

## triGEL - workholding by freezing



**The triGEL-fixture system consists of two connected members:**

1. The workholding table made of thermo-conductive material (aluminum, copper). The refrigerating gas R4040, which is not attacking the ozone layer, is circulating inside (100 x 100mm, 100 x 200mm, 200 x 400mm, 170 x 450mm, 500 x 550mm, custom made sizes on request) and
2. The control cabinet including:
  - compressor and heat exchanger 220 or 380V.
  - thermostatic control for the freezing and the reheating process, includes the maintaining of a preset temperature.
  - electrical safety circuitry.
  - control lights to watch the workholding process.
  - interface to the machine control for process monitoring.

### Workholding by freezing: triGEL

Fixturing with ice is using a physical effect. If we take hold of a metal handrail in the winter, when the temperature is below zero, we suddenly can find ourselves stuck to it. Windshield wipers, door locks and handbrakes frozen into place demonstrate the same effect. This phenomenon is used by ice clamping devices. Those made by TRIAG are known as triGEL devices. There are two different methods of achieving the necessary cooling of the machine table (working surface): one is the Peltier effect, and the other is the use of a cooling medium as it is commonly applied in a deep freezer. In this second method, the latent heat of evaporation of the cooling medium (for example R4040 which has no greenhouse effect) contained in a closed coolant circuit is used. The cold gas passes through a labyrinth of channels in the machine table, bringing its temperature to about -8°C. Both the machine table and the workpieces are covered with a fine film of water using a water atomizer. This causes the workpiece to stick to the machine table within approximately 15 to 60 seconds. The process is reversed to release the workpieces. The device then operates rather like a heat pump, so that the dew point is reached again very quickly, and the workpieces are released. The second method is significantly more powerful. TRIAG therefore uses this technique for their triGEL system.

The adhesive strength, at 2N/mm<sup>2</sup>, is approximately 10 to 20 times greater than that of vacuum clamping. Hard mechanical shocks should nevertheless be avoided. Since no clamping forces are applied to the workpiece, parts with plane base surfaces can be machined with very high precision. The thickness of the film of water or ice is negligibly small. Irregular base surfaces can be frozen solid in a water bath. All metallic and most mineral materials, as well as many plastics, can be clamped in the way. Ice clamping is now no longer confined for use in the watch making and jewellery industries. The range of applications extends from medical technology through to general mechanical production. Standard table sizes include, for instance, 100x100mm, 100x200mm, 200x400mm, 170x450mm of 500x550mm.

