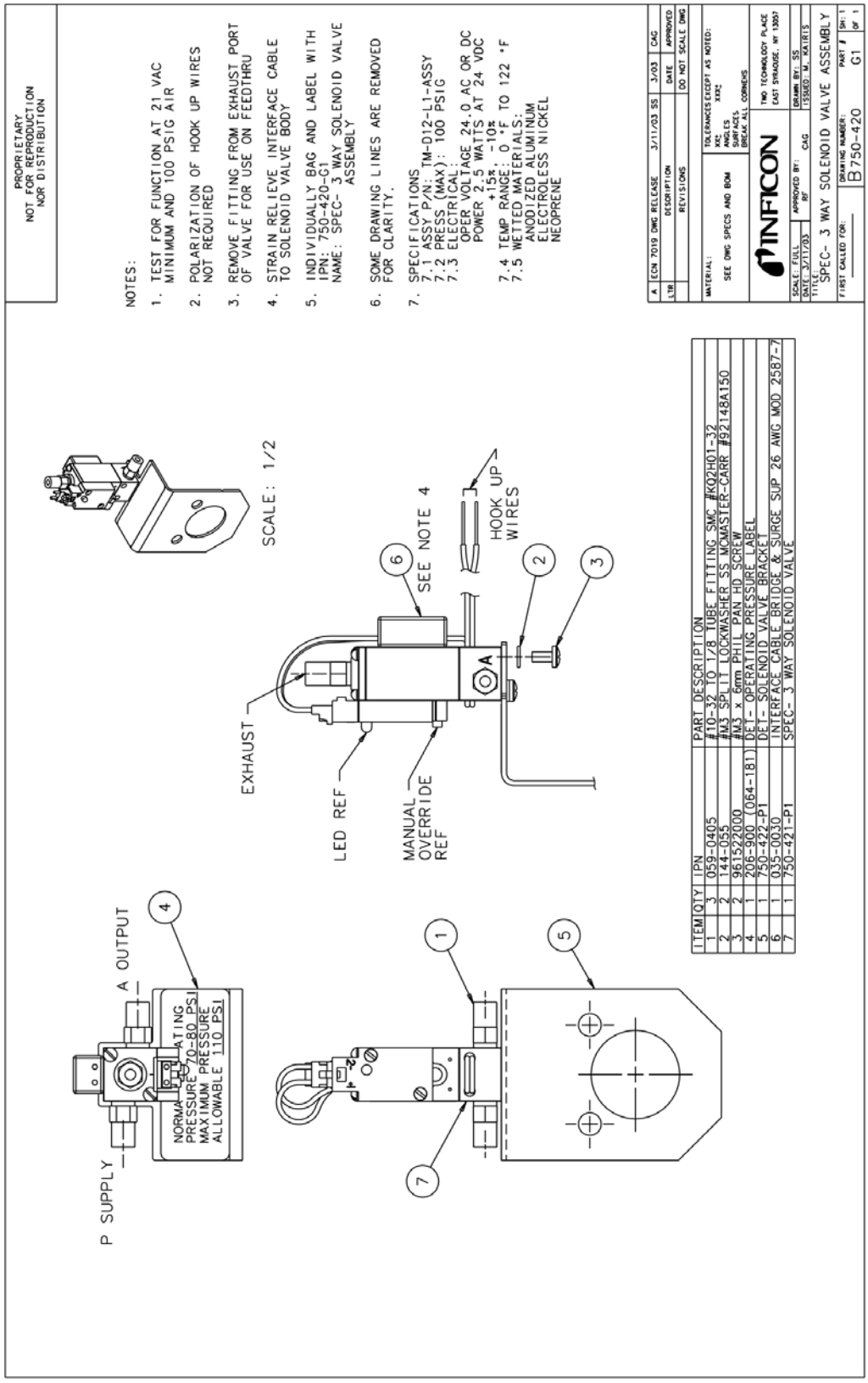

Figure 3-2 Solenoid Valve Assembly

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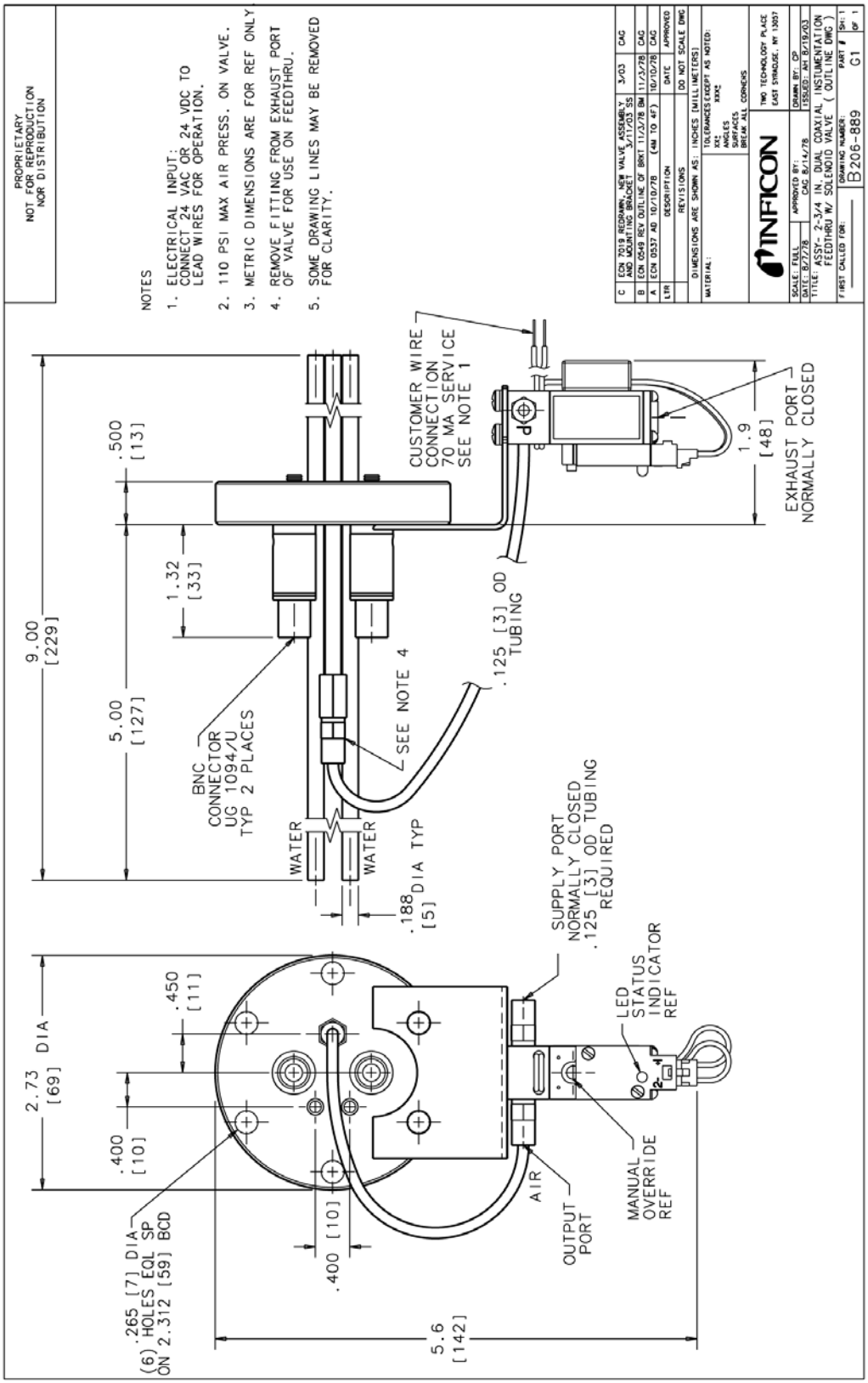

Figure 3-3 2 3/4" Dual Coaxial Feedthrough and Valve Assembly

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Chapter 4
Maintenance

4.1 General Precautions

4.1.1 Handle the Crystal with Care

Always use clean nylon lab gloves and clean plastic tweezers when handling the crystal. Handle the crystals only by their edges. Anything that comes in contact with the crystal surfaces may leave contamination, which may lead to poor film adhesion. Poor film adhesion will result in high rate noise and premature crystal failure.

CAUTION

Do not use metal tweezers to handle crystals. Metal tweezers may chip the edge of the crystal.

4.1.2 Maintain the Temperature of the Crystal

Periodically measure the water flow rate through the crystal sensor to verify that it meets or exceeds the value specified on see page 1-4. Depending upon the condition of the cooling water used, the addition of an in-line water filtering cartridge system may be necessary to prevent flow obstructions. Many system coaters use parallel water supply taps that provide high total flows. An obstruction or closed valve in the pipe that supplies water to the sensor head would not result in a noticeable reduction of total flow. The best test is to directly monitor the flow leaving the sensor.

The crystal requires sufficient water cooling to sustain proper operational and temperature stability. Ideally, a constant heat load is balanced by a constant flow of water at a constant temperature. INFICON's quartz crystals are designed to provide the best possible stability under normal operating conditions. No crystal can completely eliminate the effects of varying heat loads. Sources of heat variation include radiated energy emanating from the evaporant source and from substrate heaters.

4.1.3 Use the Optimum Crystal Type

Silver coated crystals are recommended for RF sputtering applications. Certain materials, especially dielectrics, may not adhere strongly to the crystal surface and may cause erratic readings. For many dielectrics, adhesion is improved by using crystals with silver coated electrodes. Gold is preferred for other applications.

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4.1.4 Crystal Concerns when Opening the Chamber

Thick deposits of some materials, such as SiO, Si and Ni will normally peel off the crystal when it is exposed to air, due to changes in film stress caused by gas absorption. When peeling material is observed, replace the crystal.

4.1.5 Care of the Ceramic Retainer

CAUTION

Do not use excessive force **when handling the Ceramic Retainer Assembly since breakage may occur. Always use the crystal snatcher.**

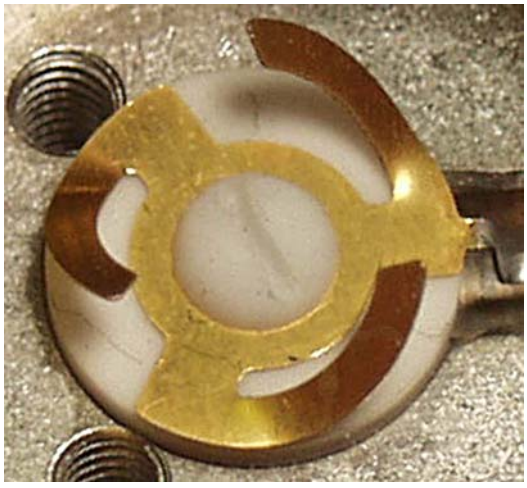
To prevent scratching **the crystal electrode, do not rotate the ceramic retainer after installation.**

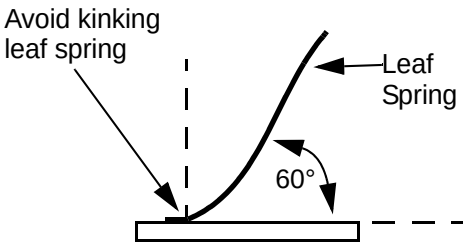
Always use clean nylon lab gloves and plastic tweezers for handling the crystal. This avoids contamination which may lead to poor adhesion of deposited material to the electrode.

4.1.6 Leaf Spring Concerns

Spring conditions should be observed as part of the routine maintenance interval. Insufficient bends or deformities in the spring contacts in the sensor body are common causes of crystal problems. Lift each leaf spring up approximately 60°.

Figure 4-1 Shaping the Leaf Spring





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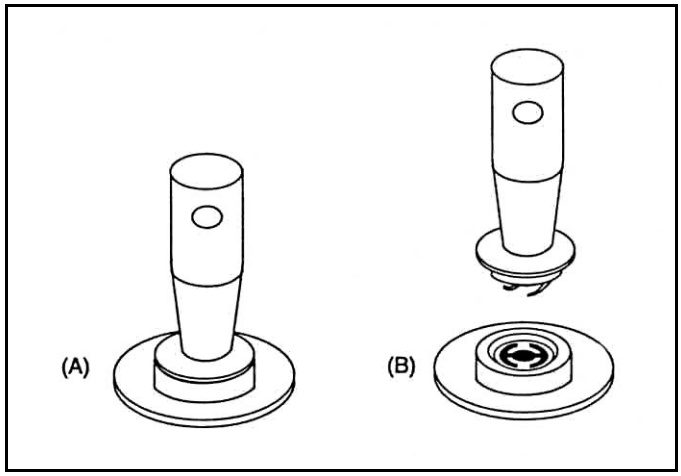
4.2 Crystal Replacement Instructions

Follow the steps below to replace the crystals: (refer to Figure 1-3 on page 1-7). Observe the general precautions (refer to section 4.1 on page 4-1) for replacing crystals.

1. Grip the crystal holder with your fingers and pull it straight out of the sensor body.
2. Insert the tapered end of the crystal snatcher (part number 008-007) into the ceramic retainer (see Figure 4-2-A) and apply a small amount of pressure. This locks the retainer to the snatcher and allows the retainer to be pulled straight out (see Figure 4-2-B).

Figure 4-2 Using the Crystal Snatcher



3. Invert the crystal holder and the crystal will drop out.
4. Prior to installing the new crystal, review section 4.1.1, Handle the Crystal with Care, on page 4-1.
5. Using clean nylon gloves, grasp the edge of the new crystal with a clean pair of plastic tweezers. Orient the crystal so the patterned electrode is facing up. Gently insert the edge of the crystal beneath one of the wire segments that protrude into the crystal cavity. Release the crystal.
6. Replace the ceramic retainer. Initially orient it at an angle to displace the spring wire segments in the crystal holder.
7. Release the crystal snatcher with a slight side-to-side rocking motion. Using the backside of the crystal snatcher, push on the ceramic retainer to ensure it is completely seated.
8. Reinstall the holder in the sensor body; push the holder straight in making certain that it is completely seated in the senor body.

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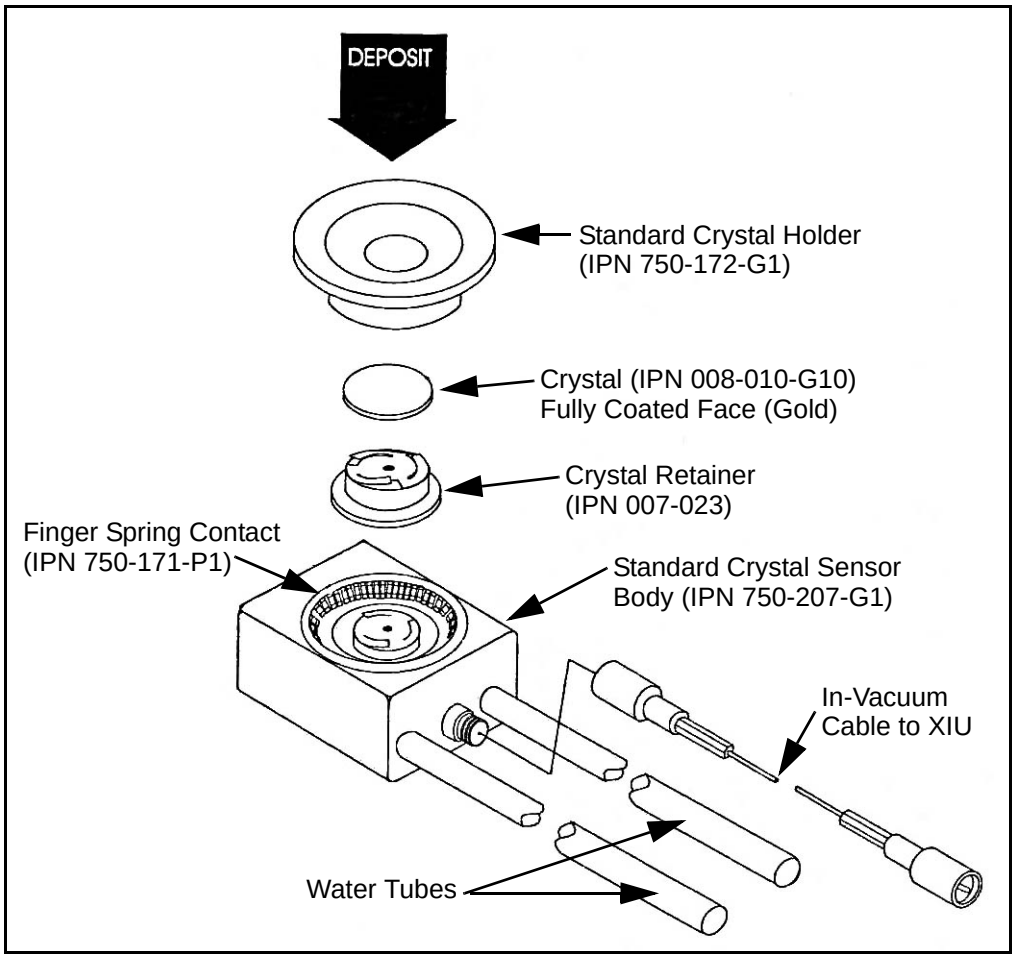
Figure 4-3 Standard Crystal Sensor (Exploded)



CAUTION

Never deposit material on a sensor unless the crystal holder and crystal are installed. Material improperly deposited on the exposed sensor body assembly will lead to complete failure of the crystal to oscillate or to premature crystal failure. Removing the deposited material will require extensive rework and new components.

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4.3 Retainer Spring Adjustment Instructions

Occasionally, you may become dissatisfied with the way the ceramic retainer is secured in the crystal holder. To alter the magnitude of the retaining force, use the following procedure.

Tools required

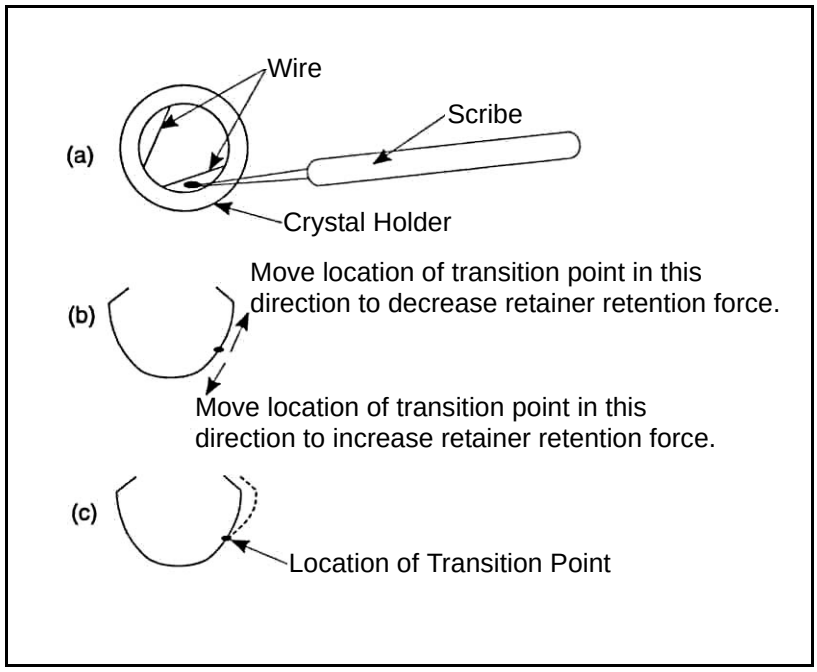
- Scribe or other pointed tool
- Needle nose pliers (two required)

Procedure

1 Position the crystal holder with the crystal aperture oriented downward.

2 Insert the point of the scribe between the inside edge of the crystal holder cavity and one of the two wire segments that protrude into the crystal cavity (see Figure 4-4-a).

Figure 4-4 Location of the Transition Point



3 Using the scribe, gently remove the spring from its groove in the crystal holder cavity.

4 Consult Figure 4-4-b to determine the direction in which the 'transition point' must be relocated, to attain the desired retention forces. Moving this transition point approximately 1/16 in. (1.59 mm) is generally sufficient.

5 Grasp the spring, with the pliers, just below the transition point. Using the second set of pliers, bend the spring as illustrated by the dashed line in Figure 4-4-c to remove the existing transition point.

6 Use both pliers to form a new transition point according to Figure 4-4-b, thus returning the spring to a shape similar to the solid line delineation of Figure 4-4-c.

7 Reinstall the spring into the groove provided in the crystal cavity.

8 Determine if the retention force is acceptable and that the wire does not impede crystal insertion. Repeat these instructions if unacceptable retention forces persist.

4.4 Crystal Holder Maintenance

In dielectric coating applications, the surface where the crystal contacts the crystal holder may require periodic cleaning. Since most dielectrics are insulators, any buildup due to blow-by will eventually cause erratic or poor electrical contact between the crystal and the sensor body. This buildup will also cause a reduction in thermal transfer from the crystal to the sensor body. Both of these will result in noisy operation and early crystal failure.

Cleaning may be accomplished by gently buffing the crystal holder to crystal seating surface with a white Scotch-Brite™ pad followed by an ultrasonic bath in soap solution followed by thorough rinsing in deionized water and drying or by ultrasonic cleaning and rinsing only.

NOTE: The crystal holder seating surface is machined to a very fine finish (16 micro inches rms). This high quality finish is essential to provide good electrical and thermal contact with the crystal. Applying excessive force during cleaning or using overly abrasive cleaning materials may damage this finish and reduce sensor performance.

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Chapter 5
Feedthrough Outline Drawings

5.1 List of Supplied Drawings

The following Feedthrough Outline Drawings provide dimensions and other pertinent data necessary for planning equipment configurations.

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Figure 5-1 1 Inch Crystal Feedthrough (002-042)

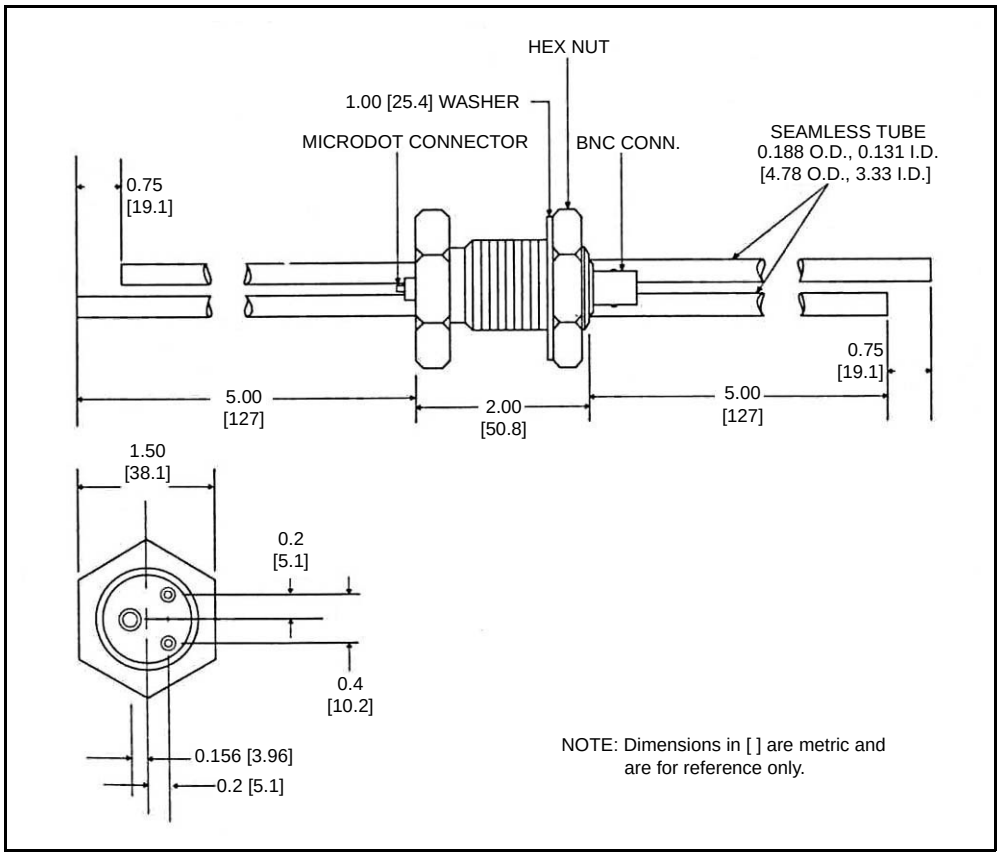

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Figure 5-2 1 Inch Crystal Feedthrough with Air Tube (750-030-G1)

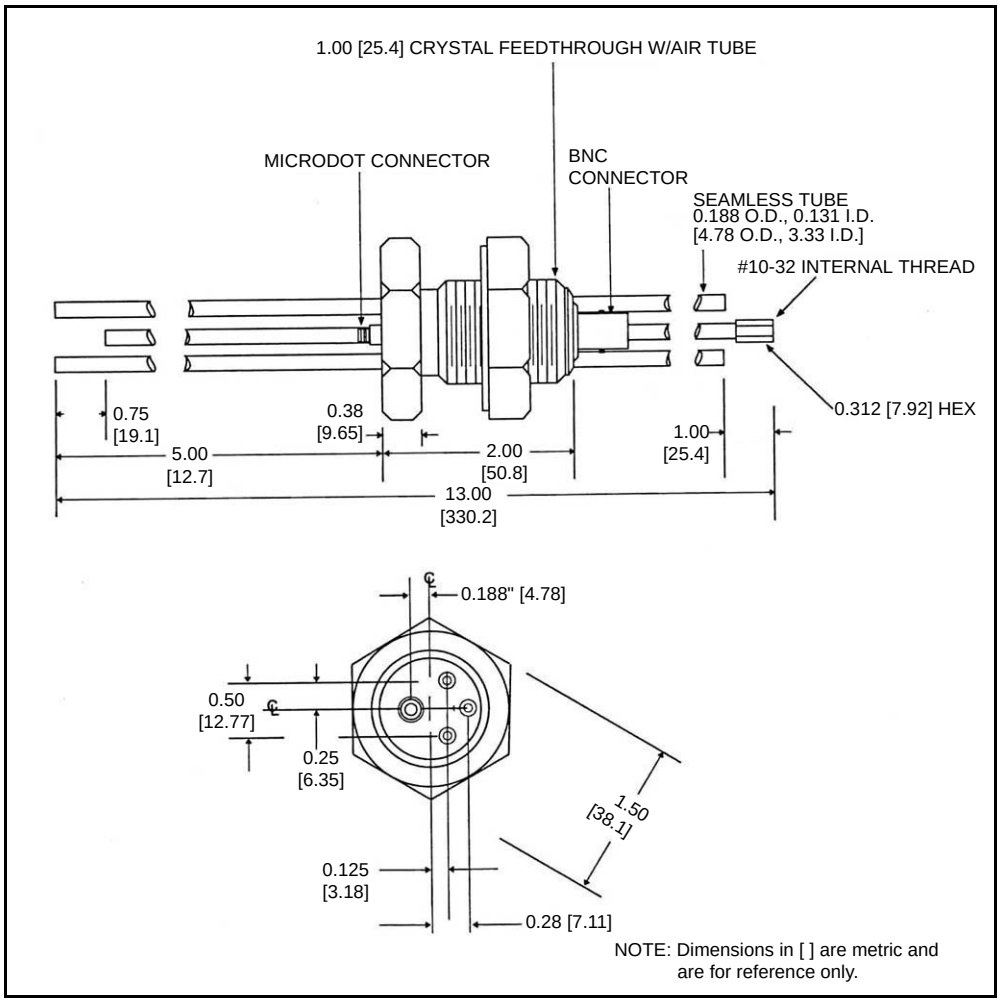


Figure 5-3 2 3/4 Inches Single Coaxial Feedthrough (002-043 - Copper Gasket)

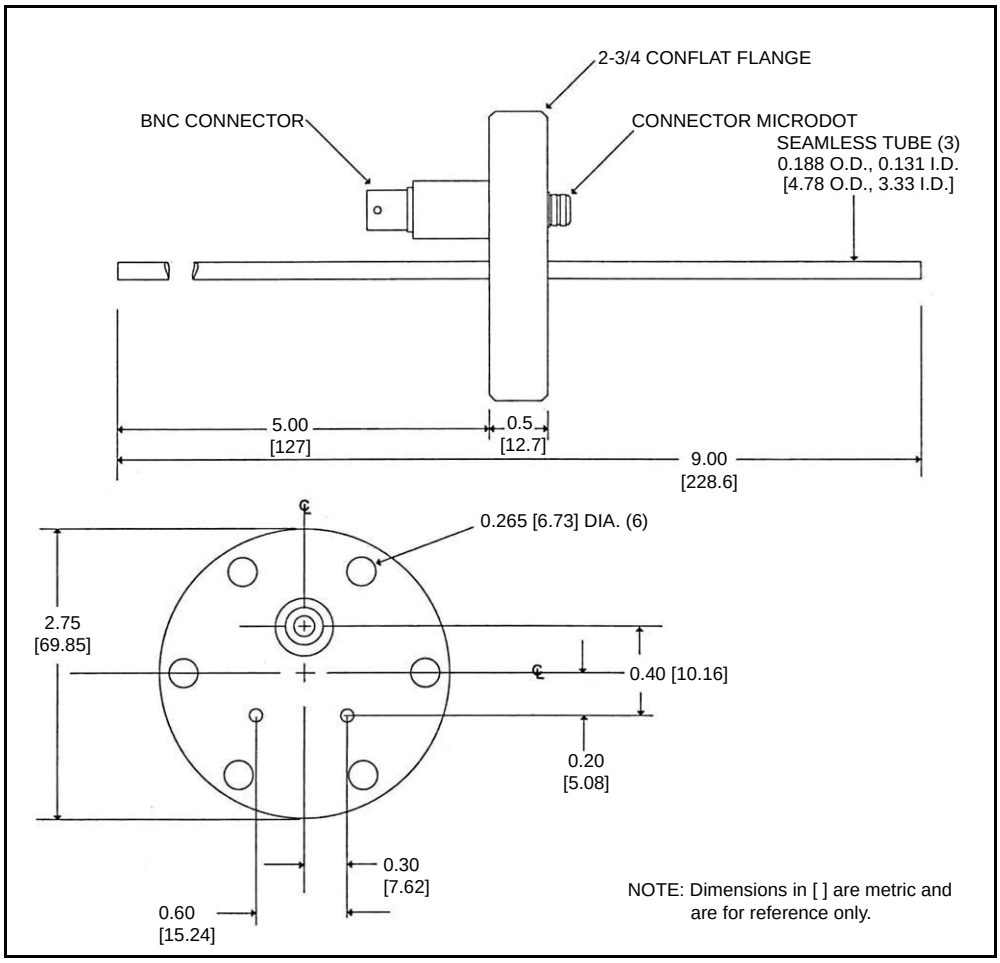
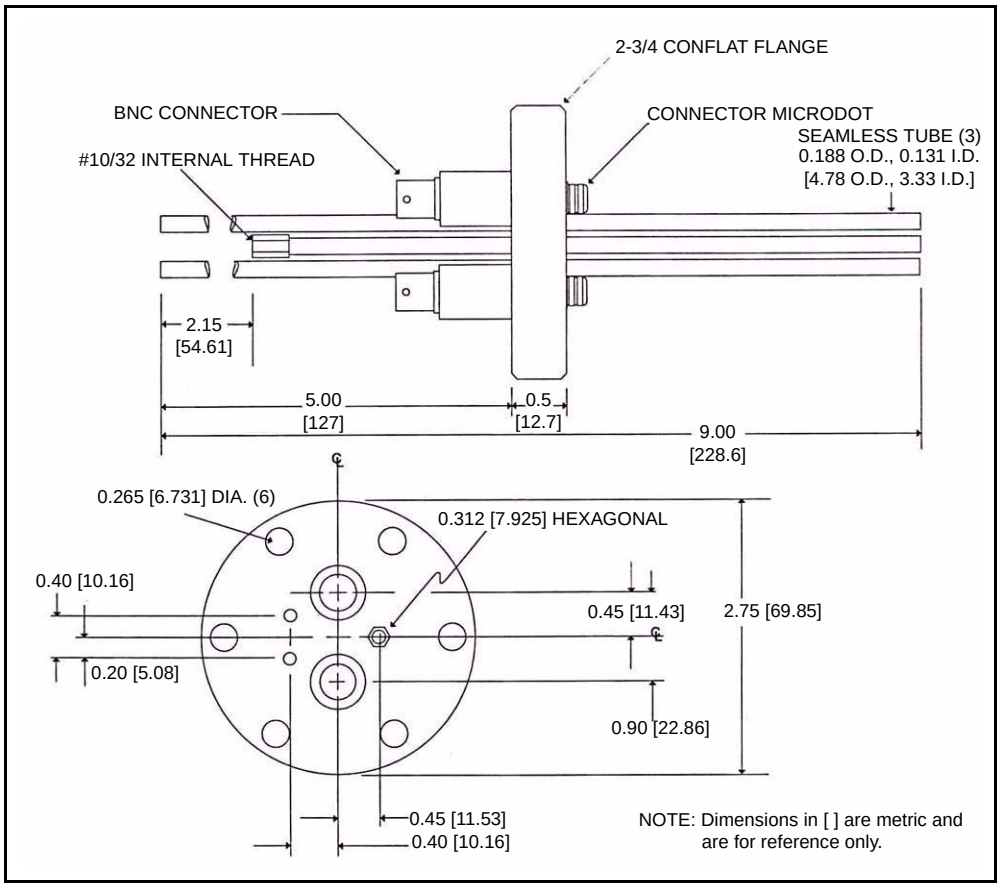


Figure 5-4 2 3/4 Inches Dual Coax Feedthrough with Air Tube (002-080 - Copper Gasket)



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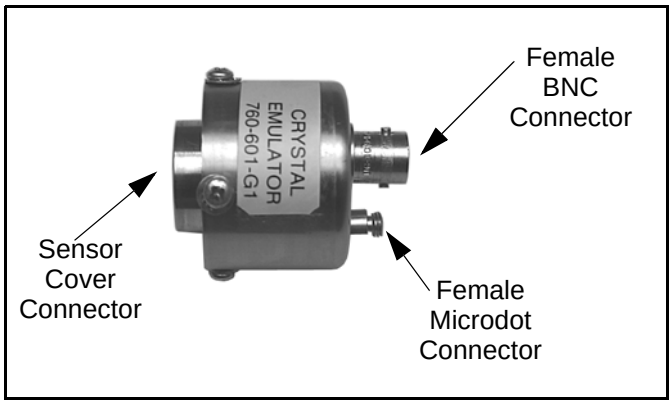
Chapter 6
Crystal Sensor Emulator
IPN 760-601-G1

6.1 Introduction

NOTE: The Crystal Sensor Emulator is not compatible for use with an IC/4.

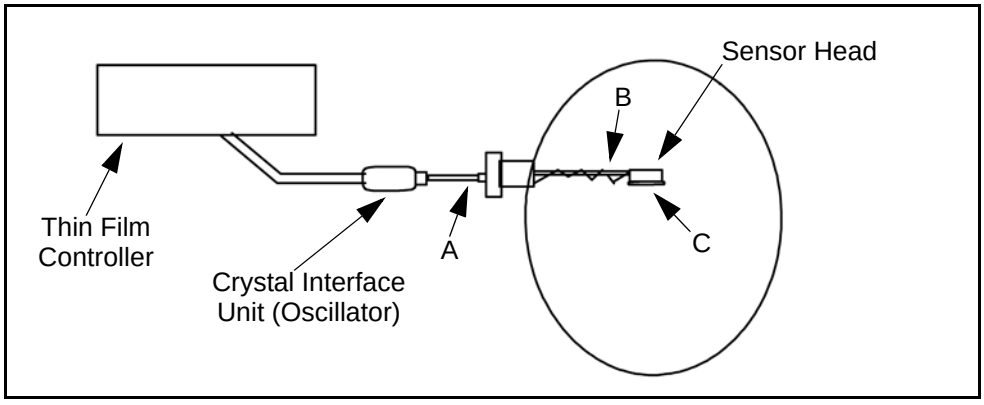
The Crystal Sensor Emulator option is used in conjunction with the Thin Film Deposition Controller to rapidly diagnose problems with the Deposition Controller's measurement system. See Figure 6-1.

Figure 6-1 Crystal Sensor Emulator



The Crystal Sensor Emulator may be attached at various points in the measurement system, from the oscillator to the sensor head. It provides a known "good" monitor crystal with known "good" electrical connections. Using the emulator and the controller in a systematic manner provides a fast means of isolating measurement system, cable, or sensor problems. See Figure 6-2.

Figure 6-2 Crystal Sensor Emulator Attachment Points



CAUTION

This product is designed as a diagnostic tool, and is not intended for use in vacuum. Do not leave the Crystal Sensor Emulator installed in the vacuum system during processing.

6.2 Diagnostic Procedures

The following diagnostic procedures employ the Crystal Sensor Emulator to analyze a constant Crystal Fail message. The symptom is a Crystal Fail message that is displayed by the Deposition Controller even after the monitor crystal has been replaced with a new “good” monitor crystal.

NOTE: The "Unable To Auto Z" message will be displayed if the Crystal Sensor Emulator is attached to an IC/4 PLUS, IC/4 MPT, or IC/5 and you are attempting to use the Auto Z feature of these instruments. This is to be expected and is normal.

6.2.1 Measurement System Diagnostic Procedure

1. Refer to Figure 6-2 on page 6-1. Remove the 6 in. BNC cable from the Feed-Through at point A.
2. Connect the Crystal Sensor Emulator to the 6 inch BNC cable at Point A.
   - If the XTAL Fail message disappears after approximately five seconds, the measurement system is working properly. Re-install the 6 in. BNC cable to the Feed-Through. Go to section 6.2.2.
   - If the XTAL Fail message remains, continue at step 3.
3. Disconnect the 6 in. (152.4 mm) BNC cable from the Oscillator and from the Emulator.
4. Visually inspect the 6 in. (152.4 mm) BNC cable to verify that the center pins are seated properly.
5. Use an Ohm meter to verify the electrical connections on the 6 in. BNC cable.
   - There must be continuity between the center pins.
   - There must be isolation between the center pins and the connector shield.
   - There must be continuity between the connector shields.

   Replace the 6 in. (152.4 mm) BNC cable if it is found to be defective and repeat Step 2 of this procedure.

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6 If the 6 in. (152.4 mm) BNC cable is not defective, re-connect the 6 in. (152.4 mm) cable to the oscillator and to the Crystal Sensor Emulator. If the XTAL Fail message remains, contact INFICON (refer to section 1.2 on page 1-2).

6.2.2 Feed-Through Or In-Vacuum Cable Diagnostic Procedure

1 Refer to Figure 6-2 on page 6-1. Remove the In-Vacuum cable from the Sensor Head at point B.

2 Connect the Crystal Sensor Emulator to the In-Vacuum cable.

- If the XTAL Fail message disappears after approximately five seconds, the Feed-Through and In-Vacuum Cable are working properly. Re-install the In-Vacuum cable to the Sensor Head. Go to section section 6.2.3 on page 6-4.
- If the XTAL Fail message remains, continue at step 3.

3 Disconnect the In-Vacuum cable from the Feed-Through and the Emulator. Disconnect the 6 in. (152.4 mm) BNC cable from the Feed-Through.

4 Using an Ohm Meter, verify continuity from the BNC center pin on the Feed-Through to the Microdot center pin on the Feed-Through. A typical value would be less than 0.2 ohms.

5 Verify isolation of the center pin on the Feed-Through from the electrical ground (Feed-Through body). A typical value would be in excess of 10 mega ohms.

If the Feed-Through is found to be defective, replace the Feed-Through, re-attach the BNC and In-Vacuum cables, and repeat this procedure starting at Step 2, otherwise continue at step 6.

6 Verify continuity from center pin to center pin on the In-Vacuum cable.

7 Verify that the center pin of the In-Vacuum cable is isolated from the In-Vacuum cable shield.

If the In-Vacuum cable is found to be defective, replace the In-Vacuum cable. Re-attach the BNC and In-Vacuum cables, and repeat this procedure starting at Step 2, otherwise continue at step 8.

8 Connect the In-Vacuum Cable to the Feed-Through.

9 Verify continuity from the center pin on the BNC connector of the Feed-Through to the center pin on the un-terminated end of the In-Vacuum cable.

10 Verify isolation from the center pin to electrical ground (Feed-Through body).

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If the Feed-Through/In-Vacuum cable system is found to be defective, look for defective contacts at the Feed-Through to In-Vacuum cable connection. Repair or replace the Feed-Through as necessary. Re-attach the BNC and In-Vacuum cables and repeat this procedure starting at step 2. Otherwise, continue at step 11.

11 Connect the 6 in. (152.4 mm) BNC cable to the Feed-Through and disconnect it from the Crystal Interface Unit (or Oscillator)

12 Verify continuity from the center pin of the Microdot connector on the Feed-Through to the un-terminated end of the 6 in. BNC cable.

13 Verify isolation from the center pin to electrical ground (Feed-Through body).

If the Feed-Through and 6 in. BNC cable system is found to be defective, look for defective contacts at the Feed-Through to BNC cable connection. Repair or replace the Feed-Through as necessary, re-attach the BNC cable to the XIU and In-Vacuum cable to the Crystal head and repeat this procedure starting at step 2.

6.2.3 Sensor Head Or Monitor Crystal Diagnostic Procedure

1 Remove the Crystal Cover from the Sensor Head.

2 Refer to Figure 6-1 on page 6-1. Connect the Crystal Sensor Emulator to the Sensor Head at Point C.

- If the XTAL Fail message disappears after approximately 5 sec. then the Sensor Head is operating properly. Re-insert the Crystal Cover into the Sensor Head and go to section 6.2.4 on page 6-5.
- If the XTAL Fail message remains, continue at step 3.

3 Disconnect the In-Vacuum cable from the Sensor Head and the Feed-Through. Remove the Crystal Sensor Emulator from the Sensor Head.

4 Using an Ohm meter, verify the electrical connections on the Sensor Head.

- Verify there is continuity from the center pin contact on the Microdot connector on the Sensor Head to the finger spring contact in the Sensor Head.
- There must be electrical isolation between the center pin of the Microdot connector and the Sensor Head body.

If the Sensor Head is found to be defective, contact INFICON to have the Sensor Head repaired (refer to section 1.2 on page 1-2).

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5 Connect the In-Vacuum Cable to the Sensor Head.

- Verify there is continuity from the finger spring contact in the Sensor Head to the center pin on the un-terminated end of the In-Vacuum cable.
- Verify there is isolation between the finger spring contact and the In-Vacuum cable shield.

If the Sensor Head or the In-Vacuum cable system is found to be defective, look for defective contacts at the In-Vacuum cable to Sensor Head connection, repair or replace the Sensor Head as necessary. Re-attach the In-Vacuum cable to the Feed-Through and repeat this procedure starting at step 2.

6 Ensure that the leaf springs in the Sensor Head and those in the ceramic retainer are bent to the approximate angle of 60° and 45° degrees respectively. Refer to section 4.1.6 on page 4-2.

6.2.4 System Diagnostics Pass But Crystal Fail Message Remains

If the system is operating properly, yet the Crystal Fail message is still displayed, perform the following tasks.

1 On the ceramic retainer verify that the center rivet is secure. Repair or replace the ceramic retainer as necessary.

2 Inspect the inside of the Crystal Cover for build-up of material. Clean or replace the Crystal Cover as necessary.

After verifying the Sensor Head contacts, the Sensor Head/In-Vacuum cable connection, and the ceramic retainer contacts, re-assemble the system. If the Crystal Fail message remains, replace the monitor crystal with a good monitor crystal. Verify that the monitor crystal works properly by inserting it into a known good measurement system. If you continue to experience problems, contact an INFICON Applications Engineer (refer to section 1.2 on page 1-2).

6.3 % XTAL Life

The Crystal Sensor Emulator contains a quartz crystal having a fundamental frequency at 5.5 MHz. With the Crystal Sensor Emulator connected, the % XTAL Life display should read:

- approximately 45% for deposition controllers which allow a 1 MHz frequency shift (IC6000, XTC, XTC/2, XTC/C, and XTM/2).
- approximately 30% for deposition controllers which allow a 1.5 MHz frequency shift (IC/4 Plus, IC/4 MPT, and IC/5).

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6.4 Sensor Cover Connection

The Crystal Sensor Emulator can be used to verify the measurement system for INFICON Thin Film Deposition Controllers and Monitors, including the IC6000, XTC, IC/4 Plus, IC/4 MPT, XTC/2, XTC/C, XTM/2, and the IC/5.

NOTE: The Crystal Sensor Emulator is not compatible for use with an IC/4.

However, the Crystal Sensor Emulator's Sensor Cover Connector is compatible with some sensor heads, and is incompatible with others. This is discussed in the following sections.

6.4.1 Compatible Sensor Heads

The Sensor Cover Connection will fit the sensor heads shown in Table 6-1.

Table 6-1 Compatible Sensor Heads

Sensor Head	Part Number
Standard Sensor Head	750-211-G1
Standard Sensor Head with Shutter	750-211-G2
Compact Sensor Head	750-213-G1
Compact Sensor Head with Shutter	750-213-G2
Dual Sensor Head	750-212-G2

6.4.2 Incompatible Sensor Heads

The Sensor Heads for which the Crystal Sensor Emulator's Sensor Cover Connector will not fit are shown in Table 6-2.

Table 6-2 Incompatible Sensor Heads

Sensor Head	Part Number
UHV Bakeable Sensor Head (12 in.) (304.8 mm)	007-219
UHV Bakeable Sensor Head (20 in.) (508 mm)	007-220
UHV Bakeable Sensor Head (30 in.) (762 mm)	007-221
UHV Bakeable Sensor Head w/ Shutter (12 in.) (304.8 mm)	750-012-G1
UHV Bakeable Sensor Head w/ Shutter (20 in.) (508 mm)	750-012-G2
UHV Bakeable Sensor Head w/ Shutter (30 in.) (762 mm)	750-012-G3
Sputtering Sensor Head	007-031
CrystalSix Sensor Head with position select	750-446-G1
CrystalSix Sensor Head	750-260-G1

NOTE: The Crystal Sensor Emulator’s Sensor Cover will not fit the crystal holder opening of the older style INFICON transducers that have the "soldered" finger springs.

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6.5 Specifications

Dimensions

1.58 in. x 1.58 in. x 1.79 in.
(40.13 mm x 40.13 mm x 45.47 mm)

Temperature Range

0 to 50 ^{o}C

Frequency

5.5 MHz +/- 30 ppm

Materials

304 Stainless Steel, Nylon, Teflon, brass. Some internal components contain zinc, tin, and lead.

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