

STONE PIT

**STONE PIT NEEDS FOR EXTERNAL PURIFIER**

Reference

**INTRODUCTION**

This document defines some recommendations for the design of cryogenic liquid pits.  
This type of pit is only to be used for small amounts of cryogenic liquid with interval between purges.

**SAFETY REMINDER**

A pit must be able to vaporize the amount of purged liquids without freezing the ground or the concrete.

Its location shall take into account reasonable safety distances:

- 1) risk created by the vaporized gases around the pit
- 2) risk of sending cryogenic liquids or gases in an underground network in the vicinity (sewage system...)
- 3) risk of freezing of neighboring foundations

A pit must be self draining: evacuation of rain water

The pits shall not:

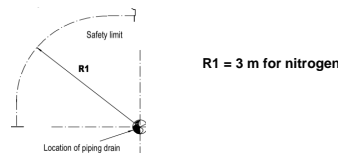
- Be connected to any underground network, whatsoever
- Installed close to an underground liquid network (rain water collection, sewages...) which is not protected by a cryogenic siphon
- Installed close to open underground trenches & conduits (such as power cables trenches) where possible liquid overflow could enter.
- Installed under a steel work platform or close to a maintenance access or in an unventilated area, etc...see restrictions below.
- Installed between two pumps casings (maintenance, access, safety, etc...).

**INSTALLATION**

**Safety Perimeter**

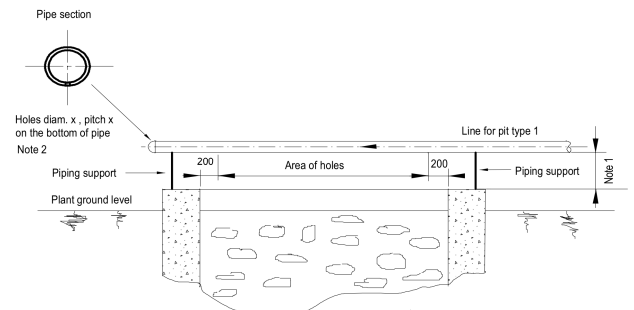
As explained in the safety reminder, a perimeter should be defined around the stone PIT.

- Edge of foundations , piles
- Edge of roads
- Platforms, stairs, casing
- Sewer ( with cryogenic protection )
- Open underground trenches & conduits



**Piping**

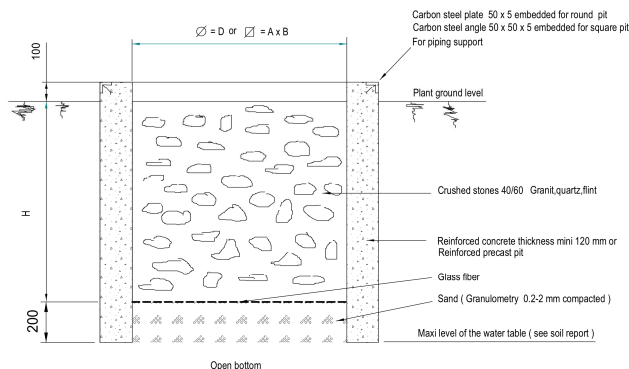
To have the maximum evaporation of the cryogenic liquid on the crushed stones, the piping shall not be inserted into the crushed stones and the arrangement of the piping drains shall be done as follow:



Note 1: About 100mm

Note 2: The bottom of the piping shall be drilled with a minimum of holes such as the total area of the holes correspond to the section total of the drain.

**Stone Pit**



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**SIZING**

**Stones Spec.**

Cp	0,78 kJ/kg/K	
Rho	2 400 kg/m3	
Void coefficient	50,00%	
Initial stones temperature	283 K	10 °C
Final Temperature	253 K	-20 °C
Energy which could be adsorbed	23 kJ/kg	

**Cryogenic Fluid Spec.**

Fluid	<b>Azote</b>	21
LN2 Latent Heat @ -196°C	198,78 kJ/kg	
Cp (N2, 1 bar, Tmoy=163K)	1,05 kJ/kg/K	
Warm Up GN2 from -196°C -40°C	163,24 kJ/kg	
Heat Required to heat up LN2 to -40°C	362,02 kJ/kg	

T (°C)	T (K)	Cp
-196	77,15	2,06 kJ/kg/K
-180	93,15	1,08 kJ/kg/K
-40	233,15	1,04 kJ/kg/K
-110	163,15	1,05 kJ/kg/K

**Cryogenic Fluid Sent to stones Pit**

Volume	200,00 L	Volume contained in the Purifier
Volume Normal	129 Nm3	
Rho	810,20 kg/m3	
Mass	162,04 kg	
Energy to be adsorbed	58 662 kJ	

**Quantity of stones and volume to consider**

Mass of stones required	2 506,9 kg
Volume	1,04455 m3

**Dimensions of the pit**

A	1,00
B	1,25
H	0,80
<b>Volume</b>	<b>1 m3</b>

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