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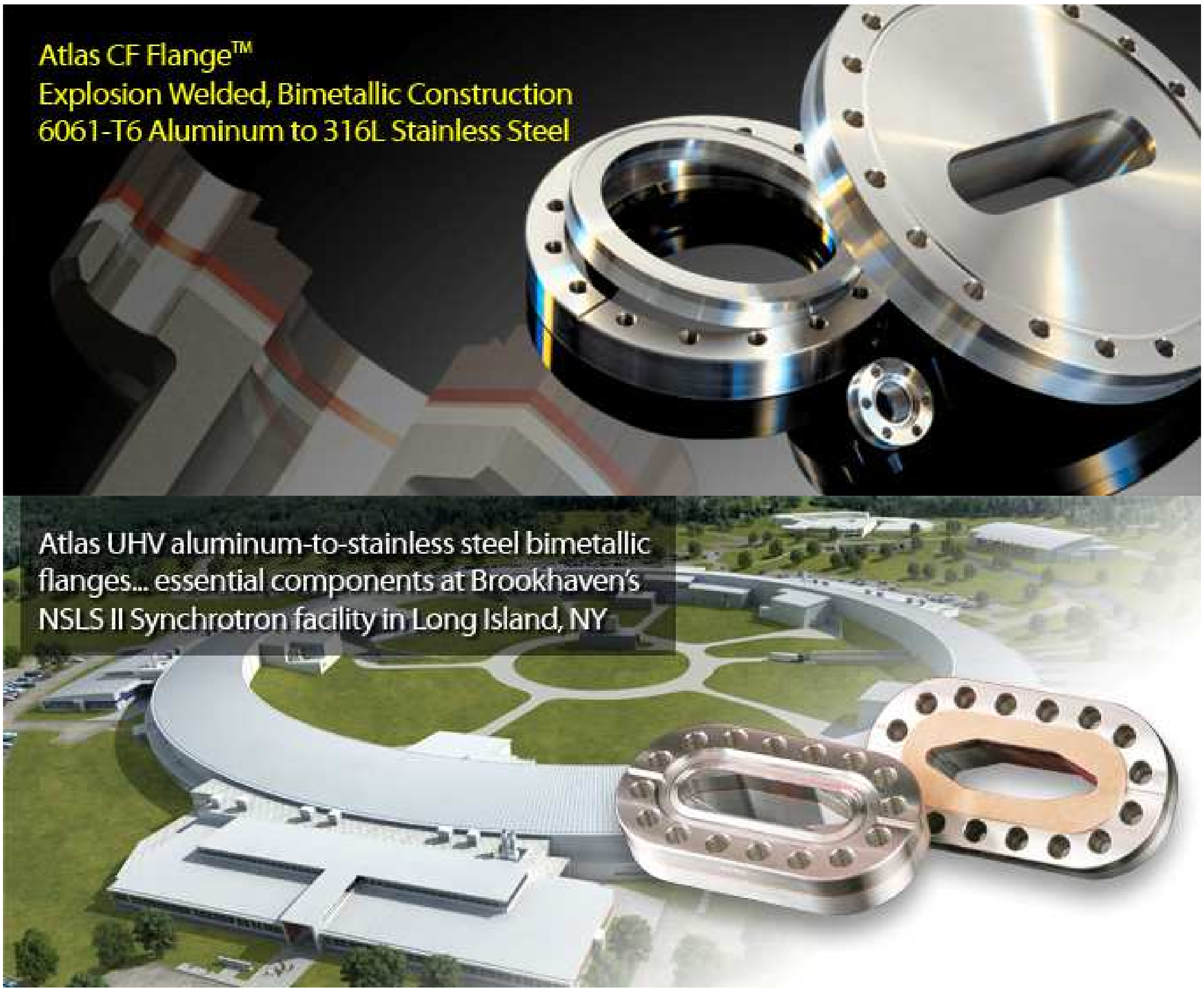
Atlas Bimetal Labs, Inc. (Atlas)

for the GERMAN SPEAKING EUROPE, BENELUX, POLAND, CZECH REPUBLIC

- Leaders in Aluminium Vacuum Technology -



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VACUUM TECHNOLOGY Hositrad

Atlas CF™ Flange All-Metal Sealing for Aluminum Vacuum

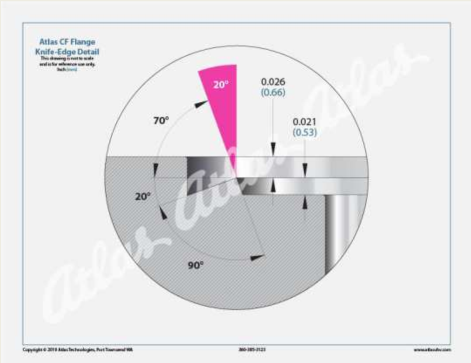

Figure 1: 20 degree back bevel on knife edge improves seal by making it more tolerant to thermal cycles as well as enhancing its durability.

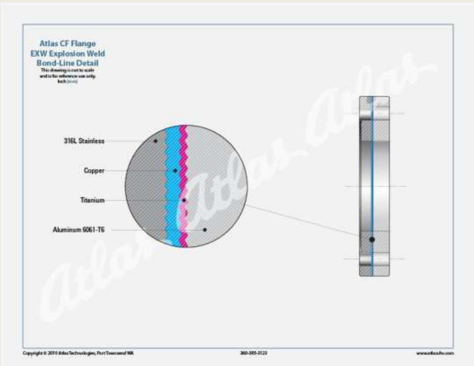

Figure 2: Cross-section of Atlas CF Flange showing stainless flange face bonded to an aluminum flange body.

Atlas CF™ bimetallic flanges-
the aluminum flange with a stainless steel knife-edge seal, makes UHV aluminum vacuum systems a reality.

Atlas CF™ Flange Features
Patented UHV aluminum to stainless explosion welding technology (EXW) that is only available from Atlas

UHV Rated to 1x10-13+ Torr

1/3 the weight of stainless flanges

90° included angle, long-life knife-edge design, developed at CERN

100% Compatible with the industry standard ConFlat® interface. Reduced stainless steel, Cryogenic, non-magnetic, rectangular and other specialty flange solutions also available

The **Atlas CF™ Flange** combines the time-tested reliability of the stainless steel ConFlat® (CF) knife edge, with an aluminum flange body for weld up to an aluminum chamber.

The **Exceptional Vacuum Properties of Aluminum** are Within Reach:The Atlas CF Flange provides standard all-metal-sealing for aluminum vacuum chambers. It enables vacuum engineers and designers to fully utilize the exceptional high and ultra high vacuum properties of aluminum.

The **Atlas CF™ Flange**—the aluminum flange with a stainless steel knife-edge seal—makes UHV aluminum vacuum systems a reality.

Using proprietary and **state-of-the-art explosion welding technology**, our stainless to aluminum bimetallic flanges are fully compatible with the industry standard ConFlat® flange interface. Employing CERN's innovative 20° back-bevel (90° included angle) knife-edge design, the Atlas CF™
Flange provides a longer service life than conventional CF flanges.

Atlas CF™ Flanges are suitable for service in vacuum levels to 1x10-13+ Torr and 250°C bakeout temperatures. Our bimetallic flanges can be easily welded to aluminum vacuum vessels and are the key to successful integration of aluminum UHV technology in your application.

Our flanges are used in **prominent high (HV), ultrahigh (UHV) and extreme high vacuum (XHV) applications** around the world. They find extensive use with semiconductor fabrication OEMs where superior heat conduction, chemical resistance, manufacturing ease and the lower cost of aluminum vacuum systems translate into measurable productivity and cost of ownership advantages.

Specifications
Atlas CF™ Flanges are fully compatible with the industry standard ConFlat® flange. Atlas uses CERN's 20° back-bevel knife-edge design with a long-life 90° encompassed angle geometry. Atlas flanges are quality controlled using material batch monitoring processes.

Materials
Body/Weld Interface: Aluminum 6061-T6
Knife-Edge: Stainless Steel 316L, Titanium (Commercially Pure) Optional
Rotatable Collar/Receiver:
Aluminum 6061-T6,
304 Stainless Steel Optional

Environmental
He Leak Tested: < 1x10E-9 mbarl/sec

Thermal
Peak Temperature:
300°C (during weld-up)
Operational Temperature:
-200°C to 250°C

Mechanical—EXW Interface
Tensile: 15,00psi (103MPa)
Shear: 10,000psi (69MPa)

Atlas Vacuum Surface Passivation -
Aluminum is produced with a heavy mill scale and rough (porous) oxide layer- a surface not well suited for vacuum, because it absorbs water vapor and other contaminants. After removing this rough layer Atlas cleans all metal surfaces before, during and upon completing the fabrication process. Atlas' advanced vacuum surface passivation process replaces thick porous oxide layers with a quality thin and dense oxide surface.

Atlas' proprietary specification establishes a standard for the creation of dense oxide surface passivation. Treating aluminum in this manner effectively reduces surface area, contamination and desorption.

Non-Magnetic Atlas CF™ Flanges:
Because aluminum is essentially non magnetic Atlas manufactures a large number of vacuum chambers and flanges for low magnetic permeability applications. Atlas offers a line of Atlas flanges made with a 316LN face instead of a 316L face. 316LN has a significantly lower magnetic permeability than standard stainless steel. Even though 316LN has a lower permeability than conventional stainless it too can often not be used due to its magnetic permeability; for applications requiring even lower permeability we manufacture Atlas CF Flanges with a titanium knife edge and face instead of a stainless steel face. The titanium faced Atlas CF flanges offer an essentially non magnetic all metal seal flanges with the favorable economic and vacuum advantage of aluminum chamber.

Typical **non magnetic uses are UHV synchrotron and particle physics and industrial applications**, where high magnetic permeability is detrimental to beam quality or experimental results. Such applications include non-magnetic beam tubes, wigglers, undulators, free electron lasers, drift tubes, spectrometers...

Low Z, Low Nuclear Activation Atlas CF Flanges:
In neutron applications such as the production of radioisotopes for medical imaging, aluminum vessels fitted with our flanges replace all stainless steel UHV systems, because residual, neutron induced, radiation in aluminum has a half-life orders of magnitude shorter than that of stainless steel (which contains Cobalt and Chrome). Our flanges enable aluminum UHV system use in cyclotrons and nuclear reactors. For such applications Atlas offers a reduced stainless face or a titanium flange face.

Light/Low Weight Atlas CF Flanges:
For weight sensitive applications such as Aeronautical, Space or portable systems Atlas offers either a reduced thickness of stainless or titanium faced or a line of Atlas CF flanges. Using these models, engineers can significantly reduce overall weight. Depending on size, reduced stainless flanges are produced with a stainless interface that's about 20% to 40% thinner than standard flanges. Contact our sales department for more information on our custom bimetallic, high and ultrahigh vacuum solutions.

Atlas Advanced Vacuum Welding -
Even to experienced welders, the welding of aluminum to vacuum standards is a challenge many are not capable of achieving.
The welding process can introduce porous oxides that impede hermitic welding. In other industries these welds can meet mechanical standards, but when tested to vacuum helium leak standards are considered inadequate.

Atlas aluminum vacuum welds are quite distinctive from conventional aluminum welds. They are more continuous, have a 'glassy' surface and minimized area.

Atlas' AT-AVW process reduces internal and external oxide inclusions, effectively eliminating leak paths or virtual leak pores -essential to good vacuum performance. Typically the AT-AVW process produces a smaller heat affected zone, which leads to less surface haze and contamination.

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Explosion Welding/Explosion Bonding:
Robust bimetallic joints for dissimilar metals
Atlas Technologies concentrates much effort in the development of methods and processes specifically intended for bonding dissimilar metals for use in ultrahigh vacuum (UHV) scientific and industrial applications. Atlas holds various patents in this technology, including those for the Atlas CF™ flange and the Atlas ATCR™ Face Seal Fitting/Gland.

Explosion welding or bonding (EXW)
is a solid state process by which dissimilar metals can be joined together at an atomic level. The bonds are very strong, fully metallurgical and ductile. Preparation for bonding requires that plates lay flat to each other, a flyer plate on top of a base plate separated by a small gap. An explosive charge is placed on the flyer plate and detonated from a point at the edge of the plate. A controlled progressive ignition travels across the flyer plate like ripples in a pond. The explosion accelerates the plates together with impact velocities of 1800~2200 m/sec. A high energy surface plasma is formed between the plates, moving ahead of the collision point and stripping electrons from the two bonding surfaces. The electron-hungry metals are then thrust together at extreme pressures forming an electron-sharing bond.

Metals like copper and stainless steel can be readily bonded through the EXW process. However aluminum and stainless are metallurgically incompatible and not be directly bonded, because of the formation of brittle intermetallic compounds. Atlas has developed patented multi-layer composites technologies that provide the metallurgical compatibility required for joining aluminum to stainless and other exotic metals.

The Atlas CF™ Flange is manufactured using a multi-layered composition consisting of 316L stainless steel, copper, titanium and 6061-T6 aluminum.

Aluminum Vacuum Chambers

Lightweight aluminum vacuum chamber for NASA, lightening pockets are machined into the walls if the chamber and stiffening ribs add extra rigidity

Atlas manufactured Synchrotron monochrometer aluminum vacuum chamber machined from solid plate. Built for Lawrence Berkeley National Lab.

Aluminum tube chamber manufactured with Atlas CF flanges for ultra high vacuum

Advantages
Atlas Technologies specializes in aluminum vacuum chambers. We strongly believe that aluminum is a superior vacuum material to stainless steel. It is easy to see by reading the following description of aluminum why the high and ultra high vacuum industry is rapidly embracing aluminum.

Atlas Aluminum vacuum chambers have excellent ultra high vacuum (UHV) properties and for most applications aluminum is a superior UHV vacuum chamber material. Aluminum has 10,000,000x (7 orders of magnitude) less Hydrogen permeation than stainless steel. Consequently, aluminum chambers have far less H2, H2O, & hydrocarbon vapor at high vacuum and ultra high vacuum levels. See references. Aluminum also has less carbon than stainless steel which reduces the amount of carbon based gas contamination in vacuum. Atlas Technologies manufactures ultra high vacuum (UHV) aluminum chambers with a thin dense aluminum oxide. This serves as a resistive barrier reducing diffusion and desorption of high vacuum & ultra high vacuum contaminates (Hydrogen, Oxygen & Carbon). Once baked Atlas' aluminum vacuum chambers generally cycle to high vacuum and ultra high vacuum levels faster than stainless chambers and require less pumping.

The following physical properties of aluminum describe why it is an excellent vacuum material.

Mechanical Properties. Typical elastic module for aluminum alloy 6061 T6 and stainless steel alloy 304 [9] are 7470 kgf/mm2 and 19700 kgf/mm2, respectively. If these values are used in mechanical formulae for standard geometries, the ratios of critical thickness for the two materials are [10]: Here, tAS(flat plate), tAS(long cylinder), and tAS(short cylinder) are the minimum thickness ratios to avoid buckling in flat plates, long cylinders, and short cylinders, respectively.

Note that the ratios are close to unity. An aluminum vacuum system will not require parts that have appreciably greater thickness than similar ones manufactured from stainless steel.

Thermal Conductivity. Aluminum's thermal conductivity, depending on the alloy, ranges between 170 W/mK and 230 W/mK. Stainless steels, by contrast, have thermal conductivities that are between 14 W/mK and 16 W/mK (aluminum is 10x stainless steel). High thermal conductivity is an advantage when designing systems that require temperature cycling. This is the case for vacuum systems that must be baked to reach UHV levels. An aluminum chamber may be baked and then cooled much more rapidly than a stainless steel chamber. Furthermore, aluminum`s high conductivity allows a complete bakeout without recondensation of gases on local cool spots, a common problem in stainless steel systems. Due to aluminum's superior thermal conductivity, aluminum vacuum chambers bake-out faster and more uniformly even at lower temperatures (150 C).

CF Flanges for Aluminum. Atlas Technologies manufactures robust demountable, all-metal-seal, Atlas Flanges™ and Atlas ATCR™ face seal fittings which have a stainless steel knife edge or sealing face on a aluminum body for weld-up to an aluminum vacuum chamber. Browse our Atlas CF Flange™, Atlas Quick Disconnect Flange or our Atlas ATCR™ pages for aluminum vacuum chamber sealing options.

Weight. Aluminum is roughly 1/3 the weight of stainless steel (2.8 g/cm3 [Al] vs. 8.0 g/cm3 [stainless steel alloys]). The cost burden associated with excess weight begins when the raw materials are handled and progresses throughout the manufacturing process. It affects all production steps, including shipping, installation, and even the architectural engineering and construction of the environment surrounding a process tool.

Magnetic Properties. Aluminum is not magnetic whereas stainless steel, being essentially an alloy of iron, exhibits residual magnetism. The absence of magnetic properties in aluminum is advantageous for applications involving charged particle beams because the vacuum chamber will not modify the fields from the beam control magnets.

Radioactivity. Aluminum, in comparison to stainless steel, has a much more rapid decay of induced radioactivity. If both types of materials are bombarded with the same flux of charged particles, the residual radioactivity will typically be one to two orders of magnitude less for an aluminum sample than for an identical stainless steel sample [13]. The nuclear half-life of elements that make up stainless steel suggests that a-particle contamination is always present in stainless steel and a possible source of circuit damage.

Corrosion. The corrosion of both aluminum and stainless steel alloys in reactive gasses is complicated. Experimental work performed on various alloys in different reactive gaseous environments shows that both aluminum and stainless steel are subject to attack by reactive gasses. Halogen-containing species are typically the most damaging and the corrosion of any given compound is usually no worse than that of its halogen component alone [9, 10]. Aluminum is not a worse corroder than stainless steel. It simply has different reaction dynamics that do not serve as a source of iron and nickel contamination, one of the most significant yield-limiting factors for silicon IC production.

Outgassing Properties. One of the most important properties of a vacuum material is the outgassing rate, as this determines the ultimate pressure that may be obtained in the vacuum chamber. Repeatable outgassing rates of <10-13 Torr liter/sec cm2 are now possible in aluminum UHV systems [13], comparable to the best outgassing rates obtainable with stainless steel [14]. This improvement in outgassing performance has been one of the principal breakthroughs that has allowed aluminum to become a competent material for the construction of UHV systems.

Conclusion: Atlas Technologies aluminum vacuum chambers offer extraordinary UHV performance. Surface treatment, automated welding processes, and metal-sealed flange technologies have made this possible. The impact of UHV environments for contamination-free manufacturing processing has yet to be determined in a quantitative fashion. Current studies, however, indicate that they will be essential components of semiconductor materials processing and control and key aspects of 300-mm processing systems.

Custom HV and UHV Solutions

Reduced Stainless Steel CF Flanges
For maximum weight reduction and minimum neutron activation, Atlas CF Flanges are also available with reduced stainless steel content. Depending on size, reduced stainless flanges are produced with a stainless steel interface that's about 20% to 40% thinner than standard flanges.

Custom Flange Solutions
Using Atlas' proprietary explosive welding process (EXW), many customized UHV bimetallic flange solutions are possible... including specialized bores, rectangular knife-edge, bimetal titanium and many more.

Rectangular Bore CF Flanges
Whether you need conventional (circular) CF flanges with custom apertures or unique rectangular or oval knife-edge geometry, Atlas can handle all of your custom CF flange requirements.

Exotic Material CF Flanges
Atlas Technologies has extensive experience in the design and fabrication of EXW flanges made from exotic material combinations for use in specialized environments and applications such as cryogenic, non-magnetic, etc. Materials include 316LN, Titanium, Copper...

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Other Products

Neutron Windows with Bimetallic Atlas CF™ Interface

In neutron applications like the production of radioisotopes for medical imaging, aluminum vessels fitted with our flanges are replacing all stainless steel UHV systems— because residual, neutron induced, radiation in aluminum has a half-life orders of magnitude shorter than that of stainless steel. Our flanges enable aluminum UHV system use in cyclotrons and nuclear reactors.

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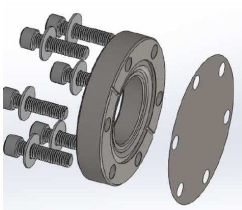
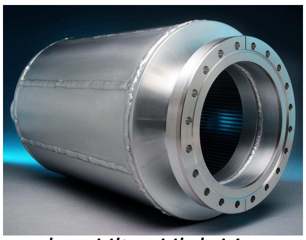
Atlas Neutron Windows are an integrated Atlas CF flange with 316L sealing surface with an aluminum window—all in one flange body with no welding or connections. Standard windows are made from 6061 T6 aluminum machined to the thickness that you desire. Atlas offers engineering finite element analysis to assure you of the mechanical strength required. Dual neutron windows can offer an internal cavity that can be differential pumped or filled with a gas and analyzed through an array of optical ports mounted around the rim of the flange. All flanges are vacuum tested to a leak rate of 1x10 -9 cc/sec of He prior to shipping.

Foil Window Flange



An ultra thin aluminum or titanium UHV window that allows for quick, inexpensive replacement in the field. an excellent alternative to beryllium.

Atlas Aluminum Titanium Sublimation Pump



Used in Cryogenics, Ultra High Vacuum (UHV),and Ultra High Purity (UHP)

Specifications:

Material: 6061-T6 Aluminum Alloy/Titanium /Copper /Stainless 316L

Environmental: Vacuum Rated to $1x10^{-11}$ Torr

Peak Temperature: 300°C
Operational Temperature from -200°C to 250°C

Delivers very low hydrogen permeation, high surface vacuum environment for condensation, and quick pump down.

Tube and Pipe Bimetallic (Al/SS) Transition Couplings

Atlas bimetallic transition couplings are metallurgical bonded dissimilar metal joints used to provide an all welded transition for dissimilar metal tubes or pipes.

Material
6061-T6 Aluminum Alloy/Titanium /Copper/Stainless 316L

Environmental
Vacuum Rated to $1x10^{-11}$ Torr
Peak Temperature: 300°C
Operational Temperature from -200°C to 250°C

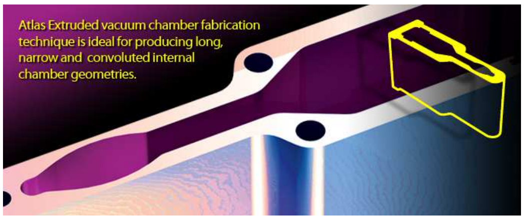
TTBI: Bimetallic Tube Transition Couplings : .25" – 8"

PTBI: Bimetallic Pipe Transition Couplings Schedules: 40 Al/10SS, 40 Al/40 SS, 80 Al/40 SS

Atlas Emissivac UHV Polish

A process which produces highly polished aluminum surfaces that are UHV and extreme high vacuum (XHV) compatible. The resulting surface have considerably lower thermal emissivity, diffusion rates, and outgassing.

Extruded Vacuum Chamber Fabrication



Extruded chambers are typically used for long chamber applications. However, intricate internal and external shapes can be economically added to other chamber types. Many synchrotrons require multiple chamber sections, each measuring between 4 to 8 meters in length. Extruded aluminum fabrication is ideal and has been used for these applications, because of cost and aluminum's ability to handle high heat loads and its resistance to photo-desorption of surface gases.

Titanium and Copper Vacuum Chamber

Titanium Vacuum Chambers
Atlas Titanium vacuum chambers offer extreme vacuum performance with very low hydrogen permeation rates and secondary gasses. Titanium vacuum chambers, due to the gettering properties of this metal, are in many ways the ultimate vacuum material.

Copper Vacuum Chambers
Copper vacuum chambers and copper alloy vacuum chambers can offer excellent performance for nonmagnetic, radio frequency (RF), and high thermal conductivity applications.

Many of the advantages for Aluminum chambers also apply to copper vacuum chambers. Copper vacuum vessels can be extruded, have very little photo-desorption, have good thermal stability, are self shielding for some radiation and have low thermal expansion.

Why Aluminum ?

Atlas has overcome the three major obstacles that have inhibited the use of aluminum in extreme vacuum applications... vacuum sealing, vacuum welding and vacuum surface passivation. Why Choose Aluminum?

- Low Outgassing
- Low Contamination
- High Thermal Conductivity
- High Vibration Dampening
- Superb Machinability
- Space and Weight Reduction
- Low Nuclear Activation
- Low Magnetic Permeability
- High Chemical Resistance
- Low Cost of Ownership

Aluminum has 10,000,000 x (7 orders of magnitude) less Hydrogen permeation. Repeatable out gassing rates of <10-13 Torr liter/sec cm2 are now possible in aluminum UHV systems.

Low Magnetic Permeability Vacuum Chambers & Flanges

Extremely Low Magnetic Permeability Vacuum Chambers & Vacuum Flanges:
Atlas Technologies builds a non magnetic model of its Atlas FlangeTM, the aluminum flange with a stainless steel knife-edge and face using 316LN stainless. This alloy ensures a minimal magnetic permeability from the stainless steel while providing an aluminum base for weld-up to an aluminum chamber that is not magnetized during welding. The magnetic permeability of aluminum, near unity, and its excellent vacuum properties such as extremely high thermal conductivity, low H2 and no C content, light weight and low Z make aluminum a superior vacuum material for many UHV applications.

Atlas also manufactures Atlas Flanges with hardened knife edges and faces using materials other than stainless. For example Atlas uses titanium instead of stainless as a knife edge material. This reduces the magnetic permeability even more than using 316LN and is ideal for extremely magnetically sensitive applications.

Some non magnetic applications are better served with copper Ultra High Vacuum UHV chambers and flanges. Atlas manufactures custom copper chambers with hardened flanges surfaces to meet your specifications.

Low permeability Atlas CF Flanges and chambers are in use at prominent national lab and accelerator facilities world wide. We would be delighted to talk with you about your application and assist you in the engineering and manufacture of flanges or chambers.

Atlas Technologies offers low magnetic permeability stainless steel Ultra High Vacuum Atlas Flanges. These flanges enable you to apply the excellent extremely low permeability of aluminum through-out your vacuum system and still enjoy rugged stainless knifes with magnetic permeabilities far below conventional stainless steel.

The low mu Atlas Flanges are carefully manufactured with atlas' proprietary technologies yielding a very low permeability in the stainless around ~1.017 µ.

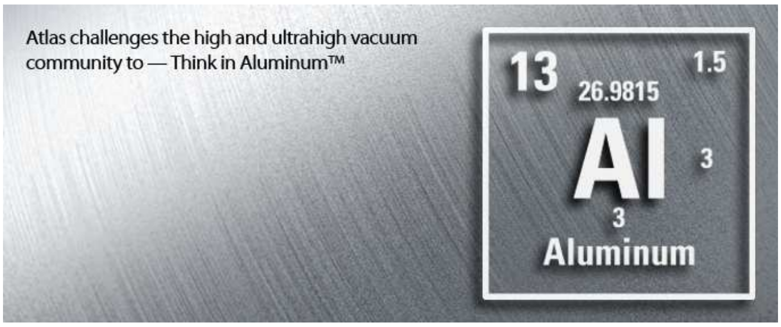
Because aluminum has a lower mu than the low mu stainless and is less expensive, Atlas' low mu flanges are the clear choice for low permeability vacuum applications.

Atlas stocks low mu Atlas flanges

Permeability : μ_r 1.00002 relative

Relative Permeability (µr) refers to the ratio of magnetic flux in any element of a medium to the flux that would exist if that element were replaced with air, magnetic-o-motive force (mmf) acting on the element remain unchanged ($\mu_r = \mu/\mu_0$)* . Permeability (µ) is the ratio unit magnetic flux density to unit magnetic field intensity in air (B/H) the Permeability of air is 1.257 x 10^6 henry per metere*

Aluminum's Extreme Vacuum Performance



Any single physical or chemical property of aluminum may be enough reason to select aluminum as a vacuum chamber choice over stainless steel. But when looked at in summary, aluminum overwhelmingly surpasses stainless steel as providing the lowest cost of ownership. Aluminum has seven orders of magnitude less hydrogen than stainless steel. It has very low levels of Carbon, resulting in significantly less H2O, CO, C2 and CH4 than stainless steel. Aluminum vacuum systems require far less pumping than comparably equipped stainless steel chambers. A baked aluminum chamber has an outgassing rate of less than $1x10^{-13}$ Torr liter/sec cm^2 compared to Stainless' 6.3 $x10^{-11}$ Torr liter/sec cm^2 (1).

An aluminum chamber processed according to Atlas specification AVSP-08, entails cleaning and baking surfaces to facilitate the formation of a dense oxide passivation layer through the conversion of hydroxides into stable oxide molecules. The resulting surface inhibits the diffusion of other contaminants, further reducing pumping requirements—and faster pumping equates to smaller and less expensive pumps.

Fluorine gas is a common cleaning agent in aluminum chambers. Atlas aluminum chambers and gas delivery lines are far more resistive to fluorine than those made of stainless steel, because Atlas' AVSP-08 process forms a dense protective oxide layer that make our aluminum a highly corrosion resistant material. These surfaces can be further protected from halogens by producing even thicker and harder oxide layers through an electrolytic anodizing process.

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Excellent thermal properties such as high conductivity make aluminum an excellent vacuum material. With 10x the thermal conductivity, 21x the thermal diffusivity of stainless and extremely low thermal emissivity rates, aluminum chambers bakeout quickly and evenly. The surface properties of aluminum allow full bakeout at 150°C — much lower than stainless. Aluminum chambers heat up quickly and uniformly, bakeouts are faster and more complete with significantly reduced cycle times.

With **low nuclear activation**, aluminum has a short neutron activated half-life measured on a scale of hours—significant when compared to stainless steel's scale, which is measured in thousands of years. This offers huge disposal savings and a priceless reduction in potential exposure to staff.

Aluminum is essentially magnetically transparent (**non-magnetic**). An aluminum UHV chamber's low magnetic permeability offers no measurable disruption to electron and ion optics.

With a low Young's' modulus (69GPa) of elasticity (1/3 that of stainless steel, 207GPa) aluminum offers **outstanding vibration dampening**, making it the material of choice for precision synchrotron, semiconductor and physics applications where excess vibration can have disastrous consequences.

Compact **aluminum vacuum chambers with up to 40% smaller footprints** are economical alternatives to bulky stainless steel systems, especially when valuable floor space is at a premium. At about 1/3 the weight of stainless steel, aluminum chambers are significantly lighter and require less expensive support structures. Lower weight translates into reduced shipping costs and faster installation times.

Because of its **superb machinability** (5x to 10x faster than stainless) aluminum chambers can be manufactured with more detail. Aluminum can also be cut, shaped or formed, and extruded quite easily. Chamber features are produced to fit an application rather than tailoring an application to fit a material's manufacturability limitations—reducing extra equipment and space.

Atlas offers **five basic aluminum chamber types**... monocoque, plate, tube, extruded and formed aluminum configurations, to give you a variety of design options and complete control of your application.

After weighing all factors, Atlas aluminum vacuum chambers can save 40% to 60% when compared to stainless—and the bigger the chamber, the more pronounced the savings—plus when fitted with Atlas CF Flanges, ATCR fittings and treated with AVSP-08, cost less than comparably equipped stainless systems. Cost savings are directly attributed to aluminum's machinability; reduced outgassing volume and surface area; fast cycling, bakeout and pump-down times; reduced footprint and smaller/lighter support structures; reduced shipping cost; and lower disposal costs when dealing with nuclear activation applications.

Aluminum's Extreme Vacuum Performance Delivered
Atlas has overcome the three major obstacles that have inhibited the use of aluminum in extreme vacuum applications... vacuum sealing, vacuum welding and vacuum surface passivation. Applying our knowledge and proprietary technology we produce state-of-the-art aluminum vacuum chambers that deliver the revolutionary physical and vacuum properties of aluminum at dramatic cost savings.

Footnotes :

Chen, J.R. et al. Thermal Outgassing from Aluminum Alloy Vacuum Chambers. Journal of Vacuum Science and Technology A 3. p. 2188.

O'Hanlon, John. Ultrahigh Vacuum in the Semiconductor Industry, Journal of Vacuum Science and Technology A 12, p. 921.

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References

Aluminum and Bimetallic Synchrotron Solutions

"We have been working with Atlas for many years using their Atlas CF flanges and explosion bonding capability for assemblies such as beryllium windows. In 2005 we had a need for a dipole magnet vacuum chamber. Atlas competed with vacuum equipment manufacturers worldwide and won the bid, beating out stainless steel vendors in Europe and Russia by a large margin.

This is a large chamber ~2.9 m long with two 50 mrad acceptance aperture IR beamlines tangential to the synchrotron electron beam orbit. All flanges including e-beam orbit, synchrotron radiation ports and pumping ports were fabricated from Atlas CF flanges. In addition to the demanding geometrical constraints of the dipole magnet the chamber was required to absorb all excess synchrotron radiation not entering the beamlines and resist any deformation due to forces incurred under vacuum. Atlas presented a preliminary design for approval before fabrication and conducted a complete FEA analysis of the chamber studying both the thermal loading and the vacuum deflection.

Atlas fabricated the chamber in two halves with each half having a water cooling surface machined into the chamber. The two halves were welded together and final machining brought the chamber overall thickness tolerance and chamber radius of curvature tolerance to less than 1mm. The chamber is presently installed in the CAMD synchrotron in bending magnet 2 and attains a base pressure less than 5x10 -10 Torr without bakeout."

Research Associate Engineer
Engineering Support Group

A USA Academic Synchrotron