HTS Cooling

Stirling Cryogenics solutions for HTS applications

STIRLING CRYOGENICS

Stirling Cryogenerators

For over seventy years Stirling Cryogenics has been designing and manufacturing Cryogenerators for extreme low temperature cooling, serving customers all over the world under all possible conditions. This experience is incorporated in our various closed loop cooling concepts, which typically have 3 fields of HTS applications:

- HTS AC Power Cables: cooling by sub-cooled one-phase LN_2 flow down to 68 K
- Fault Current Limiters: cooling by re-liquefaction of boiling LNe down to 27 K or LN_2 down to 68 K
- Generators, Motors, DC Cables and Magnets: Cooling by helium gas flow down to 20 K

To generate cooling power the Stirling Cycle is used. In short, by compression and expansion of helium gas in a closed cycle using mechanical pistons, cold is created which is used to cool a heat exchanger. The medium to be cooled is not used to create this cold: it will just flow through a cold heat exchanger where energy is extracted cooling the process.

HTS Power Cables

HTS cables need a flow of LN_2 which is sub-cooled to assure a mono-phase flow without gas bubbles. The cooling system creates this flow by liquid pumps and the sub-cooling by a pressurizing vessel which controls the system pressure. The same vessel also compensates for the contraction and expansion of the LN_2 in the loop depending temperature, especially during cool-down and warm-up.

2021 Stirling Cryogenics 67 K sub cooled LN_2 cable cooling system courtesy ComEd and AMSC, USA

The cooling power of the Cryogenerators is transferred either by pumping directly through the cold heads, or indirectly using an intermediate vessel with a heat exchanger. This intermediate vessel is a bath of boiling liquid which is re-liquefied and acts as thermal buffer.

The cooling power available ranges from 500 W to over 10 kW at 68 K or higher.

STIRLING
CRYOGENICS

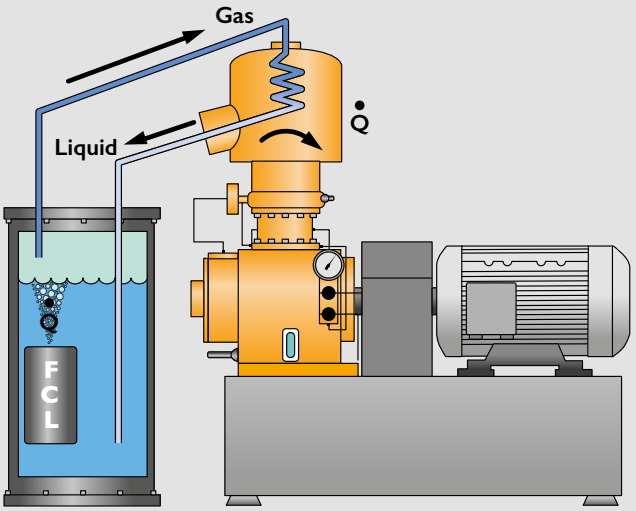
Fault Current Limiters

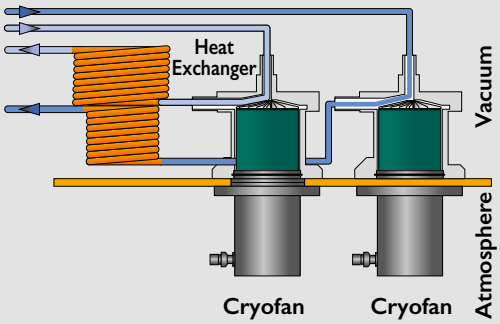
FCL's do not need flow as they are relatively compact and can therefore be submerged in a bath of boiling LNe or LN_2.

At the control system, the pressure of the bath and FCL is chosen, determining the temperature.

The evaporated gas is directed to the Cryogenerator where is it re-liquefied. The pressure is controlled by adapting the liquefaction capacity to the actual heat load,

The cooling power available ranges from 500 W to 10 kW at 68 K or higher.





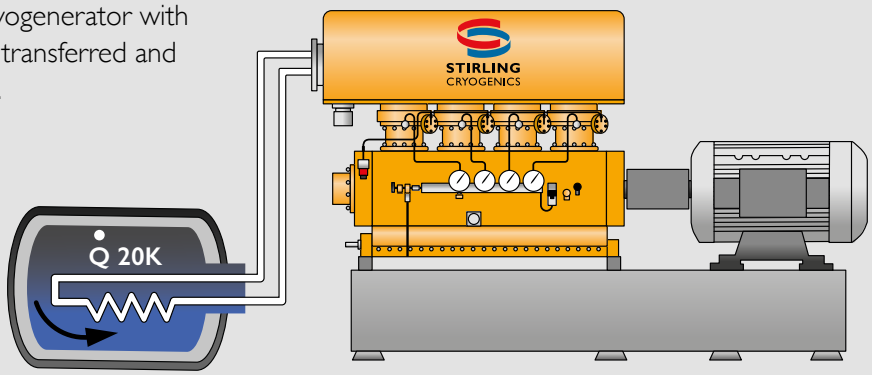
Generators, Motors, DC Cables and Magnets

HTS rotating equipment and DC Cables need low temperatures down to 20 K to function after being cooled down while stationary.

To minimize LHe consumption, LTS magnets need pre-cooling to reach 4 K. These temperatures can be achieved by applying a flow of helium gas which is circulated by our CryoFans.

The gas flow will thermally connect the Cryogenerator with the application so its cooling power can be transferred and distributed over different coils and volumes.

The cooling power available ranges from 50 W to 1 kW at 20 K or higher.



Stirling Cryogenics BV
Science Park Eindhoven 5003
5692 EB Son, The Netherlands
T +31 40 26 77 300
info@stirlingcryogenics.com

Sales Offices in USA, Germany, Sweden and Italy