## ABOUT VLT

VLT is a Company, specialized in the field of High Vacuum and Ultra High Vacuum brazing, brazing furnaces, and in all related services. The specific long term experience of its engineers and technicians, combined with a flexible and dynamic organization, allows VLT to comply with personalized client requirements without relaxing its top level quality.
For the above reasons, in combination with our competitive prices, VLT is a proud supplier of some among the biggest Companies and research establishments in Italy and Europe.
Some of the VLT technologies and processes have been developed in side the Company, which holds also some patents in the field.
The very large experience of VLT in the field of **_vacuum joining**, allows successful joining of a large variety of **metals, ceramics and composities** together in simple or complex configurations. In Tab.1 is included a list of materials which can be joined by VLT with the vacuum brazing technology, we should underline that some of these joints require the development of specific techniques and cannot be provided by all suppliers.

Tab.1

| | Nickel, nickel alloys and Kovar | Copper and copper alloys | Metalized ceramics | Stainless steel | Carbon and low alloy steel | Toolsteel and high speed steel | Nickel and cobalt super alloys | Titanium and zirconium alloys | Refractory metals | Aluminium alloys | Graphite | Sapphire | Silicon carbide | CFC(1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nickel, nickel alloys and Kovar | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Copper and copper alloys | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Metalized ceramics | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Stainless steel | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Carbon and low alloy steel | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Toolsteel and high speed steel | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Nickel and cobalt super alloys | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Titanium and zirconium alloys | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Refractory metals | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Aluminium alloys | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Graphite | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Sapphire | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Silicon carbide | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| CFC(1) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

| | |
|---|---|
| 1) | C.F.C Carbon Fiber Crbon |
| ● | Brazing is possible |
| ● | Not suitable for all applications. Limitations may apply depending on shape, dimension, etc.. |
| ● | Brazing is possible, but todate no practical application. |
| ● | Brazing is not possible |

Of course VLT can comply with any major national or international applicable codes and standards.
In addition, while VLT operates always in accordance with the procedures described in a Quality Assurance Manual, it may also provide a complete QA documentation, if required by the Client.

VLT can reliably supply high quality products at competitive prices in the following areas:

- U.H.V. all metal furnaces
- H.V. furnaces
- Special furnaces
- Chemical reactors CVI/CVD
- Ceramic – Metal and Metal – Metal Vacuum brazed components
- Systems and components for U.H.V.
- Amagnetic Multipin feedthroughs as MIL-C-5015
- Amagnetic miniature Multipin feedthroughs as MIL-C-26482 and VG95328
- Thermocouples Multipin feedthroughs as MIL-C-5015
- Components included in this catalogue

In each of the above areas VLT can offer feasibility studies, design, products and technical assistance.
For any needs, bids VLT is at your disposal feasibility studies, information.

## ABOUT VACUUM BRAZING

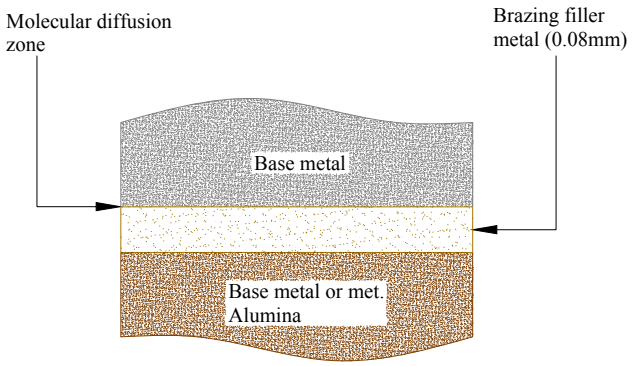
Conventional brazing process and technology are one of the oldest civilization art. However, in the last 50 years brazing has been applied to joining of a much larger variety of different materials and, therefore, has required the development of more complex processes.
Several variations of brazing processes may be considered mature technology: dip brazing, exothermic brazing, brazing under an electric blanket, induction brazing etc.
One of the latest, most powerful and innovative way of brazing is brazing in vacuum.
High temperature vacuum brazing has continuously developed in the last 30 years in an impressing way and together with the development of vacuum equipment. Therefore applications of vacuum brazing have increased considerably and new applications have been found for this joining technique.

Figure 1
High performance vacuum furnaces can be supplied by VLT. Ask for details

A few words about vacuum brazing. This technology allows to join and to seal metals to different metals and metals to metallised ceramics. Basically the method is to place the assembly in a vacuum furnace, to heat it and reach a temperature at which the filler metal (properly placed in the assembly) will fuse and will diffuse into the base materials by capillary action. The filler metal (brazing alloy) will diffuse into the cristallographic structure of the base materials thus creating a metallurgical bond. The superior quality of this sealing technique in respect to others methods is now very well recognized.
The most important advantage of vacuum brazing in respect to other methods is that it allows to joint (seal) a wide variety of metals and metal alloys and metals to metallized alumina and ceramics as shown in Tab. 1.
**The advantage in respect to brazing atmospheric pressure is that no flux is required.**

**The advantage in respect to welding, is that base metals are not locally melted, introducing metallurgical modifications and significant residual stresses. In vacuum brazing the entire assembly is heated up at the fusion temperature of filler metal or alloy which is lower than the fusion temperature of base material.**

Figure 2
Base metal does not melt. filler metal melts and diffuse into the base metal by capillary action




Main characteristics of vacuum brazed joint (seal):
- Strength: often the strength of the joint is higher than that of the joined parts.
- Temperature resistance: joints may reach an operating temperature close to that of the filler metal. that may be 1200°C
- Brazed joints are ductile and are able to withstand considerable shock and vibration stresses

High temperature vacuum brazing in furnaces is particularly well suited for joining:
- heat - resistant nickel - and iron – base alloys that contain aluminum and/or titanium
- reactive metals
- refractory metals

A list of metals, which can be joined by VLT high temperature vacuum brazing techniques is included in Table 1. We should underline that some of these joints required the development of specific techniques and cannot be provided by all suppliers.

In the pictures below we show some characteristics of a typical brazed joint.


Figure 3
Photomicrograph (20x) of a AISI 316 joint; brazing material is copper

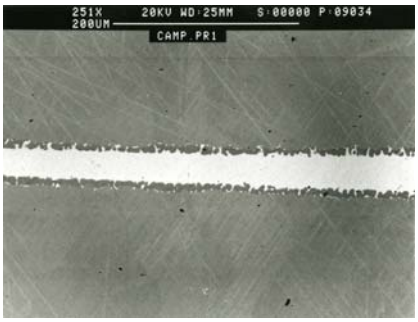



Figure 4
Photomicrograph (250x) of a detail of fig. 3 where diffusion zones of brazing material into base material may be identified

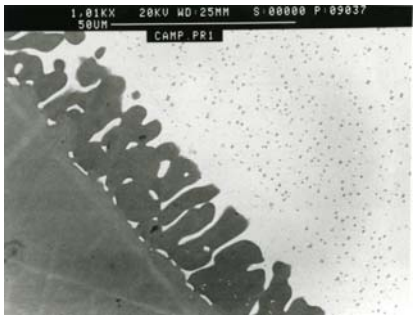



Figure5
Photomicrograph (1000x) of a detail where diffusion zone may be better identified

## HOW TO USE THIS CATALOGUE

This catalogue presents VLT standard Alumina-to-metal brazed components, manufactured by advanced vacuum brazing techniques, highly reliable and deliverable shortly after the order.
The catalogue outlines main technical characteristics of the products in order to facilitate your choices depending on your needs. If you have any doubts or you cannot find the component you were looking for, please contact VLT for any additional information and for more details on technical characteristics.
To help you in browsing the catalogue we have organized it in separate sheets, one for each series of components. On each sheet technical performances and main dimensions are listed together with outline drawings and pictures of the component, assembled on KF or CF flanges and in addition the end views of flanges with multiple components.
Of course VLT is ready to supply special order components for specific needs (e.g. a greater number of components, or a combination of different components mounted on the same flange).
We remind you that this is not the only VLT catalogue and, if you are interested, please ask us information on metal-to-metal brazed components and on complete vacuum brazing furnace systems.

**The alfanumeric identification system**

VLT has adopted an alfanumeric system for a simple and unique identification of all standard components.
**For example: FT04KF--**

- FT is the component type
- 04 is the dimension
- KF is the type of vacuum flange
- 4 is the number of feedthroughs in a single vacuum flange
- -- is a code to define the conductor material according to the Client order.

### Catalog sections

The catalogue includes the following sections:

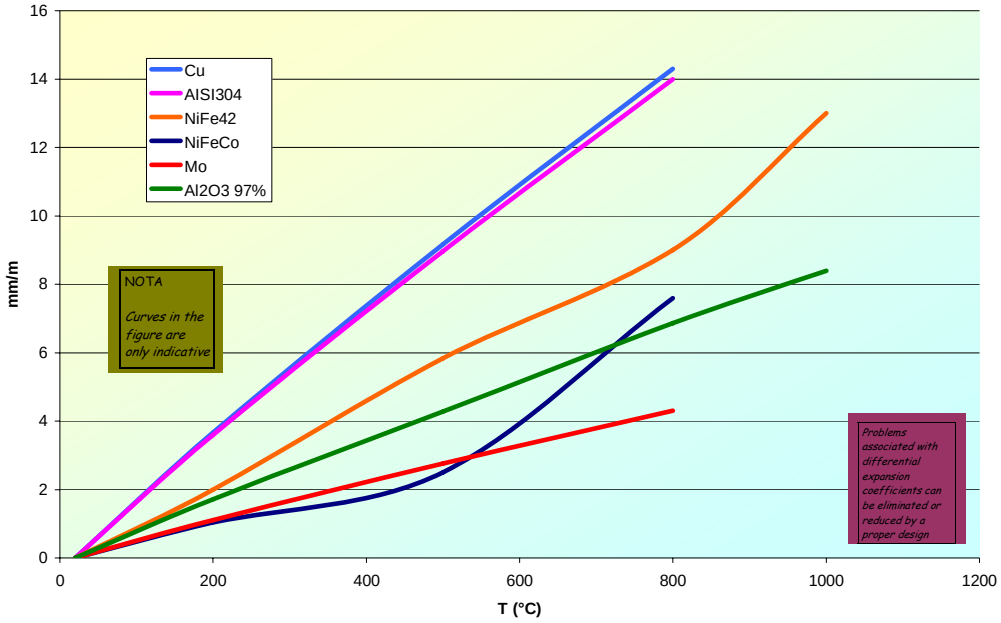


## GENERAL TECHNICAL CHARACTERISTICS

### Introduction

Metal-Alumina composite structures have been widely used in several applications, taking advantage from the good mechanical properties and, at the same time, the outstanding electrical resistivity of the alumina. More recently leaktight metal-ceramic sealings have been obtained by several techniques allowing the use of these composite structures in various laboratory and industry applications, where in most cases they are now essential.

**Figure 1 - relative thermal expansion**




A large variety of sealing techniques have been developed since 1930 to satisfy different needs; however only in the last years the vacuum brazing technique, after being extensively tested, became the leading technique to produce the best quality structures between the widest possible material combinations.
Vacuum brazing is currently used to join ceramic and different metals, while ususally nickel-iron alloys is used, because they have expansion coefficients close to that of alumina (see figure 1). Alloys Trade Marks are Kovar™, Vacodil™, Vacon™, Monel™.
Many difficulties have been encountered in joining alumina with stainless steels. They are, however, particularly interesting since they are not only mechanically stronger and more corrosion resistant, but they are also amagnetic. The structures may be also easily welded to adjacent parts by TIG process.
VLT standard production includes structures made of alumina and amagnetic metals (such as AISI 304L / 316L); they are manufactured by processes developed in the VLT research activities and proved in a number of successful applications.

## Field of application

Ceramic - metal composite structure applications are very wide and they are generally required when a low/high intensity current supply is needed up to high frequencies, inside a leaktight volume in vacuum or pressurized conditions through electrically isolated structures (even at high voltages), in particular when these structures are loaded by mechanical stresses and operate at high temperatures.
Examples of industries where such structures are becoming more and more commonly used are aereonautics, electronics, nuclear, chemical, biomedical, aereospace and research labs..
Specific application examples are vacuum tubes, mass spectrometers, ionizations vacuometers, ceramic isolators for particle accelerators, pace-maker feedthroughs, laser heads, electrical feedthroughs for high voltage and/or high current and/or high frequency, semiconductors, nuclear power plants multiple electrical penetrations, advanced nuclear reactor fuel elements, etc. But, generally speaking, most of the applications are related to critical conditions, where their use has no alternative, regardless of their cost.
Today, however, common use equipment and components (as cars, home appliances, etc.) may take advantage from the strength and reliability of metal-ceramic structures; large series productions. available now, may reduce unity costs so that they can be economically competitive with more conventional alternative solutions.

**Characteristics**

You will find below some parameters describing metal - alumina structure performances. These values shall be considered typical of standard production materials, and may be extended for special applications. In other parts of this catalogue some examples of specially designed components are provided and specific values are reported.

**Operating temperature:** 400 °C

**Thermal gradient:** Operating temperature up to 450°C is standard, but a thermal gradient less than 30°C per minute must be maintained to prevent the seal

**Leaktightness**: better than $10^{-10}$ mbar l/s

**Mechanical characteristics**: outstanding; in general structural resistance is limited by that of the weaker material and not by the brazing.

**Dielectric and resistivity characteristics**: alumina features better characteristics than glass in general; they vary depending on the ceramic type and purity, but they are kept very high even at high temperatures and in a humid environment.

Other characteristics are related to corrosion resistance (particularly if the metal is stainless steel), radiation resistance (also neutrons), and the possibility of fine machining.
Additionally, if stainless steel is used, the structure is also amagnetic.

**Materials**

**a) Insulator**
Alumina (main alumina properties are reported in table 1). As reported in the table only high purity alumina (97% and 99,5%) is used in VLT production. All alumina are also glazed in order to further increase surface electrical resistivity.

Table 1 - Main alumina properties

| **Property** | **Alumina purity** | | **Unit** |
|---|---|---|---|
| | **97,0%** | **99,5%** | |
| Density | 3,73 | 3,87 | $g/cm^3$ |
| Flexural strength | 234 | 332 | $MN/m^2$ |
| Operating temperature limit at no load | 1700 | 1800 | °C |
| Linear expansion coefficient (20 - 1000 °C) | 8,2 | 8,5 | $10^{-6}$/°C |
| Thermal conductivity @ 50 °C | 23,7 | 25,6 | W/m °K |
| Thermal conductivity @ 400 °C | 13,1 | 12,4 | W/m °K |
| Electrical resistivity @ 20 °C | $> 10^{15}$ | $> 10^{15}$ | Ω cm |
| Electrical resistivity @ 400 °C | $> 10^{10}$ | $> 10^{10}$ | Ω cm |

Quoted values shall be used for reference only

**b) Metals parts**
As standard metal parts are in AISI 304L or 316L.
For special applications other metals can be used as: Titanium, Nickel alloy, Copper, Molibdenum etc.

**c) Brazing materials**
Silver-copper, silver-copper-nickel, silver-copper-palladium, pure gold, pure copper (see also Table 2).
**Special low/high temperature melting alloys (300-1550°C) may be additionally selected for special applications. On customer request feasibility studies may be performed to investigate seal joints between materials not listed above.**

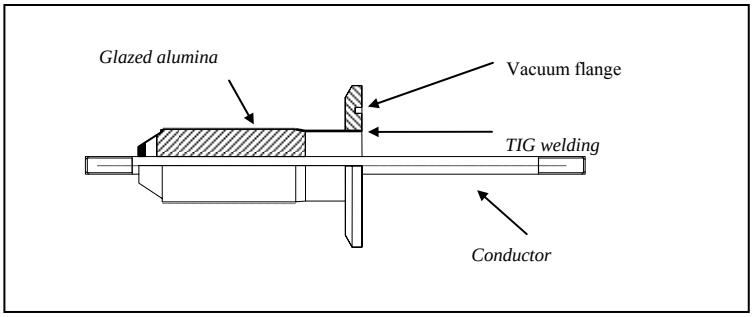
Table 2 - Brazing alloys

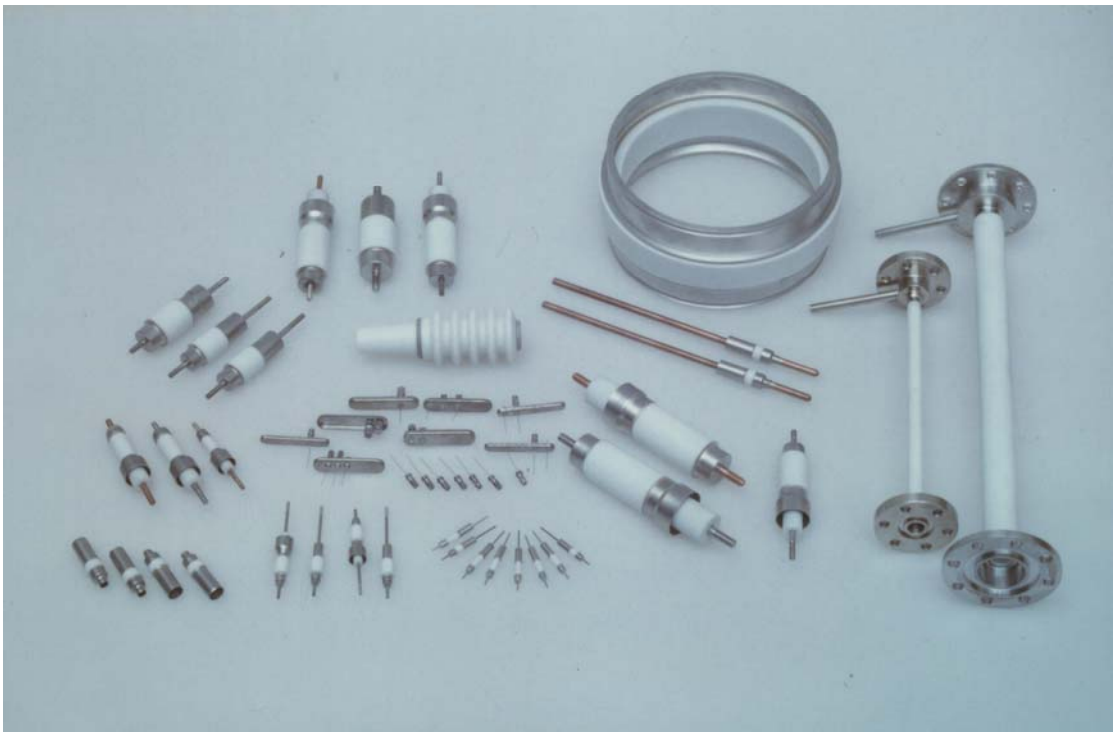
| Material | Melting temperatures (°C) | |
|---|---|---|
| | Liquidus | Solidus |
| Silver-copper | 780 | 780 |
| Silver-copper-nickel | 795 | 780 |
| Silver-Copper-Palladium | 900 | 850 |
| Gold-Copper-Nickel | 1030 | 1000 |
| Pure Gold | 1064 | 1064 |
| Pure Copper | 1083 | 1083 |

**Assembling**

Alumina-Metal structure are assembled on standard vacuum flange DN-KF, DN-CF and DN-ISO-K **or in any type of flange on client needs.** Flanges are TIG welded as in fig. 2. All welds are vacuum leak tested by Helium mass spectrometer to assure a leaktightness better than $5x10^{-10}$ mbar/l/sec.

Figure 2 - Typical electrical feedthroughs with KF flange



**SECTION A**

## Amagnetic Power Electrical Feedthroughs

All feedthroughs described in this section are totally amagnetic. Standard materials include AISI 304 or copper conductors. On request it is possible to supply other materials such as AISI 316 or Ni-Mo.
All currents indicated in the following are applicable to full section conductors. Conductors with diameters above 2 mm may be supplied in the tubular option with forced cooling.
The external surfaces of the ceramics are glazed to maximize the resistance to the surface discharge.
The maximum allowable voltages are limited by the resistance to the surface discharge on the ceramic and by the resistance between the two conductors on the vacuum side. If the vacuum is at least $10^{-5}$ Torr the critical path is the first, which is related to the lenght of the path and to its cleanliness, besides a number of other parameters. However, since the maximum allowable voltage may be reduced by several causes, data included in the catalogue may only be considered as orientation for your specific application. VLT will be glad to provide you with its expertise to help you in the choice.
The maximum voltages indicated in the following are referred to mean values at 50 Hz RMS at 50% humidity and with an atmospheric pressure of 760 mmHg.
The components may reach 400 °C and may operate continuously at 350°C.
In the catalogue the highest number of feedthroughs per flange is 4. This number is generally adequate for standard applications. However, on request, it is possible to supply flanges with an higher number of feedthroughs, and even a combination of different feedthroughs including other components described in other sections of this catalogue.

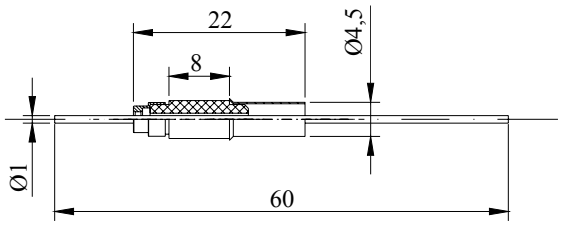
The following feedthroughs types are described in the catalogue:
**FT** (General Purpose Feedthroughs)
**HCF** (High Current Feedthroughs)
**HFT** (High Voltage Feedthroughs)

**IMPORTANT NOTE**: In the catalogue tables the last letter indicating the conductor material is missing. The choice is given to the Client (if necessary, after consultation with VLT) and the type of material shall be indicated in the Order Letter.

# GENERAL PURPOSE FEEDTHROUGHS

## SERIE FT04

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 5 | 1 |
| Copper | 5 | 10 |




FT04NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| FT04KF1_ | 1 | 16KF | 30 |
| FT04KF2_ | 2 | 25KF | 40 |
| FT04KF3_ | 3 | 25KF | 40 |
| FT04KF4_ | 4 | 25KF | 40 |

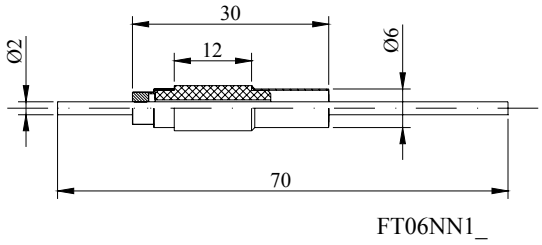
CF Flanged

| | | | |
|---|---|---|---|
| FT04CF1_ | 1 | 16CF | 34 |
| FT04CF2_ | 2 | 16CF | 34 |
| FT04CF3_ | 3 | 16CF | 34 |
| FT04CF4_ | 4 | 16CF | 34 |

➢When ordering add material code (S or C)

## SERIE FT06

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 8 | 3 |
| Copper | 8 | 35 |




FT06NN1_

KF Flanged

| *Model* | *Number of conductors* | *Flange type* | Flange diam. (mm) |
|---|---|---|---|
| FT06KF1_ | 1 | 16KF | 30 |
| FT06KF2_ | 2 | 25KF | 40 |
| FT06KF3_ | 3 | 25KF | 40 |
| FT06KF4_ | 4 | 25KF | 40 |

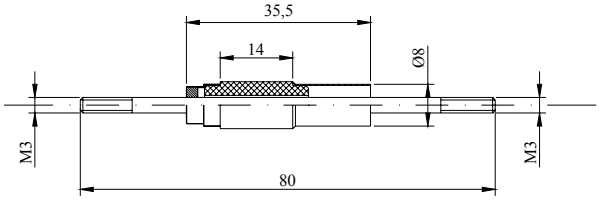
CF Flanged

| | | | |
|---|---|---|---|
| FT06CF1_ | 1 | 16CF | 34 |
| FT06CF2_ | 2 | 16CF | 34 |
| FT06CF2bis_ | 2 | 40CF | 69,5 |
| FT06CF3_ | 3 | 40CF | 69,5 |
| FT06CF4_ | 4 | 40CF | 69,5 |

➢When ordering add material code (S or C)

## SERIE FT08

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 10 | 6 |
| Copper | 10 | 60 |




FT08NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| FT08KF1_ | 1 | 16KF | 30 |
| FT08KF2_ | 2 | 40KF | 55 |
| FT08KF3_ | 3 | 40KF | 55 |
| FT08KF4_ | 4 | 40KF | 55 |

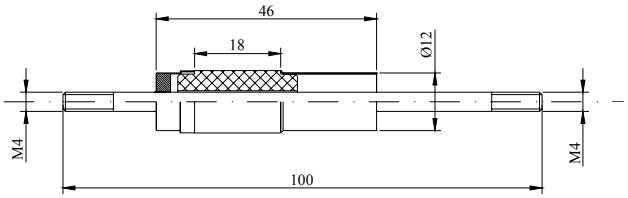
CF Flanged

| | | | |
|---|---|---|---|
| FT08CF1_ | 1 | 16CF | 34 |
| FT08CF2_ | 2 | 40CF | 69,5 |
| FT08CF3_ | 3 | 40CF | 69,5 |
| FT08CF4_ | 4 | 40CF | 69,5 |

When ordering add material code (S or C)

## SERIE FT12

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 12 | 10 |
| Copper | 12 | 100 |




FT08NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| FT12KF1_ | 1 | 25KF | 40 |
| FT12KF2_ | 2 | 40KF | 55 |
| FT12KF3_ | 3 | 40KF | 55 |
| FT12KF4_ | 4 | 40KF | 55 |

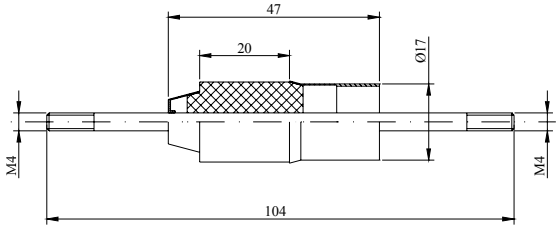
CF Flanged

| | | | |
|---|---|---|---|
| FT12CF1_ | 1 | 16CF | 34 |
| FT12CF2_ | 2 | 40CF | 69,5 |
| FT12CF3_ | 3 | 40CF | 69,5 |
| FT12CF4_ | 4 | 40CF | 69,5 |

When ordering add material code (S or C)

## SERIE FT20

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 14 | 10 |
| Copper | 14 | 100 |




FT20NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| FT20KF1_ | 1 | 25KF | 40 |
| FT20KF2_ | 2 | 63ISO-K | 95 |
| FT20KF2bis_ | 2 | 100ISO-K | 130 |
| FT20KF3_ | 3 | 100ISO-K | 130 |
| FT20KF4_ | 4 | 100ISO-K | 130 |

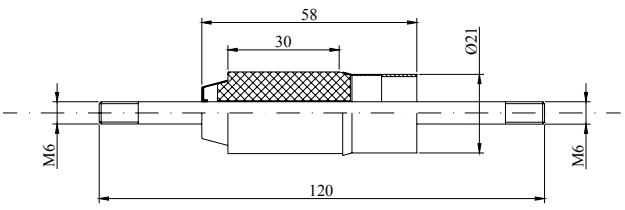
CF Flanged

| | | | |
|---|---|---|---|
| FT20CF1_ | 1 | 40CF | 69,5 |
| FT20CF2_ | 2 | 63CF | 113,5 |
| FT20CF2bis_ | 2 | 100CF | 152 |
| FT20CF3_ | 3 | 100CF | 152 |
| FT20CF4_ | 4 | 100CF | 152 |

When ordering add material code (S or C)

## SERIE FT30

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 18 | 20 |
| Copper | 18 | 180 |




FT30NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| FT30KF1_ | 1 | 25KF | 40 |
| FT30KF2_ | 2 | 63ISO-K | 95 |
| FT30KF2bis_ | 2 | 100ISO-K | 130 |

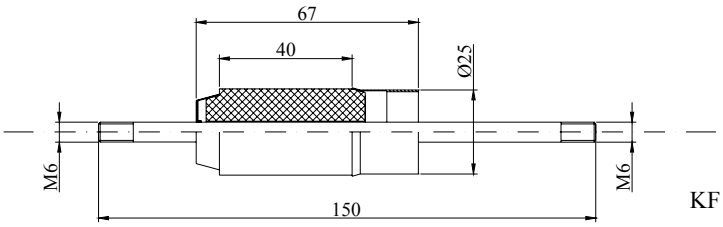
CF Flanged

| | | | |
|---|---|---|---|
| FT30CF1_ | 1 | 40CF | 69,5 |
| FT30CF2_ | 2 | 63CF | 113,5 |
| FT30CF2bis_ | 2 | 100CF | 152 |

When ordering add material code (S or C)

## SERIE FT40

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 22 | 20 |
| Copper | 22 | 180 |




FT40NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| FT40KF1_ | 1 | 40KF | 55 |
| FT40KF2_ | 2 | 100ISO-K | 130 |

CF Flanged

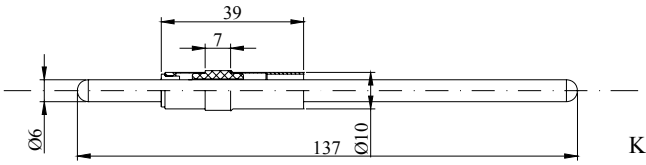
| | | | |
|---|---|---|---|
| FT40CF1_ | 1 | 40CF | 69,5 |
| FT40CF2_ | 2 | 100CF | 152 |

When ordering add material code (S or C)

## HIGH CURRENT FEEDTHROUGHS

## SERIE HCF10

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| | | |
| Copper | 3 | 140 |




HCF10NN1C

KF Flanged

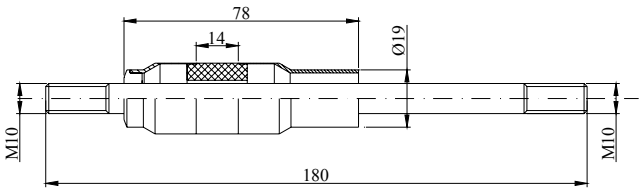
| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HCF10KF1C | 1 | 16KF | 30 |
| HCF10KF2C | 2 | 40KF | 55 |
| HCF10KF3C | 3 | 40KF | 55 |
| HCF10KF4C | 4 | 40KF | 55 |

CF Flanged

| | | | |
|---|---|---|---|
| HCF10CF1C | 1 | 16CF | 34 |
| HCF10CF2C | 2 | 40CF | 69,5 |
| HCF10CF3C | 3 | 40CF | 69,5 |
| HCF10CF4C | 4 | 40CF | 69,5 |

## SERIE HCF20

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| | | |
| Copper | 6 | 250 |




HCF20NN1C

KF Flanged

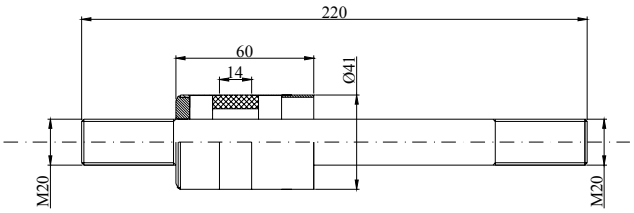
| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HCF20KF1C | 1 | 16KF | 30 |
| HCF20KF2C | 2 | 63ISO-K | 95 |
| HCF20KF2bisC | 2 | 100ISO-K | 130 |
| HCF20KF3C | 3 | 100ISO-K | 130 |
| HCF20KF4C | 4 | 100ISO-K | 130 |

CF Flanged

| | | | |
|---|---|---|---|
| HCF20CF1C | 1 | 16CF | 34 |
| HCF20CF2C | 2 | 63CF | 113,5 |
| HCF20CF2bisC | 2 | 100CF | 152 |
| HCF20CF3C | 3 | 100CF | 152 |
| HCF20CF4C | 4 | 100CF | 152 |

## SERIE HCF38

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| | | |
| Copper | 6 | 600 |




HCF38NN1C

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HCF38KF1C | 1 | 50KF | 75 |

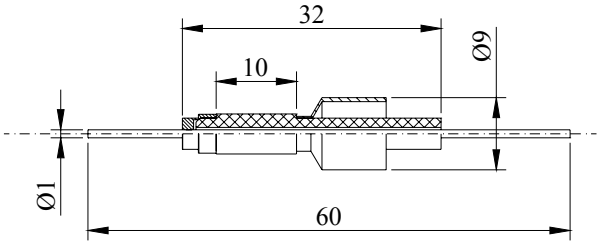
CF Flanged

| | | | |
|---|---|---|---|
| HCF20CF1C | 1 | 40CF | 69,5 |

## HIGH VOLTAGE FEEDTHROUGHS

## SERIE HFT04

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 8 | 1 |
| Copper | 8 | 12 |




HFT04NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HFT04KF1_ | 1 | 16KF | 30 |
| HFT04KF2_ | 2 | 25KF | 40 |
| HFT04KF2bis_ | 2 | 40KF | 55 |
| HFT04KF3_ | 3 | 40KF | 55 |
| HFT04KF4_ | 4 | 40KF | 55 |

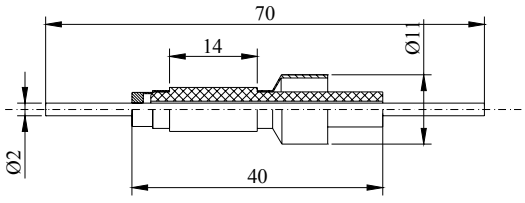
CF Flanged

| | | | |
|---|---|---|---|
| HFT04CF1_ | 1 | 16CF | 34 |
| HFT04CF2_ | 2 | 40CF | 69,5 |
| HFT04CF3_ | 3 | 40CF | 69,5 |
| HFT04CF4_ | 4 | 40CF | 69,5 |

➢When ordering add material code (S or C)

## SERIE HFT06

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 10 | 3 |
| Copper | 10 | 35 |




HFT06NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HFT06KF1_ | 1 | 16KF | 30 |
| HFT06KF2_ | 2 | 25KF | 40 |
| HFT06KF3_ | 3 | 25KF | 40 |
| HFT06KF4_ | 4 | 25KF | 40 |

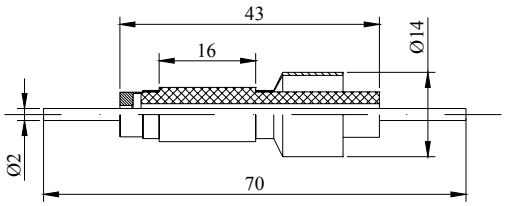
CF Flanged

| | | | |
|---|---|---|---|
| HFT06CF1_ | 1 | 16CF | 34 |
| HFT06CF2_ | 2 | 40CF | 69,5 |
| HFT06CF3_ | 3 | 40CF | 69,5 |
| HFT06CF4_ | 4 | 40CF | 69,5 |

➢When ordering add material code (S or C)

## SERIE HFT08

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 14 | 6 |
| Copper | 14 | 60 |




HFT08NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HFT08KF1_ | 1 | 25KF | 40 |
| HFT08KF2_ | 2 | 50KF | 75 |
| HFT08KF3_ | 3 | 50KF | 75 |
| HFT08KF4_ | 4 | 50KF | 75 |

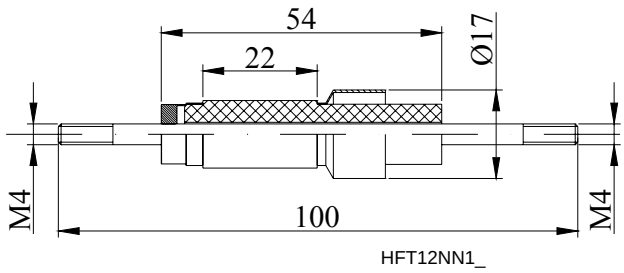
CF Flanged

| | | | |
|---|---|---|---|
| HFT08CF1_ | 1 | 16CF | 34 |
| HFT08CF2_ | 2 | 40CF | 69,5 |
| HFT08CF3_ | 3 | 63CF | 113,5 |
| HFT08CF4_ | 4 | 63CF | 113,5 |

➢When ordering add material code (S or C)

## SERIE HFT12

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 16 | 10 |
| Copper | 16 | 100 |




HFT12NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HFT12KF1_ | 1 | 25KF | 40 |
| HFT12KF2_ | 2 | 63ISO-K | 95 |
| HFT12KF3_ | 3 | 63ISO-K | 95 |
| HFT12KF4_ | 4 | 63ISO-K | 95 |

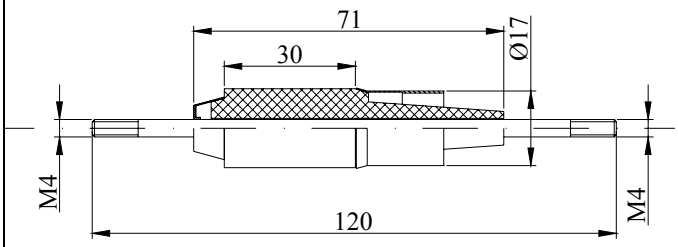
CF Flanged

| | | | |
|---|---|---|---|
| HFT12CF1_ | 1 | 16CF | 34 |
| HFT12CF2_ | 2 | 40CF | 69,5 |
| HFT12CF2bis_ | 2 | 63CF | 113,5 |
| HFT12CF3_ | 3 | 63CF | 113,5 |
| HFT12CF4_ | 4 | 63CF | 113,5 |

➢When ordering add material code (S or C)

## SERIE HFT30

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 20 | 10 |
| Copper | 20 | 100 |




HFT30NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HFT30KF1_ | 1 | 25KF | 40 |
| HFT30KF2_ | 2 | 63ISO-K | 95 |
| HFT30KF2bis_ | 2 | 100ISO-K | 130 |
| HFT30KF3_ | 3 | 100ISO-K | 130 |
| HFT30KF4_ | 4 | 100ISO-K | 130 |

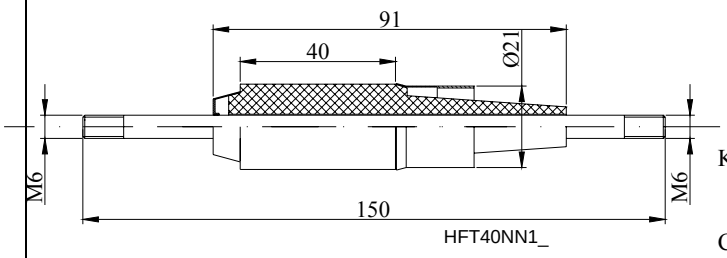
CF Flanged

| | | | |
|---|---|---|---|
| HFT30CF1_ | 1 | 40CF | 69,5 |
| HFT30CF2_ | 2 | 63CF | 113,5 |
| HFT30CF2bis_ | 2 | 100CF | 152 |
| HFT30CF3_ | 3 | 100CF | 152 |
| HFT30CF4_ | 4 | 100CF | 152 |

➢When ordering add material code (S or C)

## SERIE HFT40

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 23 | 20 |
| Copper | 23 | 180 |




HFT40NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HFT40KF1_ | 1 | 25KF | 40 |
| HFT40KF2_ | 2 | 63ISO-K | 95 |
| HFT40KF2bis_ | 2 | 100ISO-K | 130 |

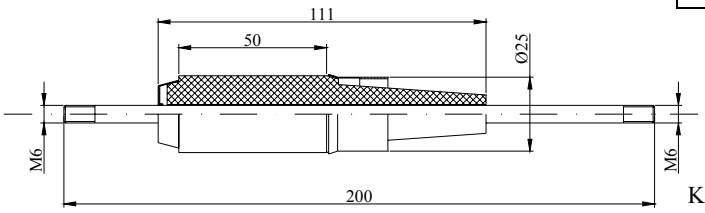
CF Flanged

| | | | |
|---|---|---|---|
| HFT40CF1_ | 1 | 40CF | 69,5 |
| HFT40CF2_ | 2 | 63CF | 113,5 |
| HFT40CF2bis_ | 2 | 100CF | 152 |

➢When ordering add material code (S or C)

## SERIE HFT50

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 27 | 20 |
| Copper | 27 | 180 |




HFT50NN1_

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HFT50KF1_ | 1 | 40KF | 55 |
| HFT50KF2_ | 2 | 100ISO-K | 130 |

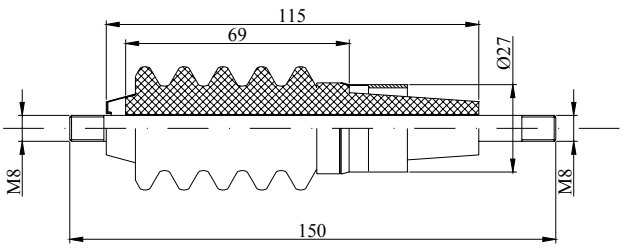
CF Flanged

| | | | |
|---|---|---|---|
| HFT50CF1_ | 1 | 40CF | 69,5 |
| HFT50CF2_ | 2 | 100CF | 152 |

➢When ordering add material code (S or C)

## SERIE HFT70

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 40 | 30 |
| Copper | 40 | 280 |




HFT70NN1_

KF Flanged

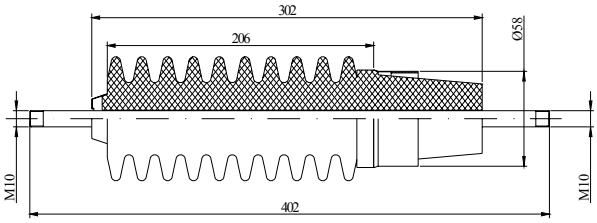
| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| HFT70KF1_ | 1 | 40KF | 55 |

CF Flanged

| | | | |
|---|---|---|---|
| HFT70CF1_ | 1 | 40CF | 69,5 |

➢When ordering add material code (S or C)

## SERIE HFT150




HFT150NN1_

| Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|
| Aisi inox - SS | 100 | 40 |
| Copper | 100 | 400 |

| | Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|---|
| KF Flanged | HFT150KF1_ | 1 | 63ISO-K | 95 |
| CF Flanged | HFT70CF1_ | 1 | 63CF | 113,5 |

➢When ordering add material code (S or C)

**SECTION B**

## Amagnetic Instrumentation Electrical Feedthroughs

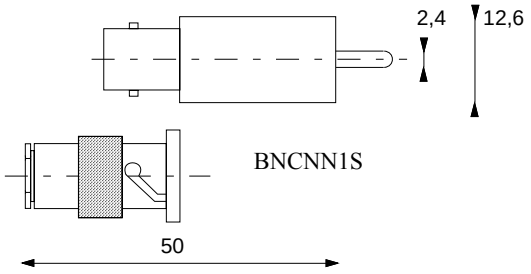
All feedthroughs are completely amagnetic and rated for high-vacuum and ultra-high-vacuum applications. They are also suitable for cryogenic temperatures. They are constructed of vacuum grade materials with high purity alumina insulation on AISI 304 stainless steel weldable mounts, flanges and threaded fittings.
Atmosphere side mating connectors are supplied as shown in the drawings. Other connector types are available on order.
All standard feedthroughs are available in the grounded shield version.
The following types are included in the catalogue:

**BNC** (Bayonet Naval Connector) c**oaxial**
**MHV** (Miniature High Voltage) **coaxial**
**N coaxial**
**SMA50 coaxial**

**Figure B-1**
**Examples of VLT amagnetic coaxial instrumentation feedthroughs production**

## SERIE BNC

| Technical Specifications | | | | Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|---|---|---|---|
| Impedance | Temperature rating | | | Aisi inox - SS | 500 V DC | 3 |
| | Weld adapter, CF | KF, O-Ring, NPT bases | Connectors | | | |
| Non constant | -200°C / 450°C | fino a / up to 150 °C | -65°C / 165°C | | | |




BNCNN1S

- Air side mating connector included

KF Flanged

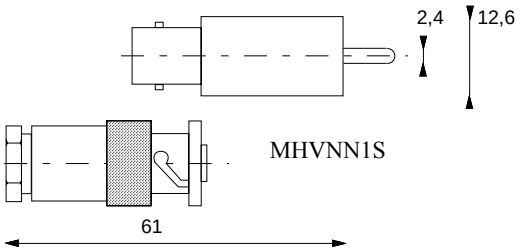
| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| BNCKF1S | 1 | 16KF | 30 |
| BNCKF2S | 2 | 50KF | 75 |
| BNCKF3S | 3 | 50KF | 75 |
| BNCKF4S | 4 | 50KF | 75 |

CF Flanged

| | | | |
|---|---|---|---|
| BNCCF1S | 1 | 16CF | 34 |
| BNCCF2S | 2 | 40CF | 69,5 |
| BNCCF3S | 3 | 40CF | 69,5 |
| BNCCF4S | 4 | 40CF | 69,5 |

## SERIE MHV

| Technical Specifications | | | | Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|---|---|---|---|
| Impedance | Temperature rating | | | Aisi inox - SS | 5000 DC | 3 |
| | Weld adapter, CF | KF, O-Ring, NPT bases | Connectors | | | |
| Non constant | -200°C / 450°C | fino a / up to 150 °C | -65°C / 165°C | | | |




MHVNN1S

- Air side mating connector included

KF Flanged

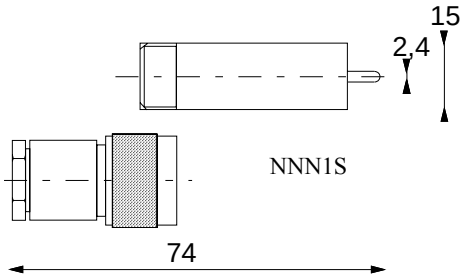
| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| MHVKF1S | 1 | 16KF | 00 |
| MHVKF2S | 2 | 50KF | 75 |
| MHVKF3S | 3 | 50KF | 75 |
| MHVKF4S | 4 | 50KF | 75 |

CF Flanged

| | | | |
|---|---|---|---|
| MHV00CF1S | 1 | 16CF | 34 |
| MHV00CF2S | 2 | 40CF | 69,5 |
| MHV00CF3S | 3 | 40CF | 69,5 |
| MHV00CF4S | 4 | 40CF | 69,5 |

## SERIE N

| Technical Specifications | | | | Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|---|---|---|---|
| Impedance | Temperature rating | | | Aisi inox - SS | 500 DC | 3 |
| | Weld adapter, CF | KF, O-Ring, NPT bases | Connectors | | | |
| Non constant | -200°C / 450°C | fino a / up to 150 °C | -65°C / 165°C | | | |




- Air side mating connector included

KF Flanged

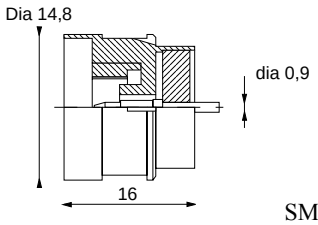
| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| N00KF1S | 1 | 25KF | 40 |
| N00KF2S | 2 | 63ISO-K | 95 |
| N00KF3S | 3 | 63ISO-K | 95 |
| N00KF4S | 4 | 63ISO-K | 95 |

CF Flanged

| | | | |
|---|---|---|---|
| N00CF1S | 1 | 16CF | 34 |
| N00CF2S | 2 | 63CF | 113,5 |
| N00CF3S | 3 | 63CF | 113,5 |
| N00CF4S | 4 | 63CF | 113,5 |

## SERIE SMA50

| Technical Specifications | | | | Conductor material | Max voltage (V) Grounded shield | Max current (A) |
|---|---|---|---|---|---|---|
| Impedance | Temperature rating | | | Aisi inox - SS | >1500 DC | 1 |
| | Weld adapter, CF | KF, O-Ring, NPT bases | Connectors | | | |
| 50 Ω | -200°C / 450°C | fino a / up to 150 °C | -65°C / 165°C | | | |




SMA50NN1

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| SMA50KF1S | 1 | 25KF | 40 |
| SMA50KF2S | 2 | 63ISO-K | 95 |
| SMA50KF3S | 3 | 63ISO-K | 95 |
| SMA50KF4S | 4 | 63ISO-K | 95 |

CF Flanged

| | | | |
|---|---|---|---|
| SMA50CF1S | 1 | 16CF | 34 |
| SMA50CF2S | 2 | 63CF | 113,5 |
| SMA50CF3S | 3 | 63CF | 113,5 |
| SMA50CF4S | 4 | 63CF | 113,5 |

**SECTION C**

## Amagnetic Vacuum Breaks

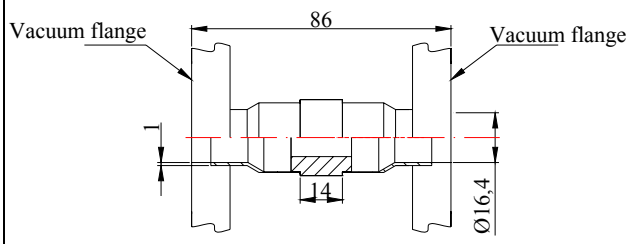
VLT Vacuum Breaks and Electric Isolators (CB) are designed for applications which require high voltage insulation in high vacuum and ultra high vacuum use.
Both sleeves are AISI 304 and therefore the entire break is amagnetic. Sleeves of other materials (such as AISI 316 or Kovar™, Copper) may be supplied on request.
Both KF (ISO-K for larger sizes) and CF flanges may be mounted on all breaks.
Maximum RMS voltage ratings are listed in the following tables.
In the tables also temperature ratings are indicated

**Figure D-1**
**VLT amagnetic Vacuum breakers production**

**Figure D-2**
**VLT amagnetic Vacuum breakers production**

## SERIE CB22

| Max voltage (kV) Grounded shield | Max T (°C) |
|---|---|
| | |
| 6 | 400 |




CB22NN1

KF Flanged

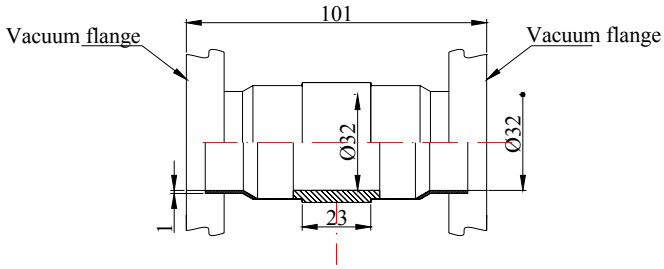
| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| CB22KF1 | 1 | 25KF | 40 |
| CB22KF2 | 1 | 50KF | 75 |

CF Flanged

| | | | |
|---|---|---|---|
| CB22CF1 | 1 | 40CF | 69,5 |

## SERIE CB41

| Max voltage (kV) Grounded shield | Max T (°C) |
|---|---|
| | |
| 6 | 400 |




CB41NN1

KF Flanged

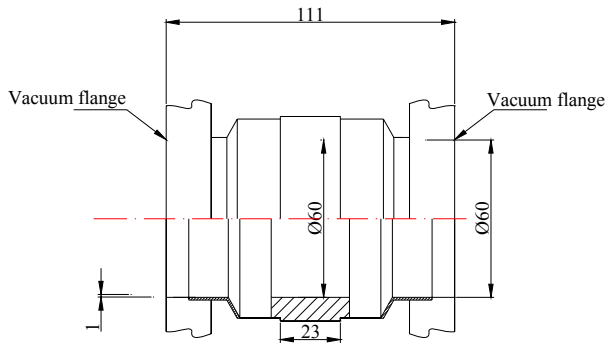
| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| CB41KF1 | 1 | 40KF | 55 |
| CB41KF2 | 1 | 50KF | 75 |

CF Flanged

| | | | |
|---|---|---|---|
| CB41CF1 | 1 | 40CF | 69,5 |

## SERIE CB73

| Max voltage (kV) Grounded shield | Max T (°C) |
|---|---|
| | |
| 10 | 400 |




CB73NN1

KF Flanged

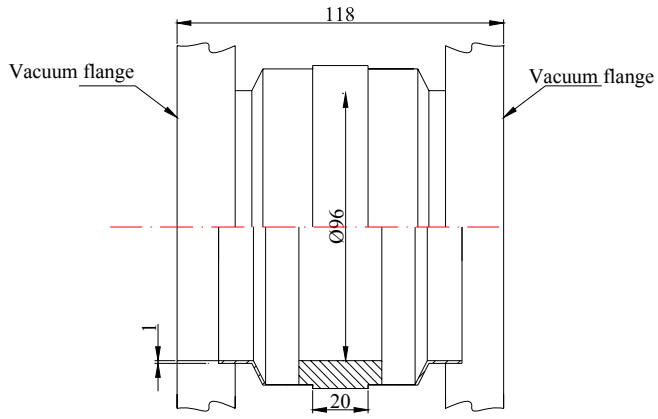
| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| CB73KF1 | 1 | 63 ISO K | 95 |
| CB73KF2 | 1 | 100 ISO K | 130 |

CF Flanged

| | | | |
|---|---|---|---|
| CB73CF1 | 1 | CF63 | 113,5 |
| CB73CF2 | 1 | CF100 | 152 |

## SERIE CB111

| Max voltage (kV) Grounded shield | Max T (°C) |
|---|---|
| | |
| 10 | 400 |




CB111NN1

KF Flanged

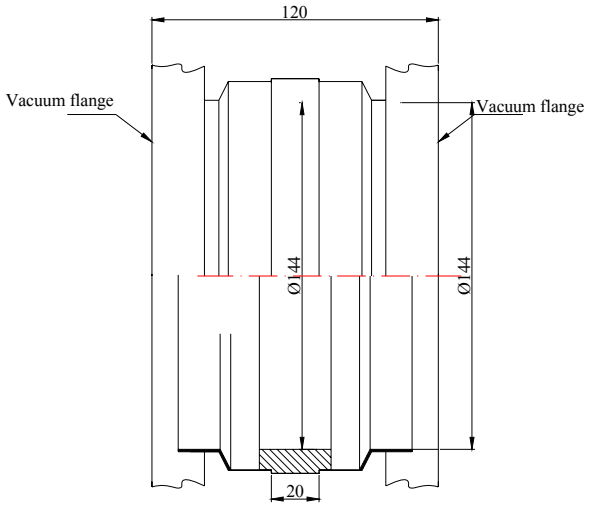
| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| CB111KF1 | 1 | 100 ISO K | 130 |
| CB111KF2 | 1 | 160 ISO K | 180 |

CF Flanged

| | | | |
|---|---|---|---|
| CB111CF1 | 1 | 100 CF | 152 |
| CB111CF2 | 1 | 160 CF | 202,5 |

## SERIE CB150

| Max voltage (kV) Grounded shield | Max T (°C) |
|---|---|
| | |
| 10 | 400 |




CB150NN1

KF Flanged

| Model | Number of conductors | Flange type | Flange diam. (mm) |
|---|---|---|---|
| CB150KF1 | 1 | 160 ISO K | 180 |
| CB150KF2 | 1 | 200 ISO K | 240 |

CF Flanged

| | | | |
|---|---|---|---|
| CB150CF1 | 1 | 160 CF | 202,5 |
| CB150CF2 | 1 | 200 CF | 253 |

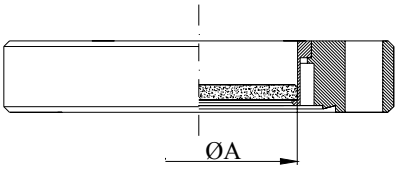
**SECTION D**

## Sapphire Viewports

VLT supply a large choise of amagnetic viewport zero length on standard vacuum flange DN CF, DN KF, DN ISO-K.

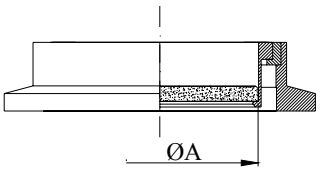
- Sapphire standard viewport
  - Plane parallel window up to 50mm free view
  - Optical surface finish up to 50-20 scoth-dig
  - Crystal orientation normal to the optic axis
  - Orientation parallel to window surface available on request at additional cost
  - Antireflection coating available on request at additional cost. The uniformity of AR coating will be not over the 80% of the window clear aperture.

- Viewport with other optical materials available on request.
- Special executions on request




KF Flanged

| Model | ØA | Flange type | Flange diam. (mm) |
|---|---|---|---|
| OWKF16 | 15 | 16KF | 30 |
| OWKF40 | 35 | 40KF | 55 |
| OWKF50 | 35 | 50KF | 75 |




CF Flanged

| | | | |
|---|---|---|---|
| OWCF16 | 15 | 16CF | 34 |
| OWCF40 | 35 | 40CF | 69,5 |
| OFCF63 | 50 | 63CF | 113,5 |

**SECTION E**

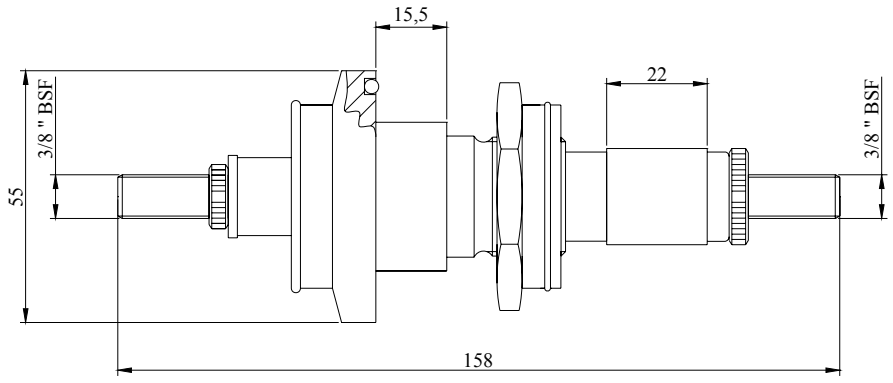
## Feedthroughs for glow-discharge

VLT presents a model of feedthrough for glow-discharge. The model features the same characteristics than other feedthroughs presented in Section A.
The feedthrough is supplied complete with nut and O-ring.

**Figure E-1**
**Model HT10D**

**SERIE HT10D**

| Max voltage (kV) | Max Current (A) |
|---|---|
| | |
| 10(dc) | 250 |
| Max temperature (°C) | |
| 250 | |



**SECTION F**

## Thermocouples

VLT present a large selection of high and ultra-high-vacuum cladded thermocouples , suitable for temperature measurements in closed environment, where a perfect leaktightness is required. The principal feature of the VLT production is that the thermocouple are supplied already assembled with their flanges and/or feedthroughs. In this way the thermocouples are not only very compact, but they are also immediately operable.
Thermocouples are available in 2 standard configurations:

– high vacuum brazed on all types of flanges and transitions (KF, CF, VCR, etc.)
– high vacuum brazed on electrical feedthroughs and then joined with flanges (KF, CF, VCR, etc.) by vacuum brazing or TIG welding.

In the second version the thermocouple cladding is ground isolated. The thermocouple, therefore, can be utilized directly on objects under high voltage.

### Technical characteristics of standard thermocouple

- Type K (Chromel Alumel) temperature range -200 +1200°C
- Type J (Iron – Costantan) temperature range 0 +750°C
- Type T (Copper – Costantan) temperature range -200 +350°C
- Inconel cladding 1,5 mm diam.
- Mg $O_2$ 99,4% Insulating material
- Thermocouple length on request
- Cold junction:
  - Miniature standard connectors (200°C)
  - Miniature ceramic connector (650°C)

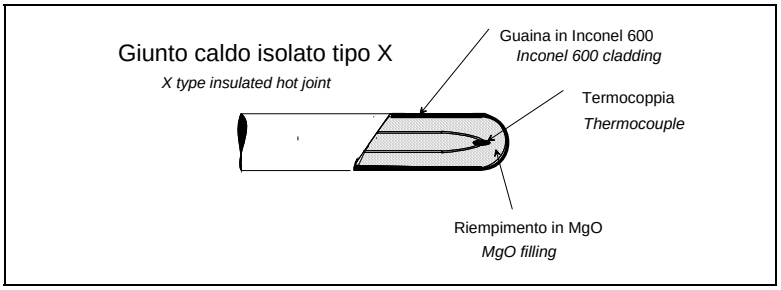
VLT can supply multi-type feedthroughs, including both thermocouple and power feedthroughs

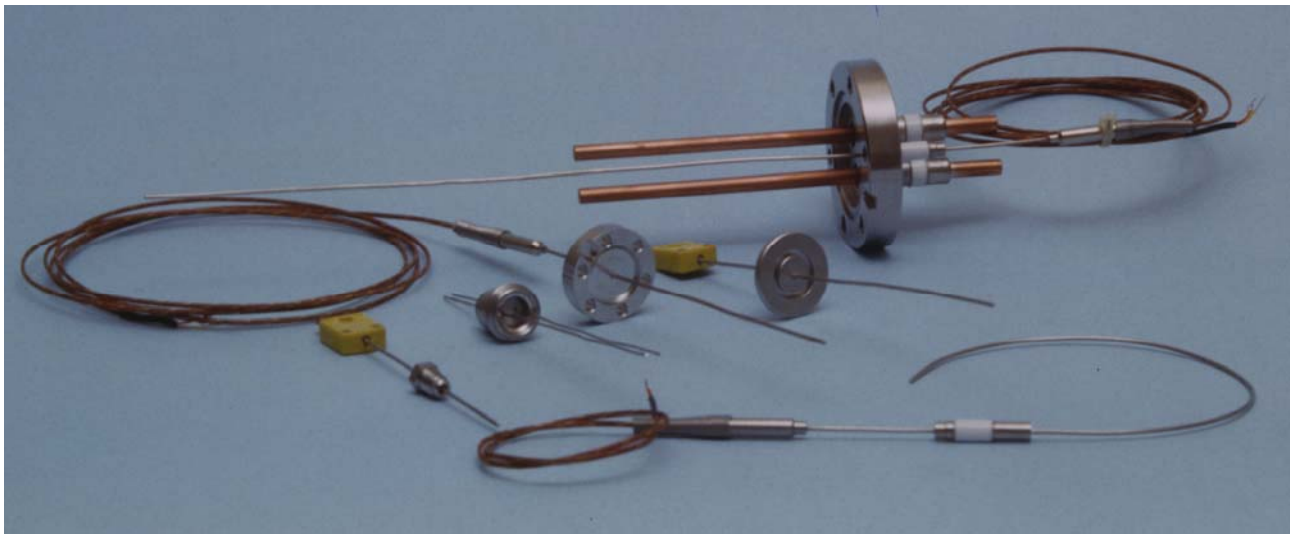
### Thermocouple identification system

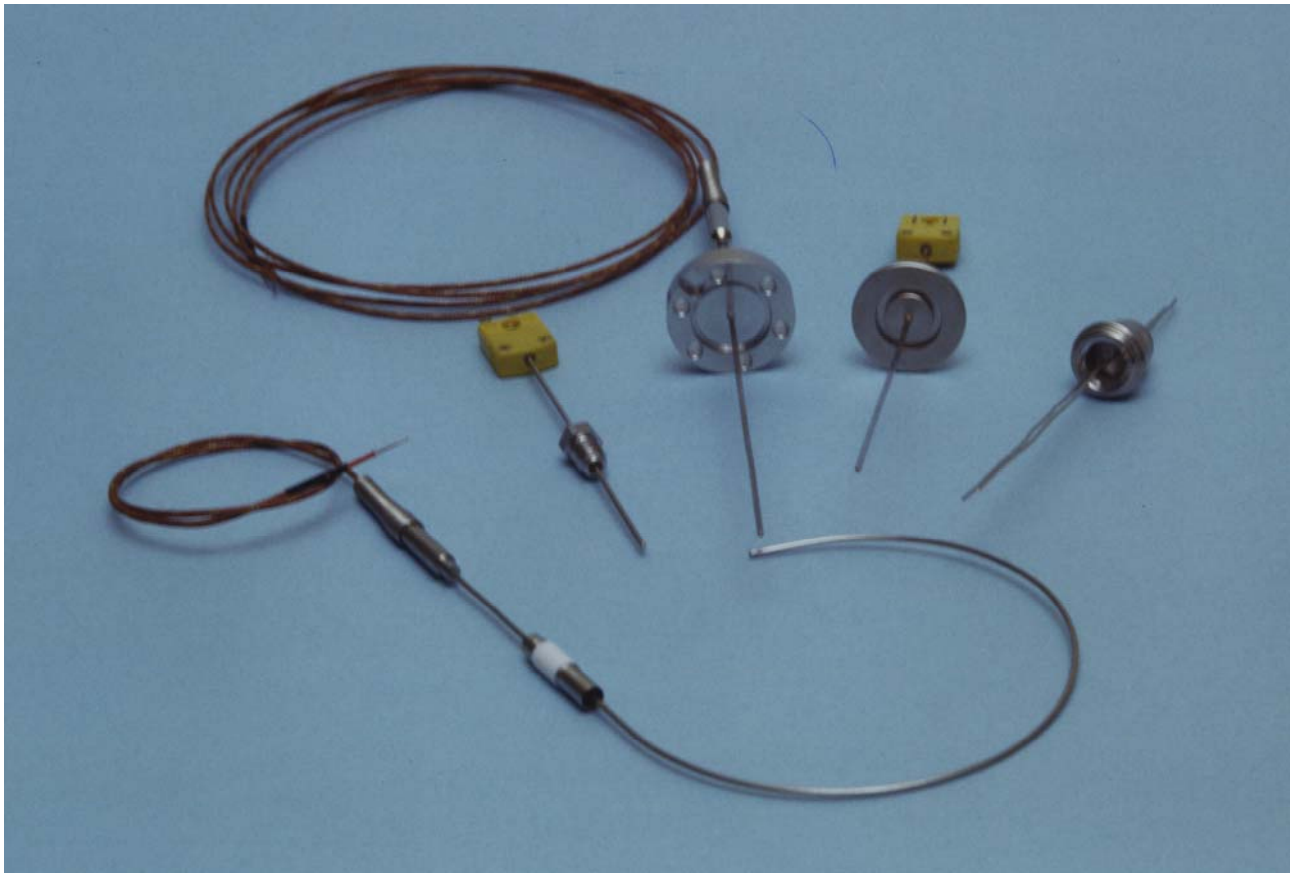
A simple alphanumeric system is adopted to identify thermocouples foe example:

TCK KF 04—where:

- TCK is for thermocouple type K
- KF is the vacuum flange type
- 04 is the number of T.C. in one vacuum flange
- -- is the thermocouple length



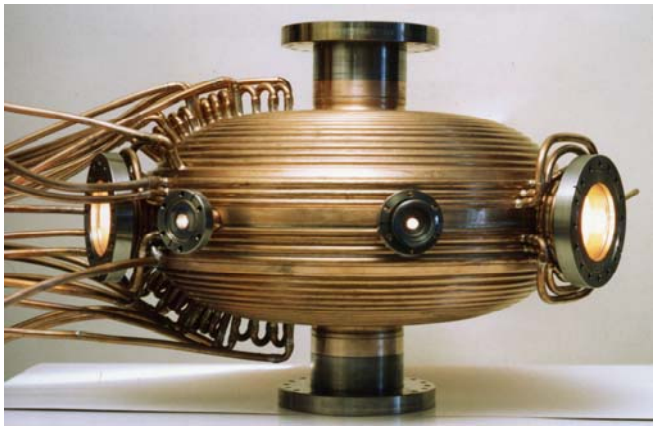


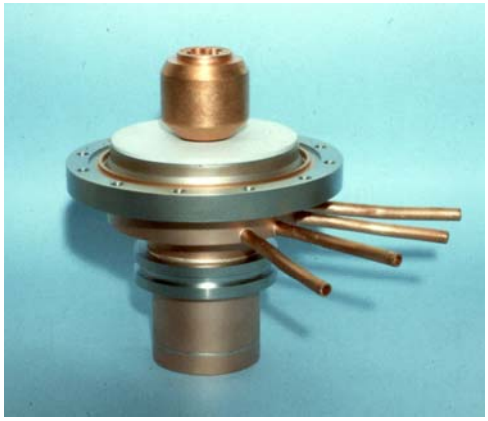


**SECTION G**

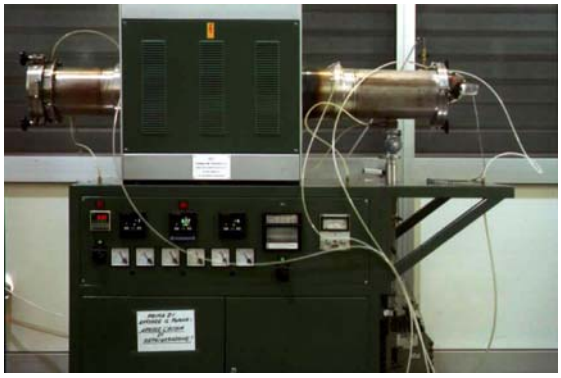
## Special components

This section is a presentation of a few special components designed and manufactured on client needs. Components may be manufactured either with Alumina to Metal or Metal to Metal vacuum brazing.





## Vacuum Furnaces

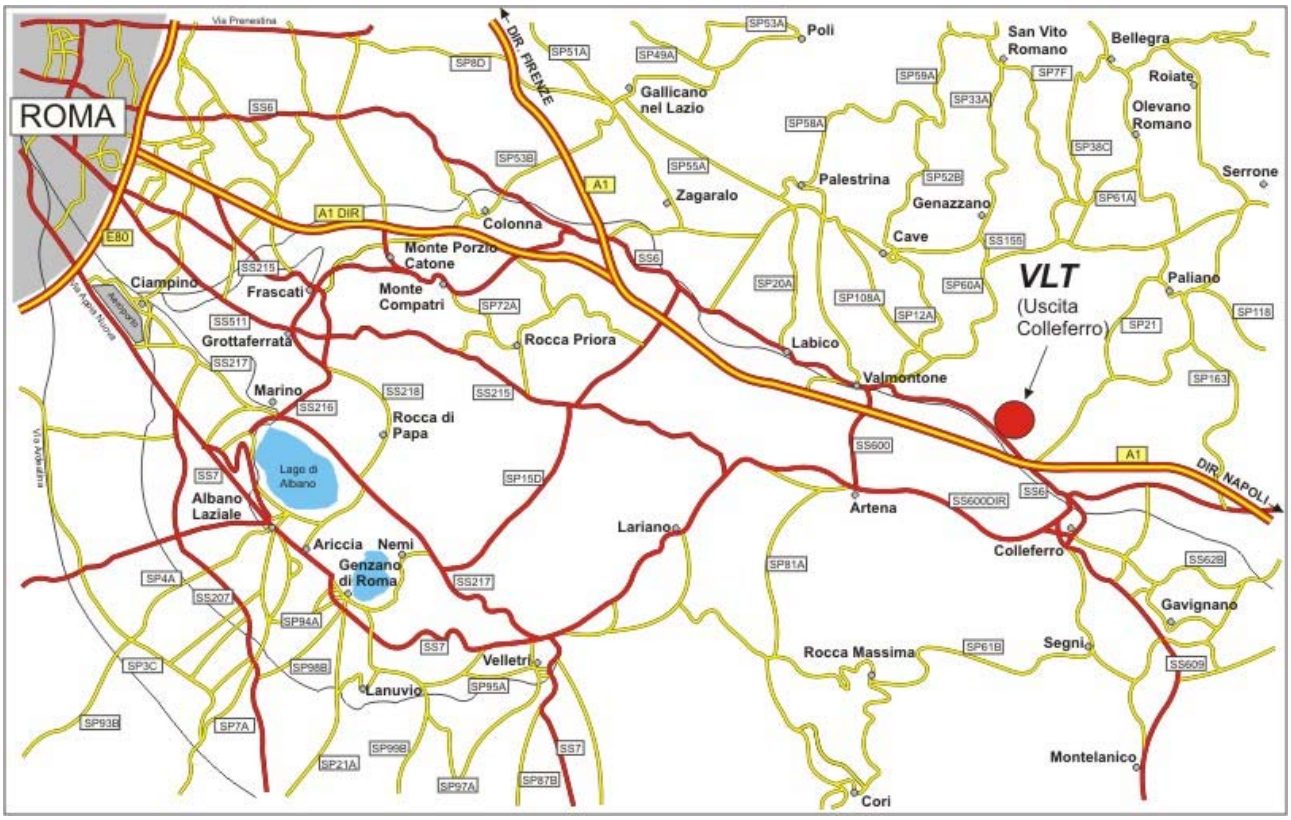


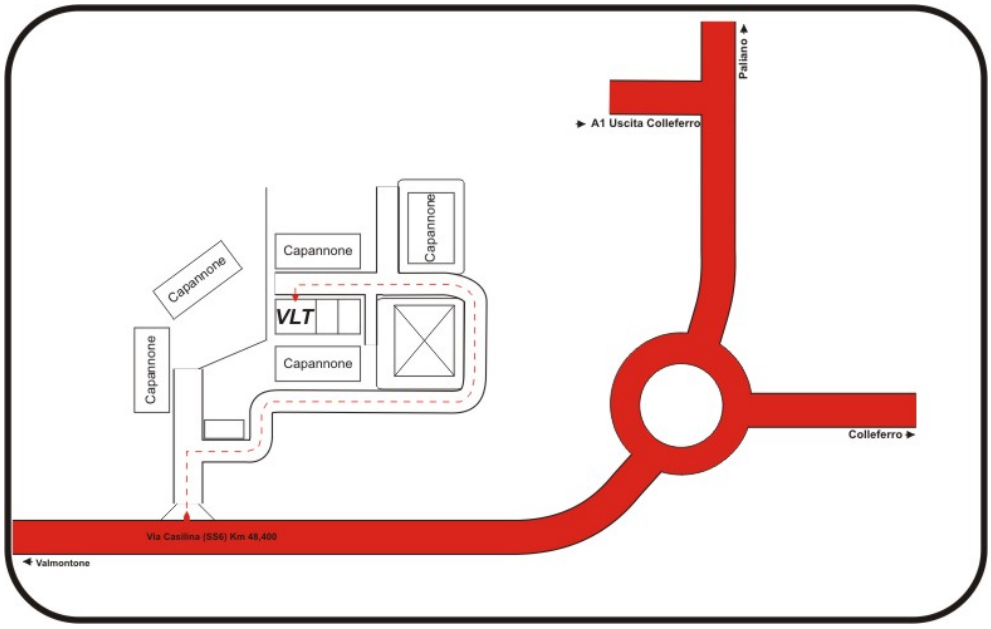
Special Furnace for research laboratory

VMS 2-20

CVI-CVD

## HOW TO FIND VLT




V.L.T. Srl - Vacuum Laser Technology
Località Piombinara, Lotto I - 00034 Colleferro
Tel. / Fax. 06.9770957
E-mail: vlt.srl@virgilio.it Sito Web: www.vlt-srl.it