



Development and Fabrication of Liquid Nitrogen Draw Pump 2

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1. Purpose

How to transfer Liquid Nitrogen (LN₂) from a container to a cryostat are generally...

- (1) Apply pressure to the container to push out liquid under the differential pressure,
- (2) Pour liquid into the cryostat by lifting the container.

To overcome these inconveniences in a laboratory, **we have been developing a portable LN₂ centrifugal pump** which is small and less costly.

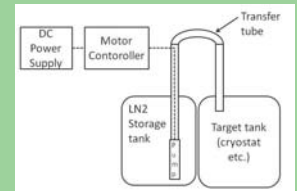


Fig.1 LN₂ Pump System

2. Test and Result

We prepared two pumps, A and B, to compare and clarify factors in operation. **Specification and results of tests are summarized** on the table briefly.

Assembly of the pump

The impeller(7) scatters cryogen continuously, then scattered cryogen flows the gap between the motor(5) and the casing wall(4).

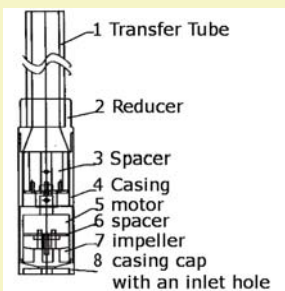


Fig.2 Pump A (schematic)
(Pump B has same components)

*1 DC brushless motor

*2 polyoxymethylene

*3 polyvinyl chloride

*4 The discharge volume rate largely depended on the shapes of the casing and the spacer as for the test on Pump B.

Pump A



Fig.3 Pump A
(A)with transfer tube (B)overhauled

Pump B



Fig.4 Pump B (overhauled)



Fig.5 Test setup of Pump A
Right: storage tank (alloyed Al.)
Left: target tank (stainless)



Fig.6 Test setup of Pump B
storage : glass insulated dewar tank

Motor's power*1	6 - 8 W	15 W
Rotation at test	9000 - 12000 rpm	10000 - 37000 rpm
Impeller material, height	POM*2, 8 mm	POM, 10 mm
in/out radius	6 mm/11 mm	2.5mm/8mm
Casing material, length	PVC*3, 92mm	PVC, 91mm
in/out diameter	25mm/26mm	19mm/24mm
Inlet hole diameter	8mm	12mm
Transf. tube material, length	PVC, 800 mm	glass insulated tube, 1000 mm
in/out diameter	13mm/26mm	4mm/12mm
Storage tank entrance diam., vol.	28mm, 50L	54mm, 22L
Target tank entrance diam., vol.	24mm, 50L	185mm, 6L
Total heads	more than 800mm	more than 1000mm
Discharge volume rate	4 L/min	0.3 - 1.8 L/min*4

3. Conclusion

We have **succeeded** in development of the **LN₂ centrifugal pumps with small radii and enough total heads to transfer LN₂ without pressuring cryostats.**

Points to examine next:

- (1) The characteristics of the discharge volume rate on the input power or motor rotation
- (2) How the inside shape influences the discharge volume rate
- (3) The flush loss of LN₂ during the operation

We also have a plan to apply the pump to liquid helium transfer in the future.