

# How to Specify a Spherical Vacuum Chamber

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## STEP 1: Specify the Material and Finish

### MATERIAL OPTIONS:

- 304L Stainless Steel (standard)
- 316L Stainless Steel
- 6061 Aluminum

### FINISH OPTIONS:

#### Sphere Finish Options:

- Mechanically Polished Brushed Finish (standard)
- Electropolished

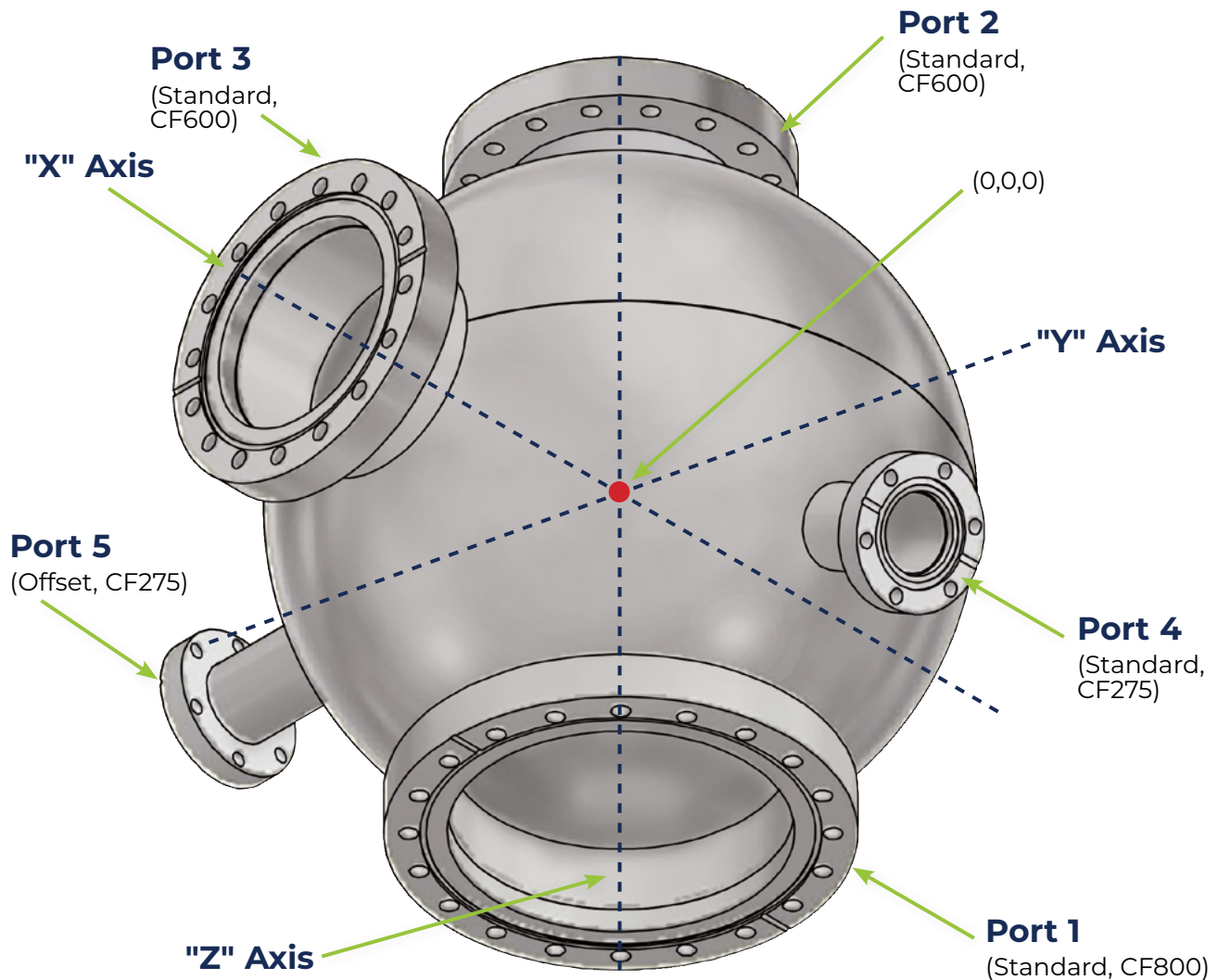
#### Tubing Finish Options:

- Mechanically Polished Brushed Finish (standard)
- Electropolished

#### Flange Finish Options\*

- Machined Finish (standard)
- Electropolished

*\*Sealing surfaces and knife edges are protected during any finishing process to ensure functionality.*



**Figure 1:**

Spherical Example Chamber with Port Numbers, Port Orientations, Flange Types & Sizes, and 3D Cartesian Coordinate System (Isometric)

## STEP 2: Specify the Main Body

The **Main Body** of a spherical chamber is defined as the sphere itself (excluding all ports). In most cases, including our **Spherical Example Chamber (Figure 1)**, this sphere is fabricated using two hemispheres (**Figure 2**).

### Specify the Main Body Sphere

- Nominal Outer Diameter
- Nominal Wall Thickness

**Portholes** are the holes in a chamber body where tubing and flanges are eventually welded to make ports. When fabricating a sphere from two hemispheres, the first step is to machine the portholes that are located at the pole of each hemisphere. These

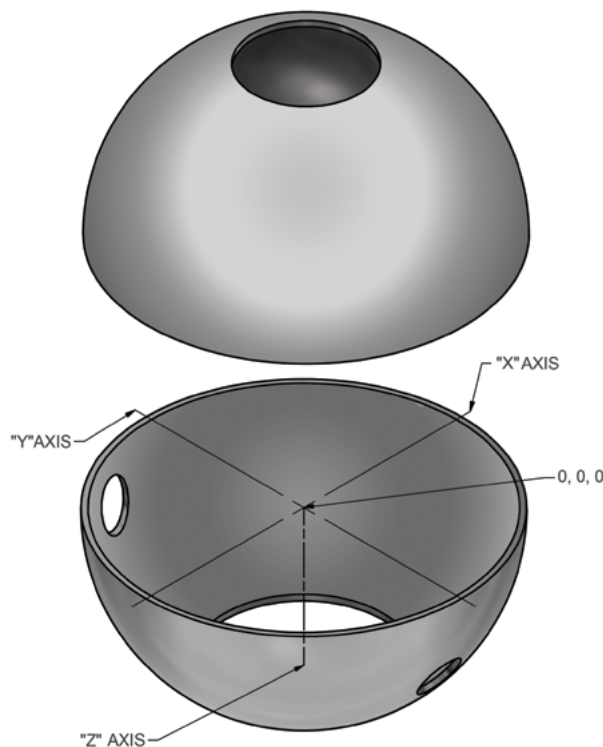
portholes allow access for welding, so **ANCORP** recommends that chamber designers:

- Locate your largest desired portholes at the poles of your spherical chamber.
- At minimum, locate at least one porthole that is 6-inches in diameter or larger at a pole.

If possible, additional portholes are machined into the hemispheres prior to welding.

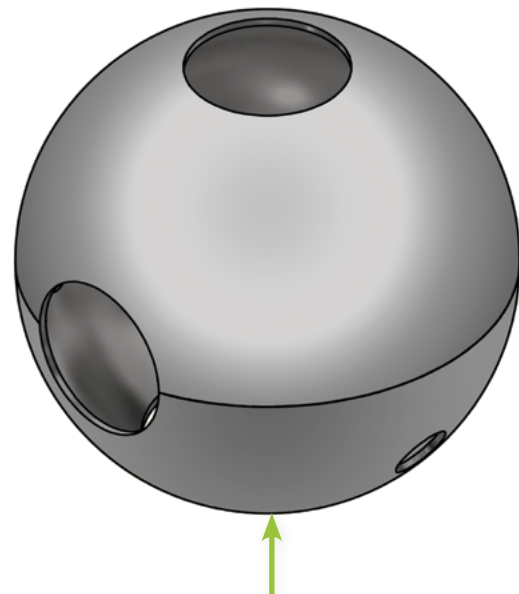
Next, the two hemispheres are welded together along the interior of the seam where they meet to form a sphere. An interior weld is preferable to an exterior weld in accordance with good vacuum practice.

Finally, any remaining portholes are machined into the sphere (**Figure 3**).



**Figure 2:**

Spherical Example Chamber - Upper and Lower Hemispheres Prior to Welding with 3D Cartesian Coordinate System (Isometric)



**Main Body Sphere:**

(12.000 O.D., 0.188 (3/16) WALL)

**Figure 3:**

Spherical Example Chamber - Main Body Sphere after Welding and Machining Remaining Portholes (Isometric)

## STEP 3: Specify the Ports

The **Ports** of a spherical chamber are the tubulated, flanged points of access that allow vacuum hardware, instrumentation, and other components to connect to the chamber. On our **Spherical Example Chamber (Figure 1)**, we show five ports: **Ports 1, 2, 3, 4, & 5**.

### A) SPECIFY PORT FLANGES\* (Type & Size)

Please refer to the catalog for all possible flange sizes. Representative examples are provided in **Table 2** on page 6.

*\*Each flange size has an associated standard tube size. Unless otherwise requested, this standard tube size will be used.*

### B) SPECIFY PORT LOCATION AND ORIENTATION

The following features and dimensions define a port's location and orientation on the spherical chamber (**Figures 4, 5, & 6**):

**ORIENTATION:** On a spherical chamber, we differentiate between two distinct port orientations: **Standard & Offset**.

- **Standard** (eg., Ports 1, 2, 3, 4)
  - o Focal Point is the center of the Main Body sphere
- **Offset** (eg., Port 5)
  - o Focal Point is not the center of the Main Body sphere

**FOCAL POINT:** A port's **Focal Point** is a feature that helps define the port's orientation and focal length.

- Locate each Focal Point in space using a 3-dimensional Cartesian coordinate system.

**POLAR ANGLE:** A port's **Polar Angle**

defines its latitudinal position along the outer surface of the spherical chamber.

- Specify each port's Polar Angle relative to a common polar origin.

**AZIMUTHAL ANGLE:** A port's **Azimuthal Angle** defines its longitudinal position along the outer surface of the spherical chamber.

- Specify each port's Azimuthal Angle relative to a common azimuthal origin.

**OFFSET DISTANCES:** A port's **Offset Distances** define how far its Focal Point is from the center of the Main Body sphere. Three Offset Distances are defined: one each along the X-Axis, Y-Axis, and Z-Axis of the Main Body sphere. Each Offset Distance is equal to the absolute value of the Focal Point coordinate along that same axis.

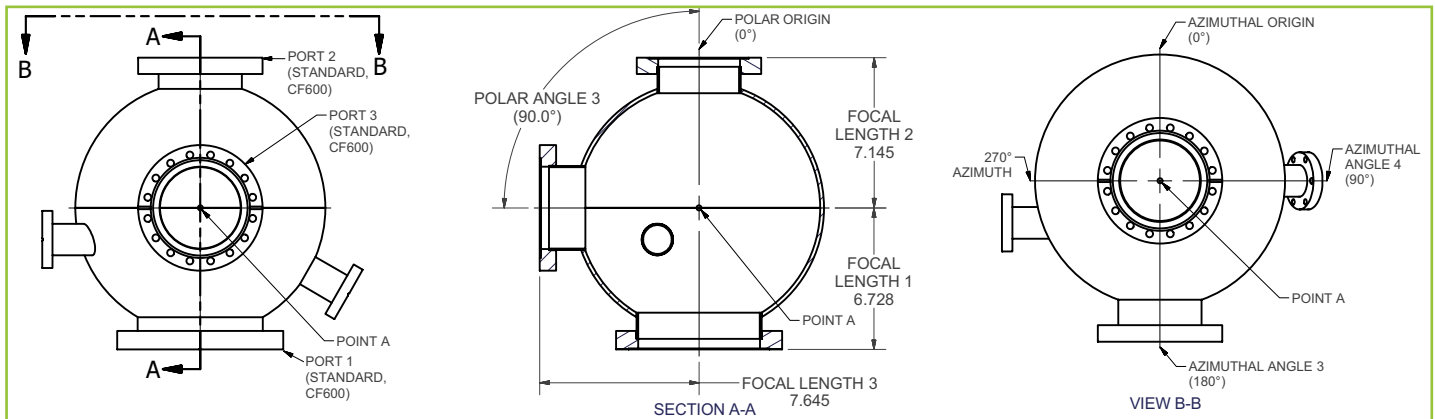
- Specify each port's Offset Distances.
  - o For Standard ports, the Offset Distances all equal zero.
  - o For Offset ports, at least one of the Offset Distances does not equal zero.

**FOCAL LENGTH:** A port's **Focal Length** defines the linear distance between the port's flange face and Focal Point.

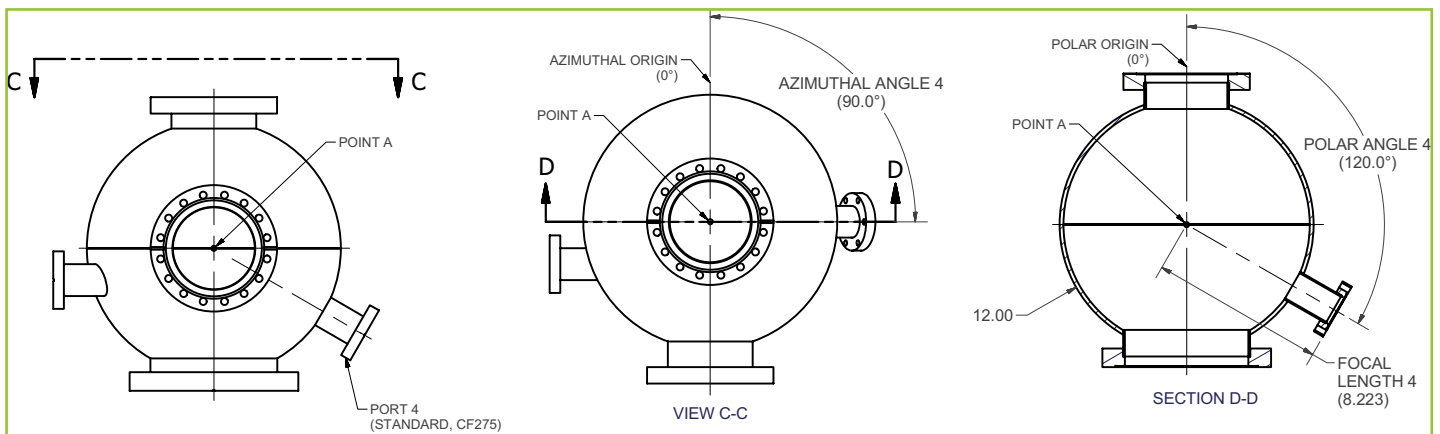
- Specify each port's Focal Length relative to its flange face and its established Focal Point.

**Table 1** on page 5 summarizes all the information needed to properly specify the ports on our **Spherical Example Chamber**.

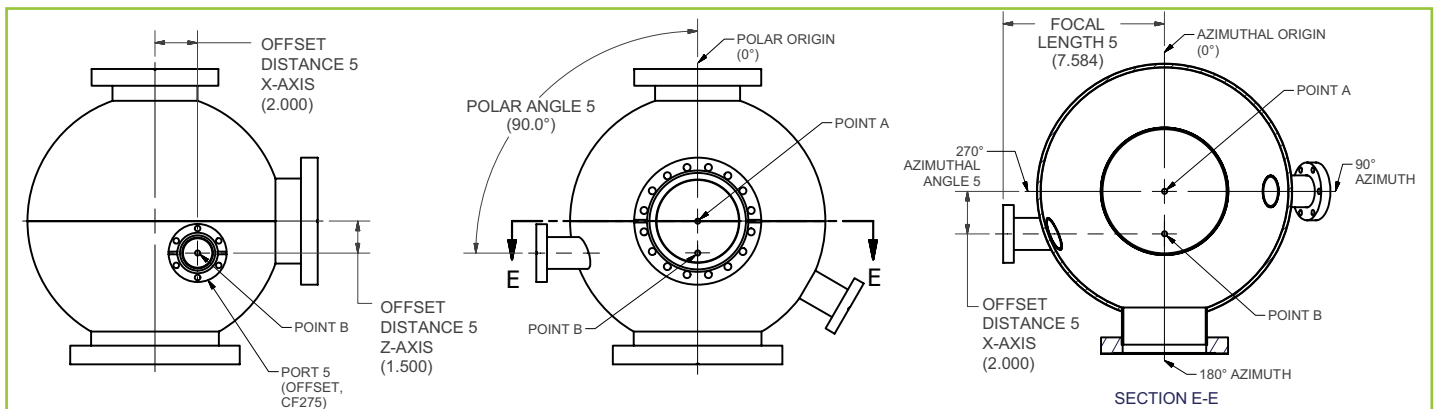




**Figure 4:** Spherical Example Chamber - Features and Dimensions of Ports 1, 2, & 3



**Figure 5:** Spherical Example Chamber - Features and Dimensions of Port 4



**Figure 6:** Spherical Example Chamber - Features and Dimensions of Port 5

**Table 1:** Port Specifications for Spherical Example Chamber

Port	Flange	Orientation	Focal Pt.	Focal Pt. Coordinates (X,Y,Z)	Polar Angle	Azimuthal Angle	Offset Distances (X,Y,Z)	Focal Length
1	CF800	Standard	Point A	(0.000, 0.000, 0.000) in.	180.0°	0.0°	(0.000, 0.000, 0.000) in.	6.728 in.
2	CF600	Standard	Point A	(0.000, 0.000, 0.000) in.	0.0°	0.0°	(0.000, 0.000, 0.000) in.	7.145 in.
3	CF600	Standard	Point A	(0.000, 0.000, 0.000) in.	90.0°	180.0°	(0.000, 0.000, 0.000) in.	7.645 in.
4	CF275	Standard	Point A	(0.000, 0.000, 0.000) in.	120.0°	90.0°	(0.000, 0.000, 0.000) in.	8.223 in.
5	CF275	Offset	Point B	(2.000, 0.000, -1.500) in.	90.0°	270.0°	(2.000, 0.000, 1.500) in.	7.584 in.

**Table 2:** Flange Types, Sizes, Vacuum Ratings, and Temperature Ratings

Flange Type	Flange Sizes	Vacuum Rating	Temperature Range*
<b>CF</b> - ConFlat	<b>133, 212, 275, 338, 450, 462, 600, 675, 800, 1000, 1200, 1325, 1400, 1450, 1650</b>	1X10 <sup>-13</sup> Torr	-200°C to 450°C
<b>WF</b> - Wire-Sealed	<b>1200, 1400, 1700, 1900, 2200, 2700</b>	1X10 <sup>-13</sup> Torr	-200°C to 450°C
<b>QF</b> - Quick Flange	<b>10, 16, 25, 40, 50, 63, 80, 100, 160, 200</b>	1X10 <sup>-8</sup> Torr	-20°C to 200°C
<b>LF</b> - Large Flange (Clamp)	<b>63, 80, 100, 160, 200, 250, 320, 400, 500</b>	1X10 <sup>-8</sup> Torr	-20°C to 200°C
<b>LFB</b> - Large Flange (Bolt)	<b>63, 80, 100, 160, 200, 250, 320, 400, 500</b>	1X10 <sup>-8</sup> Torr	-20°C to 200°C
<b>ASA</b>	<b>100, 150, 200, 300, 400, 600, 800, 1000</b>	1X10 <sup>-8</sup> Torr	-20°C to 200°C

\*Temperature range dependent on sealant material



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