Vacuum Chamber Inspection

Features

- Materials
- Water cooling
- Machining
- Welding
- Cleaning
- Leak testing
- Shipping

Materials

Type 304 stainless steel is ideally suited for vacuum vessel construction because of its machining characteristics, excellent corrosion resistance and overall cost effectiveness. Unless otherwise specified all materials used in the fabrication of vacuum chambers will be type 304 stainless steel. Caburn can quote the fabrication of chambers using other materials as required by a customer's application. Other materials used include 304L, 316 and 316L stainless steels. Low magnetic permeability materials such as mu-metal have also been used for the construction of magnetic shields used on conventional vacuum chambers. Caburn specifies a magnetic permeability of less than or equal to 1.05μ when buying raw 304 stainless steel materials. Stresses induced during metal forming and welding operations will produce a change to this value in the proximity of an affected area, which may be significant to some applications. Distances between an application's process and the affected areas should be maximized for applications that are highly sensitive to this increase in the material's magnetic permeability.

Water Cooling

Caburn can provide water cooling features to most vacuum chamber geometry.

Practical and safe water flow rates must be determined by the user by taking into account variables such as coolant path, temperature, pressure and a coolant's heat dissipating capacity.

Customers requiring water cooling for their chamber should keep in mind that the water cooling features must be incorporated in the early stages of a chamber's design or construction.

Caburn Custom Spherical Chamber

Caburn Custom Chamber

All dimensions are nominal in millimetres unless specified - Weights given are approximate

Welding

Caburn employs advanced tungsten inert gas welding techniques (TIG) with high purity Argon as the inert gas medium. Manual as well as automated orbital welding machines are at the heart of all welding operations. Caburn adheres to stringent UHV welding standards and practices including that of nonfiller metal, all internal fusion weld joints. External weld joints are not used unless required for structural reinforcement and then, limited to skip or span weld configurations. In the event that a weld joint can not be made internally, a one hundred percent full penetration external weld will be used. All weld joints are leak tested using a mass spectrometer leak detector with a minimum helium sensitivity of $2x10^{-10}$ standard cc/sec.

Surface Finishes

Vacuum chamber finishes include internal and external polishing of all body and port tube surfaces. Flanges and machined components have a standard 0.8Ra surface finish on sealing faces. Vacuum annealing of all fabrications is a Caburn default.

Leak Testing

Caburn is dedicated to providing standard as well as custom high and ultrahigh vacuum components of the highest quality and performance. To this end all vacuum rated components manufactured by Caburn are leak tested repeatedly, as required, throughout the manufacturing process to insure these goals are met. All weld joints, braze joints and seals are leak tested using a mass spectrometer leak detectors with a minimum Helium sensitivity of $2x10^{-10}$ standard cc/sec.

Cleaning

Upon final machining, which uses water soluble non-sulphurous cutting oils, components are washed in a high temperature detergent bath followed by multiple tap and de-ionized water rinses. After the last rinse, parts are blown dry and packaged. Products are shipped clean and leak tested, ready for vacuum installation and service.

Packaging and Shipping

Packaging includes the meticulous covering of all open ports with oil-free aluminium foil and the installation of protective plastic flange covers to prevent seal surface damage during transit. Where applicable components are packed, boxed or crated. For an additional cost Caburn can ship chambers with ports blanked-off. Note that this additional cost will include the purchase of all required port hardware including blank flanges, gaskets, fasteners and installation labour.

Pressure Rating

Caburn vacuum chambers and components are constructed to maximize their high and ultrahigh vacuum capabilities. As such they are not designed for positive pressure applications with ratings above one atmosphere.

Multiport Flanges and Fittings

Leak Checking

Milling

Machining Capacity

Turning	1.27m (50") between centres
	0.39m (15½") swing
	0.57 (22½") swing in gap
Milling	Table size 290 x 1200mm max
	Traverse 300 x 660mm
	Knee vertical travel 406mm
Boring (Horizontal)	950 x 700m 2 axis

Welder

Setting-up Centre Lathe

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Contact your sales office for more details...

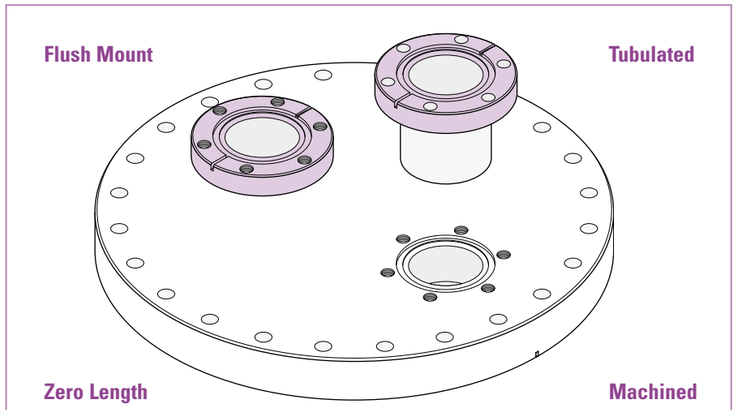
Typical Caburn Multiport Flange Assembly

Caburn's technical sales engineers are available to discuss your requirements for any non-standard component. In the case where a catalogue item may be close to your needs, but would benefit from a slight modification, the requirements could be easily noted using the existing catalogue drawing. Locate the catalogue page of the product to be modified.

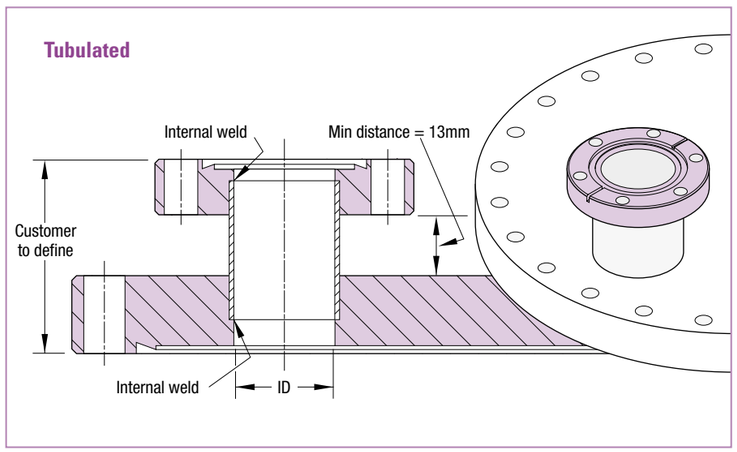
Provide the page number, a reference number if it's available, and a brief description of the modification requirements along with a marked up copy of the catalogue drawing.

One example of the multiple ways to specify a custom component

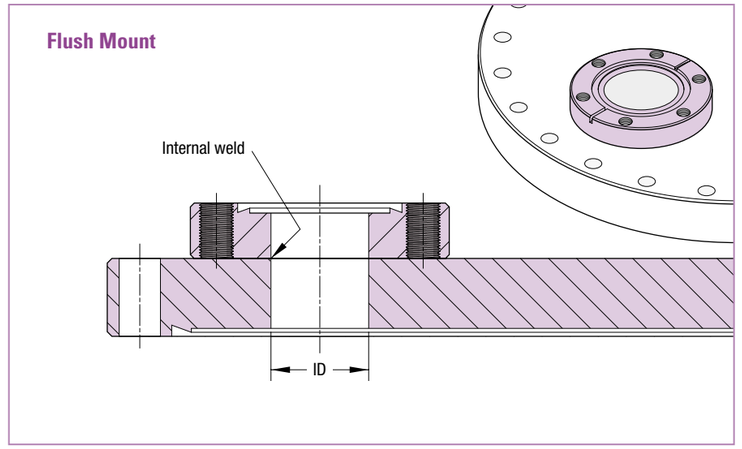
The flange assembly on the right depicts four popular methods of installing flanges in to a larger flange or plate. CF metal seal flanges have been used for the purpose of this example. The four methods of construction are referred to as standard tubulated, top flush mounted, zero length recessed and single piece integrally machined. These are given as examples for commonly asked questions. Discussing your application with an Caburn technical sales engineer will help determine the appropriate solution for your application.



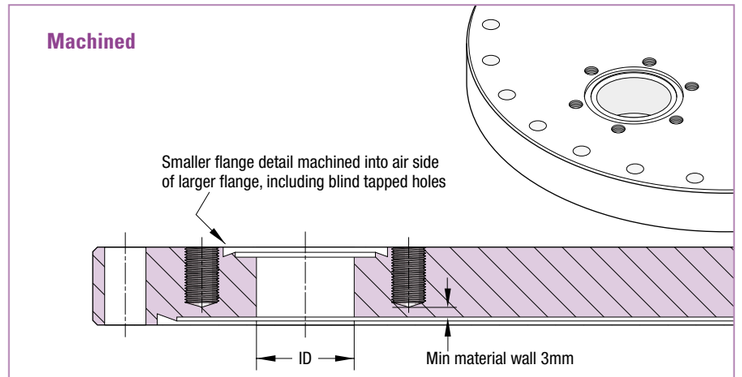
The tubulated method of construction would be one in which a standard or custom half-nipple is welded to the larger flange at the tube end. The larger flange or plate is counter-bored to match the tube's inside and outside diameters. The tube to flange transitions are welded in the same fashion along the bore's inside diameter. This method of construction allows the use of clearance hole, bolt and nut fasteners, and is the only configuration that would allow the use of a rotatable flange.



The most economical method of installing a flange would be to use standard off the shelf components requiring the minimum amount of modification and fabrication or in other words a top mounted method. In this method the larger flange or plate is bored to match the bore size of a smaller flange. Both are then joined by fusion welding internally along the interface between the two bored pieces. In some cases, external skip welds are provided for additional mechanical strength. This is the most economical method of construction.



An integrally machined method eliminates all weld joints, but requires the most amount of machining. Special machining steps include the use of blind-tapping for all bolt holes and off-centre turning of the knife-edge seal geometry as well as through bore operations. In some instances it may even be desirable to use helical thread inserts, since these would be easy to replace in the event a thread is damaged. Conventional threads would be very difficult to repair. This type of fabrication is the most aesthetic, but also the most expensive of the three choices.



[Manufacturing Defaults. Click to Download PDF Copy.]

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