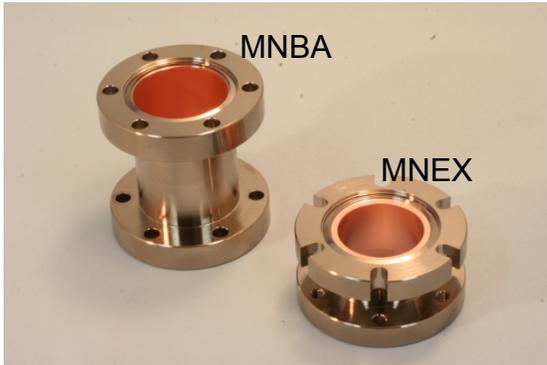


Magical Nipple

To improve the Gauge Performance

Features



1. **Reduce outgassing from bare BA gauge**
1/8 of SS nipple
2. **Improvement in ultimate pressure**
Closer to true pressure measurement
3. **Filament power, save 1/3**
Lower emissivity wall
4. **Low beryllium copper alloy**
0.2% Be high conductivity copper
5. **Passivated Cu surface**
No degradation at atmosphere
6. **NiP plating on edge & outside**
Available 300°C baking temperature
7. **Cu gasket sealing**
Similar thermal expansion to stainless steel

<Configuration>

- Insert and fix the BA or Extractor gauge into the Magical Nipple
- Attach the Magic Nipple with gauge on the vacuum chamber
- Realized the low outgassing from a gauge

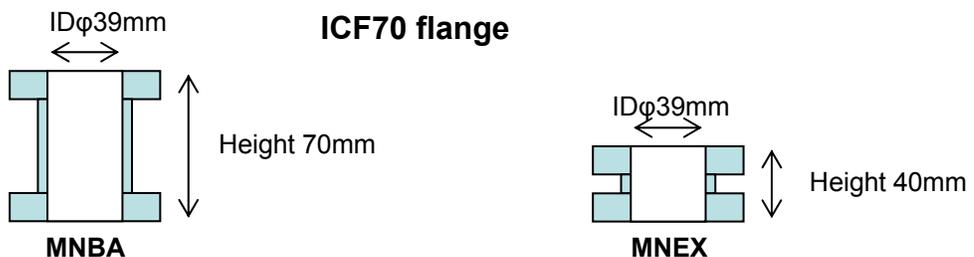
Nipple material vs Outgassing speed * (measured by VacLab)

Outgassing speed	Magic Nipple	Stainless steel Nipple
MNBA (BA gauge) (1/4) **	$2.1 \times 10^{-11} \text{ Pa} \cdot \text{m}^3/\text{s}$	$8.9 \times 10^{-11} \text{ Pa} \cdot \text{m}^3/\text{s}$
MNEX (EX gauge) (1/8)	$4.5 \times 10^{-12} \text{ Pa} \cdot \text{m}^3/\text{s}$	$3.9 \times 10^{-11} \text{ Pa} \cdot \text{m}^3/\text{s}$

* 200°C 2 hours baking and measured after 18 hours pumping (Throughput method)

** ESD noise affect to the BA gauge outgassing speed reduction limit to 1/4
(Outgassing reduction performance is same as EX gauge)

Reference: JVST.A11(1993)432, JVST.A22(2004)181

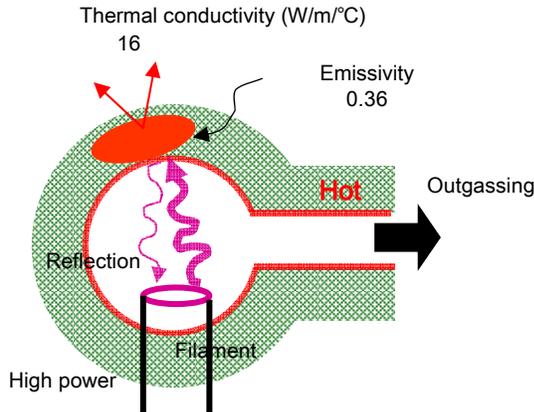


Outgassing performance will not be improved except on bare ion gauge!

Made & sold by VacLab Inc.

Why the Magical Nipple makes low outgassing from a gauge ?

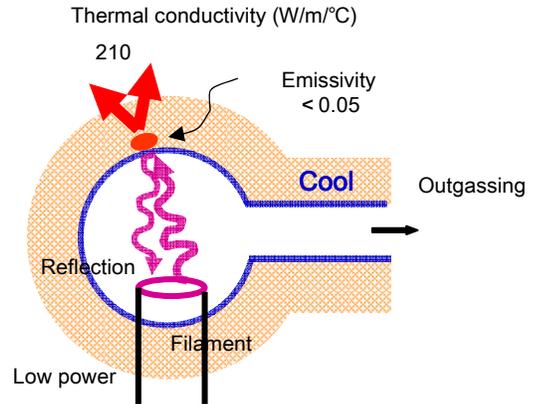
Stainless steel nipple



Thermal irradiation from a filament is absorbed on stainless steel which has the high emissivity of 0.36. Because reflected irradiation from wall to the filament is a little, the filament, needs more electric power to achieve the temperature to emit the enough electron.

Heat is accumulated on the surface of wall because of low thermal conductivity cause to hold the absorbed heat in the vacuum side wall.
Increase the vacuum wall temperature and increase the out gassing.

0.2%BeCu nipple



Only a small amount of the part of infrared ray from filament is absorbed by 0.2%BeCu wall because of low radiation factor. Reflected infrared ray helps the filament temperature to emit the enough electron with less electric power.

The wall will be kept cool by diffusing the absorbed heat because of high thermal conductivity and by low heat radiation factor.

Less vacuum wall temperature rise makes less out gassing.
Quite low out gassing rate from 0.2%BeCu alloy itself.

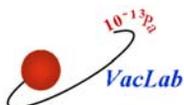
Why use 0.2%BeCu alloy?

VacLab developed the 0.2%BeCu alloy for extremely high vacuum and ultra low outgassing material. It is high electric conductive material with lower radiation factor of 1/4 and greater thermal conductivity of 13 times compared with stainless steel. The BA gauge and extractor gauge which contain the hot filament will be reduced the outgassing and will measure the accurate vacuum pressure by using with this alloy nipple. The 0.2%BeCu alloy is contained only 0.2% (weight %) beryllium, so it has large thermal conductivity of 210W/m/k same as pure aluminum. The hardness and thermal expansion are same as stainless steel, so this material is available to retrofit to the stainless steel vacuum tools with Cu gasket without leakage.

There is an weak point which is the increase of outgassing from the oxidation surface caused by leaving it after the manufacturing process. VacLab developed the patented surface passivation technology for the 0.2%BeCu alloy to prevent from this issue. The beryllium is diffused on the alloy surface by thermal treatment under the vacuum condition, and after cool down it will be exposed to the oxygen to covered by the fine beryllium oxide layer to prevent from the farther oxidation. (no discoloration is observed even if it is exposed the atmospheric condition long time) During this thermal treatment, the hydrogen and other gasses contained in the alloy are degassed. After then, the fine beryllium oxide film will cover the surface and protect from the gas resolution through the surface into alloy. Finally, VacLab experienced the lowest outgassing rate in the world.

There are some people who dislike the beryllium because of hazardous material, but our product is not hazardous while no one try the unexpected treatment, because the beryllium oxide on the surface is very thin film which is 30 Å. The surface faced to the atmosphere and knife edge on the ConFlat flange are electroless Ni plated to prevent from oxidation during the baking. And also this Ni plating will prevent from the adhesion of flange and gasket.

Order from VacLab the Extractor gauge refreshment and sensitivity calibration



Develop s pecific v acuum i nstrument, gas analysis, and vacuum consultant

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