

CHART VACUUM INSULATED PIPE



Insulated pipe is needed to carry the extremely cold (-320°F/-196°C) liquid nitrogen from the bulk storage tank to the test chamber. The three basic options for the insulated pipe are discussed below:

Copper Pipe Insulated With Foam: This is the least expensive option to purchase, however it has the worst performance by far. The foam insulation does not provide near the insulating capability as vacuum insulation. In addition, the foam insulation tends to absorb water from the atmosphere over time. As the foam absorbs water, the insulation becomes even more in-efficient. The only way to minimize the water problems is to strip all of the foam off the pipe and re-insulate with new foam every 3 - 5 years. This re-insulation process can be very expensive. Foam insulated pipe also makes installation a bigger challenge. Typically the foam insulation is 2 - 3" thick which ultimately means the pipe system is greater than 7" in diameter. This large diameter can make installation much

more difficult than smaller diameter pipe systems.

Dynamic Vacuum Pipe: This style of pipe is insulated by a vacuum system that is continuously running. Each section of pipe will be installed with a vacuum pump connected to it. The vacuum pump will run and continuously draw vacuum in the annular space.

While this pipe is more efficient than foam insulated pipe, it still has many drawbacks. Since the pipe has a vacuum pump continuously running on each section, there is the added cost of frequent pump maintenance and electrical power to run the pump(s). The vacuum pumps (multiple pumps for multiple sections of pipe) also create an additional heat load on the building's HVAC system. In addition, if the vacuum pumps were to break, the whole section will lose its vacuum and be extremely inefficient.

Dynamic vacuum pipe is made with flexible piping. When the pipe is installed in the facility, it looks less appealing, as it tends to sag between each of the supports. The piping is made flexible by having many corrugations in the material. These corrugations (often made of copper) are more susceptible to damage or fatigue cracking of the inner or outer pipe

Static Vacuum Insulated Pipe: The type of pipe that Chart manufactures is insulated with a "static" vacuum. This differs from the above mentioned Dynamic Vacuum Pipe as the vacuum is achieved and permanently sealed off at our factory. Building our pipe this way has many advantages:

- The equipment used to create the vacuum in the annular space in our factory is much better than the equipment used in Dynamic Vacuum pipe. This equipment allows us to obtain lower vacuum levels which means much more efficient insulation. Static Vacuum pipe is the most efficient pipe available.
- The pipe is made of rigid pipe (no corrugations) which looks more appealing when installed and is much less likely to be damaged or experience fatigue failures.
- The inner pipe (which carries the liquid nitrogen) is made of stainless steel. Stainless steel is much more durable than copper and is less likely to crack.
- Flexible sections can be made to help make final installation easier or work around obstacles.

