GASEOUS NITROGEN

HEAT EXCHANGER

D-Zero Engineering Note: 3740.510-EN-174

C.H. Kurita

August 19, 1988

Approved: _____ 8/19/88

A heat exchanger is necessary to warm the gaseous nitrogen from the nitrogen dewar from 77 K to ambient temperature for use in the D-Zero Building. The original proposal would use an ambient air vaporizer, but further investigation led to the consideration and evaluation of other possibilities and a different final system. The vaporizer must be able to handle a flow rate of 1200 scfh at 30 psig on a continuous basis subject to local weather conditions.

Upon consulting with a representative from Thermax Incorporated, So. Dartmouth, Massachusetts, four different heat exchanging systems were proposed. Their advantages and disadvantages are stated as follows.

Option #1: Single large ambient air vaporizer sized for approximately three times the expected flow

- use of super-gap modules allows for a longer period before ice bridging between elements occurs

Advantages

- in the event of overdrawing, all liquid is vaporized
- low pressure drop

Disadvantages

- must periodically knock off ice
- final gas temperature can only approach ambient

Option #2: Electric heater (only)

- flow rate is small enough that an electric heater can be used

Advantages

- gas is fully heated to ambient temperature (or above) as required

Disadvantages

- greater potential for operational problems

- may see liquid if overdrawing occurs
- high pressure drop

Option#3: Electric heater/Ice-rack hybrid

- placing an ice-rack before the heater lightens the load on the heater by acting as a pre-heater

Advantages

- gas is fully heated to ambient temperature (or above) as required
- in the event of overdrawing, ice-rack will vaporize the liquid

Disadvantages

- greater potential for operational problems
- high pressure drop

Option #4: Two smaller ambient air vaporizers in parallel with an electrically actuated diverted valve

- use of super-gap modules extends the period before ice-over occurs, and switching between the modules allows for one unit to defrost while the other is in use

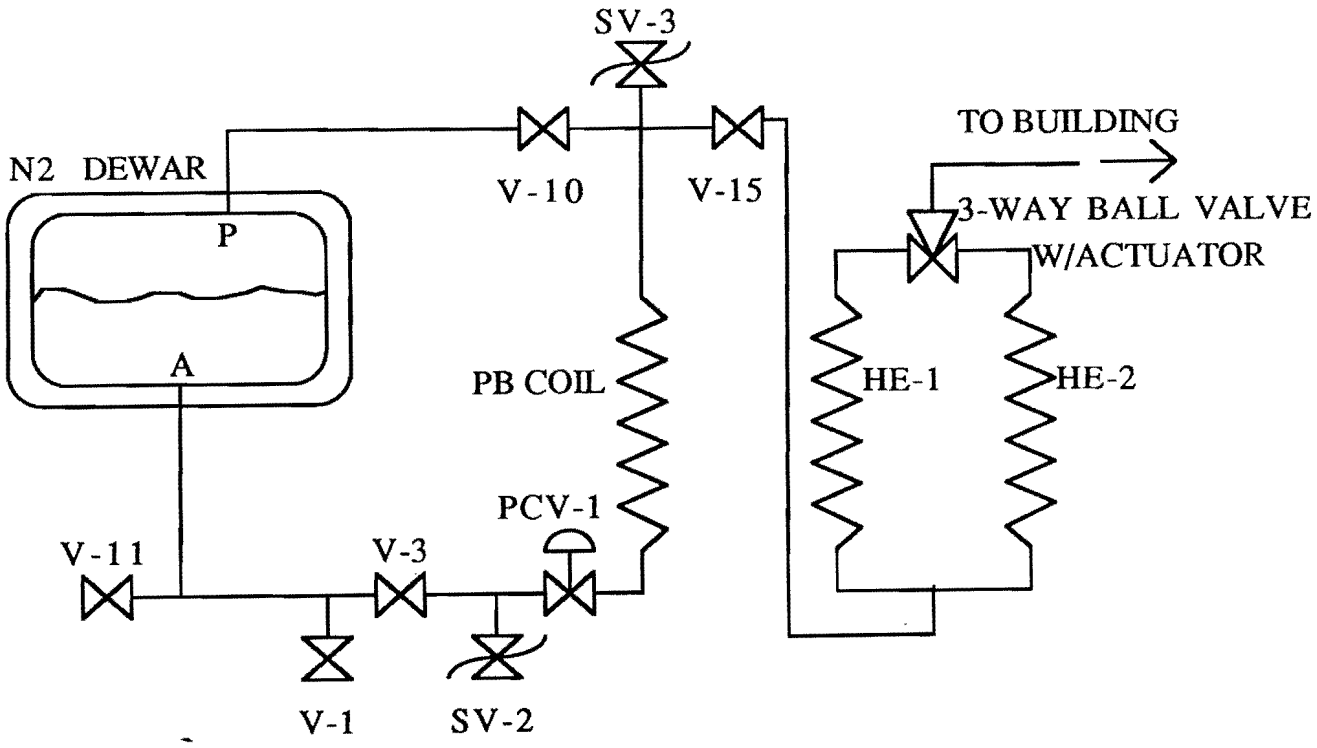
Advantages

- in the event of overdrawing, all liquid is vaporized
- low pressure drop
- simple valve control through PLC

Disadvantages

- must periodically knock ice off in very cold weather
- final gas temperature can only approach ambient

After weighing the advantages and disadvantages of each option, it was decided that Option #4 would be best suited for the intended application. The system selected includes two Thermax super-gap ambient air vaporizers (#TF0410-HF-SG) and a Worcester Controls 3-way cryogenic ball valve (#C416-PMSE-V1) with a NEMA IV 110V actuator (#1275W).



A	BOTTTOM FILL/PRESS. BUILD LINE
P	PRESSURE BUILD RETURN LINE
V-1	BOTTOM FILL VALVE
V-3	PRESSURE BUILD LIQUID SHUT-OFF VALVE
V-10	VAPOR RETURN VALVE
V-11	AUXILIARY LIQUID WITHDRAWL VALVE
V-15	GASEOUS N_2 WITHDRAWL VALVE
SV-2	PRESSURE BUILD LIQUID SAFETY VALVE
SV-3	PRESSURE BUILD VAPOR SAFETY VALVE
PCV-1	PRESSURE BUILD CONTROL VALVE
HE-1	THERMAX AMBIENT AIR VAPORIZER (1)
HE-2	THERMAX AMBIENT AIR VAPORIZER (2)
PB COIL	PRESSURE BUILDING COIL

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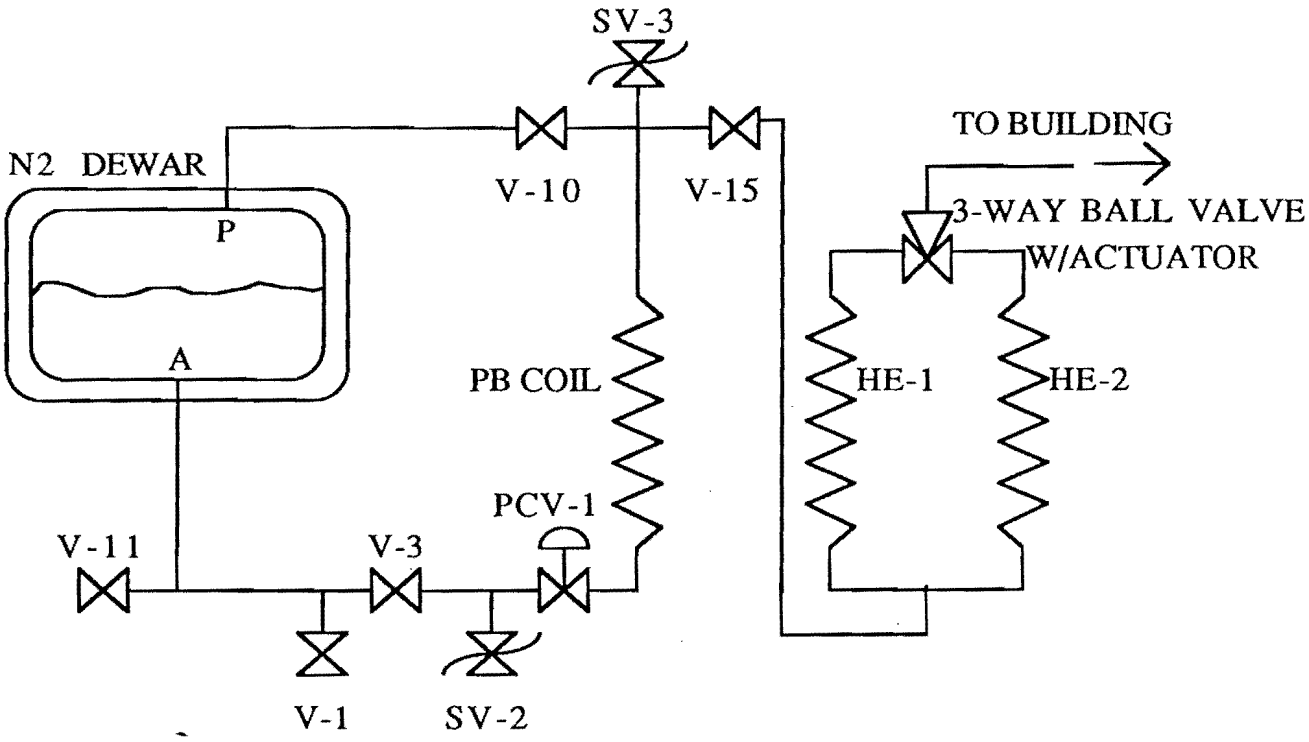

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