Preliminary Evaluation of Process Equipment Test Mock-up for Construction of Drying System

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1. Introduction

Pyro-process researches are performed in a salt environment. Because salt causes corrosion, moisture in air must be removed. At the development stage, however, workers and test equipment must be able to access frerly. Thus, as a part of the construction of the drying room, the room of the panel structure except the drying system was constructed first. In this study, we introduce the basic test results for the constructed room.

2. Mock-up for Process Equipment Test

The mock-up for process equipment test consists of an auxiliary room and a process room. The auxiliary room ($8m^3$) serves as an access passage for workers or process equipment between the outside of the mock-up and the process room. The door sizes of the rooms are 1.3m (W) x 1.9m (H), respectively. The door of the auxiliary room is a rotation type with airtight and the door of the process room is a slide type. The process room ($104m^3$) has two tempered glass windows on the front and right side and a double ceiling structure. Below the first ceiling, a gantry crane with a capacity of 0.5 ton was installed, and a gantry handling system was installed under the crane. The 25A pipe was extended to the inside of the process room to supply the compressed dry air provided by the KAERI.

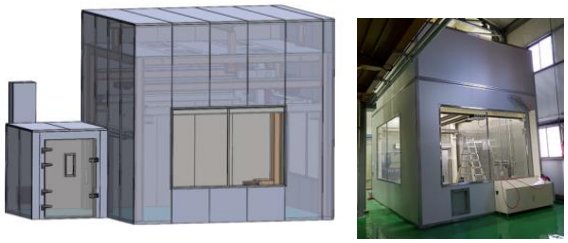

Fig.1. Mock-up for Process Equipment Test.

3. Preliminary Evaluation

3.1 Purging with Dry Air

As shown in Fig. 2, the compressed dry air is supplied into the process room through a floating area flowmeter (model GA-101, air 1~10 CMH) installed in the compressed air pipe (25A). The supply flow rate is set by reading the scale by adjusting the manual valve attached to the front of the flow meter with tick mark. The dew point of dry air supplied by the KAERI is below -40 °C. The dew point inside the room is measured with a dewpoint transmitter (VAISALA, Model DMT143, -80 to 20 ℃ Td).

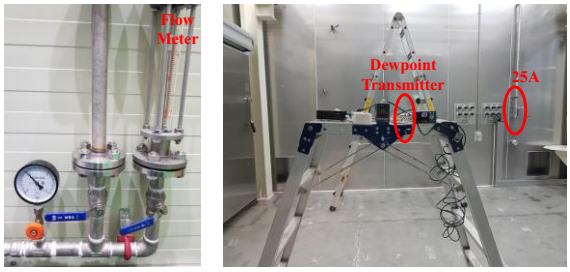

Fig.2. Flow Meter and Dewpoint Transmitter.

3.2 Leak Test of Mock-up

To calculate the leak rate of the mock-up, a test was performed to purge the dry air. When a constant flow is continuously supplied to the mock-up, the pressure remains constant after a certain period of time.

This is the leakage rate at that pressure. Table 1 shows the pressure information obtained while changing the purge flow rate.

As the pressure increases, it is shown that leakage rate increases.

Table 1. Pressure according to Purge Flow Rate

Flow Rate (CMH)	Pressure (mmAq)
1	1.2
2	1.4
3	1.8
4	2.3
5	2.8
6	3.5
7	4.3
8	4.8
9	5.5
10	6.4

3.3 Dew Point Test with Constant Purge Flow

It was purged at a flow rate of 10CMH inside the process room of the mock-up. The initial dew point of the process room was 3.6 ℃ (about 8,000 ppm), and after 10 days, the dew point was -40 ℃ (about 127 ppm). Fig. 3 shows the results.

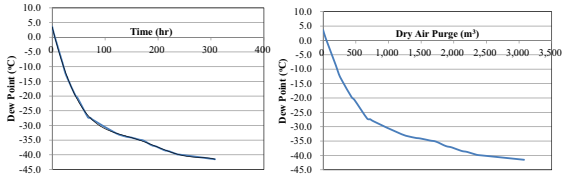

Fig. 3. Dry Air Purge with 10 CMH.

3.4 Dew Point Test with Variable Purge Flow

The dew point was measured while changing the purge flow rate to observe the dew point change. As shown in Table 2, when the purge flow rate is decreased from 10 CMH to 1CMH, the dew point is increased. The dew point is increased even if the flow rate is increased up from 1 CMH to 4 CMH. When the flow rate exceeds 5 CMH, the dew point is not increased but decreased.

Table 2. Dew Point according to Purge Flow Rate

Flow Rate (CMH)	Purge Time (hr)	Dew Point (°C)	Δ•∇	Pressure (mmAq)
10	-	-44.7	-	6.4
1	14	-41.2	Δ	1.2
2	5.5	-40.3	Δ	1.4
3	3.5	-40.1	Δ	1.8
4	44	-39.3	Δ	2.3
5	19	-40.2	∇	2.8
6	8	-40.9	∇	3.5

4. Conclusion

From the test results, it was confirmed that dry air should be purged above 5 CMH to maintain the dew point below -40℃. We plan to utilize the results to build a hybrid drying system in the future.

REFERENCES

[1] Byungsuk Park, et al., “A Consideration on the Dehumidification Methods for Designing the Dry Room”, Proc. of the KRS 2017 Autumn Conference, 15(2), 109-110.