

Equipment for laser welding & laser cutting How to choose your type of pipe?

Types of contamination

Permanent contamination involving the phenomena of back diffusion and desorption: this represents the level of humidity that will be permanently present in the pipe.

Occasional contamination: this corresponds to phenomena of contamination on tube walls.

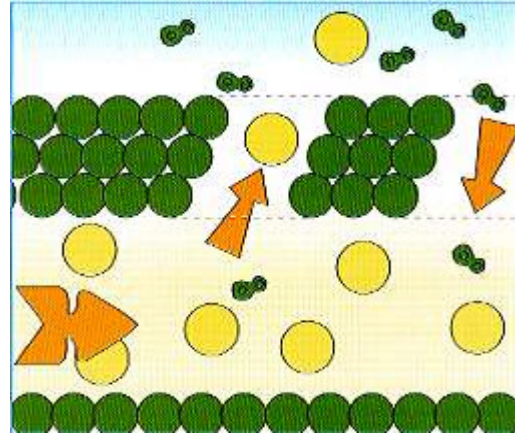
Principal causes of contamination of lasing gases by humidity

- Presence of air in installations

Before setting an installation into service or when changing a gas source, the installation may be filled with air. It is therefore necessary to bleed the installation. The most suitable type of bleeding procedure for lasing gas pipes is bleeding by compression/expansion cycles with venting. The bleed gas is pressurized in the installation and diffuses in the gas to be bled off, so forming a mixture which is discharged to the atmosphere. This operation is repeated a number of times: between 5 and 10 times. The optimal bleeding pressure is between 1 and 10 bars relative.

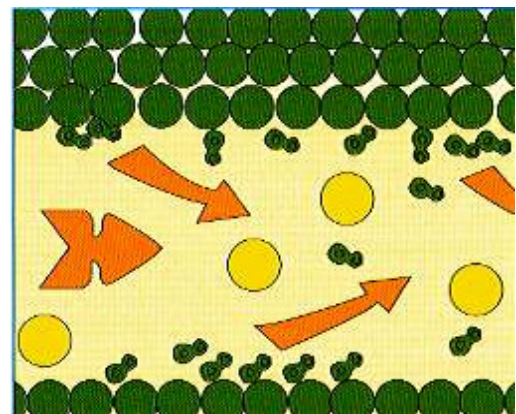
- Inadequate sealing

If an installation is not perfectly tightly sealed, gas leaks to the outside occur. However, it may happen that, at the same time, air enters the pipe even though the pressure in the pipe is higher than atmospheric pressure. This surprising phenomenon, known as back diffusion, consists in the diffusion of molecules from an environment under low pressure to another environment under high pressure. Back diffusion can be explained by comparing the partial pressures of the various gases located on either side of a wall. For the user, it has the effect of degrading the quality of the gas used, and this effect is all the greater when the flow rates are low or discontinuous.



- Selective adsorption of gas molecules by the inside walls of the installation, followed by desorption

A wall can lead to various interactions with gas: physical or chemical adsorption, desorption, for example. In this context, some molecules such as water molecules show the specific characteristic of being adsorbed by the walls with which they come into contact. As a result, when the installation is filled with pure gas, these molecules can desorb and contaminate the gas. This type of contamination can persist for a very long time. Most plastics desorb.



- Insufficient cleanliness of internal walls of installation

Some substances with high vapor tensions, such as oil, greases and some plastics, contaminate the pure gas they come into contact with.

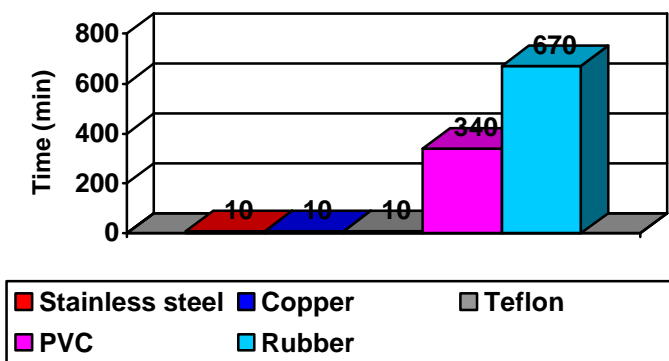
In brief, three major factors can be identified:

- the necessity of bleeding the installations used,
- the need for clean pipes,
- the need to choose pipes of a suitable nature.

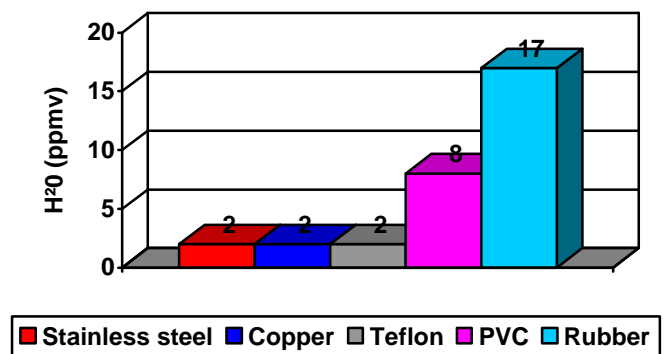
Nature of pipe

The nature of the pipes used governs the phenomena of back diffusion and absorption which govern the levels of permanent contamination. This parameter depends on the dimensions of the pipes with the effect that, the greater the pipe thickness, the easier it becomes to limit back diffusion phenomena. The graphs below illustrate the bleed times with helium containing 2 ppmv of humidity at 2 bars and at 4 l/min, to obtain a permanent contamination level that is as low as possible, i.e. as close as possible to the 2 ppmv of the reference gas. The pipe is 10 meters long and 2 mm thick, with an outside diameter of 8 mm.

Bleed time



Permanent contamination



For these pipes, it is preferable to use stainless steel piping that has been cleaned with a chemical solvent to remove grease and other contaminants. The tubes are then connected together by the T.I.G. process with internal inerting.

Equipment such as pressure reducers will be of the stainless steel, high-purity type with diaphragm. It is a good idea to install a filter.