

Temperature and Humidity of Winter University Archives

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ABSTRACT

In view of the detailed requirements of the industry standard JGJ25-2000 for the temperature and humidity of the archives room, this article conducted a detailed inspection of the winter temperature and humidity of the university archives room of Zhongyuan Institute of Technology in Henan Province in January 2025. Every 5 minutes, a total of 8933 time points of data were obtained through testing. The results showed that the temperature in the archives was significantly lower during the measurement period, with about 99.7% of the measurement time not meeting JGJ25-2000. After setting the thermal resistance of typical personnel clothing and typical activity intensity, calculations show that the average PMV value is -1.14 ± 0.32 , indicating that the environment is significantly colder. The average PPD value is 33.96 ± 14.28 , indicating a significantly higher proportion of dissatisfaction with the environment. Therefore, it is recommended to appropriately consider the winter temperature and PMV values of the archive in the later stage, in order to make the archive more friendly to archives and indoor personnel.

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I. INTRODUCTION

The temperature and humidity changes in the archive warehouse are one of the most fundamental and important environmental factors for archives or archives rooms. The temperature and humidity of the archive (room) warehouse are directly related to the geographical location of the archive, external environmental conditions, warehouse conditions and control measures, as well as the configuration and use of control equipment. Therefore, archives in various countries have established strict temperature and humidity control standards. For example, the Chinese industry standard "Code for Design of Archives Buildings" (JGJ25-2000) (issued by the National Archives Administration in 1985) stipulates that the temperature range inside the archives room should be controlled between 14 and 24 degrees Celsius, and the humidity should be controlled between 45% and 60%. The previous author conducted a study on the summer situation in the archives from July 30th to August 30th, 2023. The results indicate that 62% of the temperature during the survey period did not meet the above requirements, and 100% of the humidity did not meet the above requirements. This means that in order for the archive room to meet the requirements, it must undergo major renovations.

Based on the above requirements, this article will continue to use the Thermal Comfort Meter from Paper [1] to conduct a detailed study on the temperature and humidity of university archives in January 2025. When using this device, data was collected every 5 minutes, resulting in 8933 time intervals. Now, we will conduct a detailed analysis of these data.

II. RESULTS

1. Air temperature

Among the 8933 data points, there are only 183 moments greater than 14 degrees, accounting for 2%. This means that 98% of the time during the measurement period, the temperature is not within the range specified in the industry standard JGJ25-2000.

During the measurement period, the average value of these 8933 data points is 8.87 ± 2.20 °C. Figure 2 shows the temperature distribution chart, from which it can be seen that, except for 2% of the time when the temperature is greater than 14 °C, the proportion of measurement points at 10-14 °C, 8-10 °C, and <8 °C are 29%, 31%, and 38%, respectively.

Low temperature is beneficial for archive preservation, but there may be staff or borrowers in the archive room to access the archives. If the temperature is too low, it may cause significant cold damage to people. Therefore, the temperature inside the archive room is significantly low, and consideration should be given to adding heating and other equipment to ensure the physical health of personnel inside the archive room.

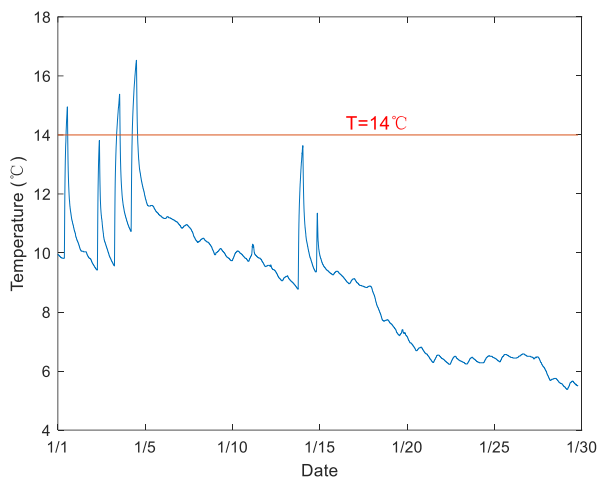


Figure 1: Variation of air temperature over Time

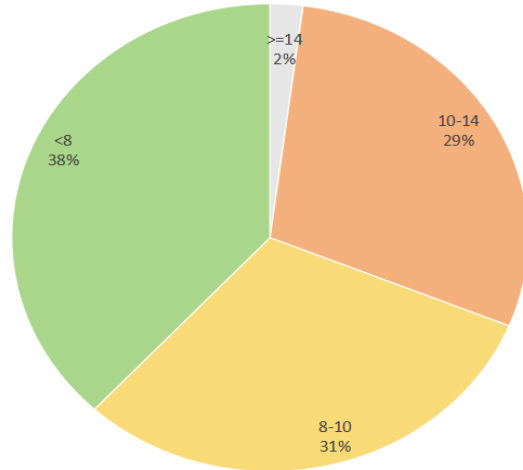


Figure 2: Schematic diagram of air temperature distribution

2. Relative humidity

The relative humidity throughout the month is between 30% and 55% (see Figure 3). Among the 8933 data points, there are 3267 moments with a value greater than 45%, accounting for 37%. This means that for 37% of the measurement period, the relative humidity is within the range specified in the industry standard JGJ25-2000. And the rest of the time does not meet the industry standards.

During the measurement period, the average value of these 8933 data points is $43.08 \pm 4.77\%$. Figure 4 shows the distribution of relative humidity. It can be seen from the figure that, except for 37% of the time when it is greater than 45%, the proportion of measurement points at 40-45%, 35% -40%, and <35% are 36%, 25%, and 2%, respectively.

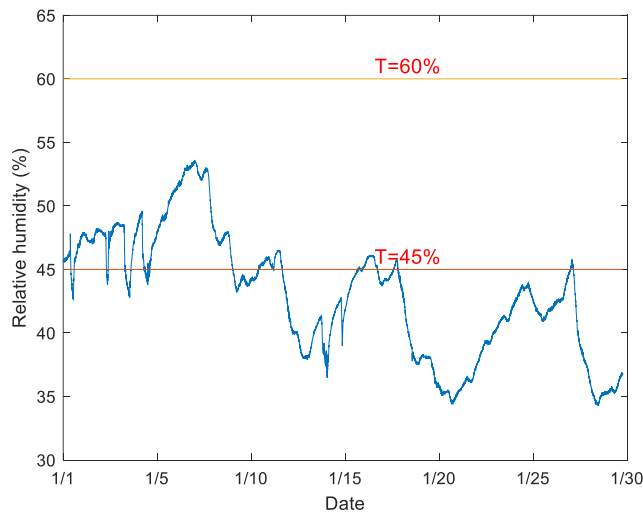


Figure 1: Variation of relative humidity over Time

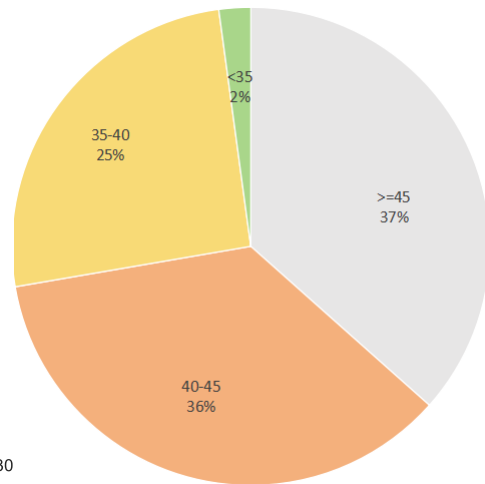


Figure 2: Schematic diagram of relative humidity distribution

A joint analysis was conducted on temperature and humidity, and 28 measurement time points were found to be within the range of temperature greater than 14 degrees and relative humidity between 45% and 60%, accounting for only 0.3%. That is to say, approximately 99.7% of the measurement time period did not meet industry standards throughout the entire measurement period.

3. PMV

From the temperature and humidity measurements above, it is evident that the archive room being measured has a significantly low temperature, which is not friendly to personnel in between. Therefore, according to ISO 7730-2025 [2], the PMV of the measurement point is calculated as follows. Assuming that the clothes worn by the archive personnel are typical winter clothing for students in this school, including long sleeved and long leg underwear, warm jackets and pants, shoes, and socks, with a thermal resistance of 1.2 clo. When checking the file, it was in a standing position, with mild activity and a metabolic rate of 1.6 met. Therefore, the calculation results are shown in Figure 5. Among them, there are 281 PMVs greater than or equal to -0.5, accounting for 3%. The maximum and minimum PMV values are -1.65 and 0.003, respectively, with an average of -1.14 ± 0.32 , indicating that the environment is significantly colder.

Figure 6 shows the distribution of PMV, from which it can be seen that, except for 3% of the time being greater than -0.5, the proportion of measurement points at -0.5-1, -1~-1.5, and <-1.5 are 35%, 46%, and 16%, respectively. Most of the time, PMV is in a "slightly cold" phase.

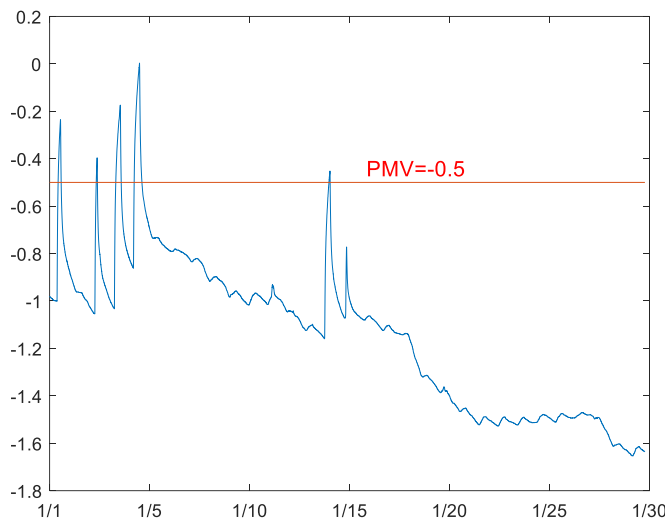


Figure 5: Variation of PMV over Time

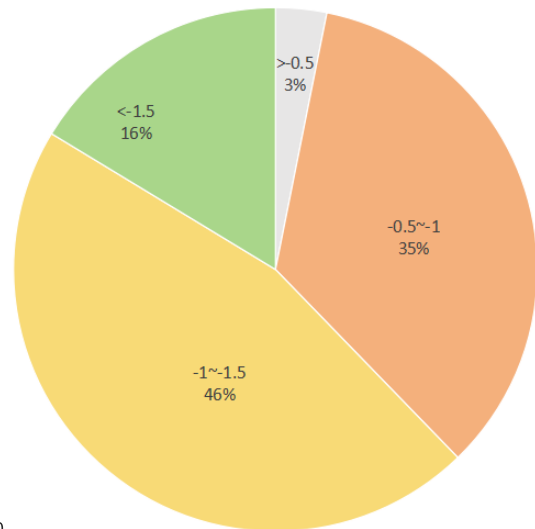


Figure 6: Schematic diagram of PMV distribution

4. PPD

The maximum and minimum PPD values were 59.23% and 0, respectively, with an average of 33.96 ± 14.28 , indicating a significantly higher proportion of dissatisfaction with the environment.

Figure 8 shows the PPD distribution map, from which it can be seen that the proportion of measurement points with <10, 10-20, 20-30, and >30 is 3%, 15%, 33%, and 49%, respectively. More than 30% of people are dissatisfied with the environment in nearly half of the time.

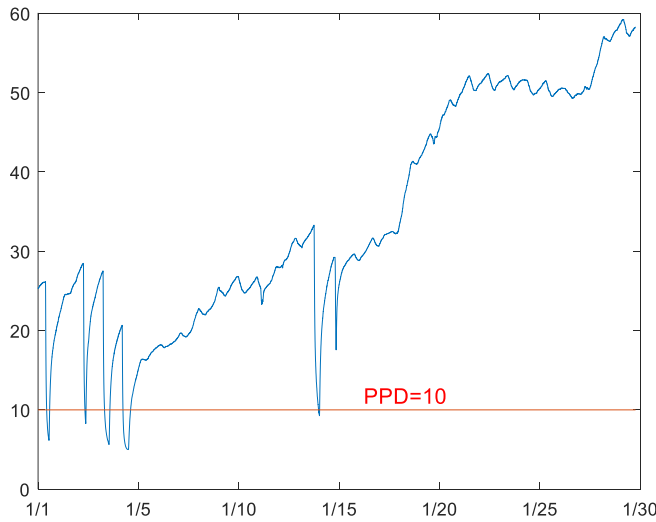


Figure 7: Variation of PPD over Time

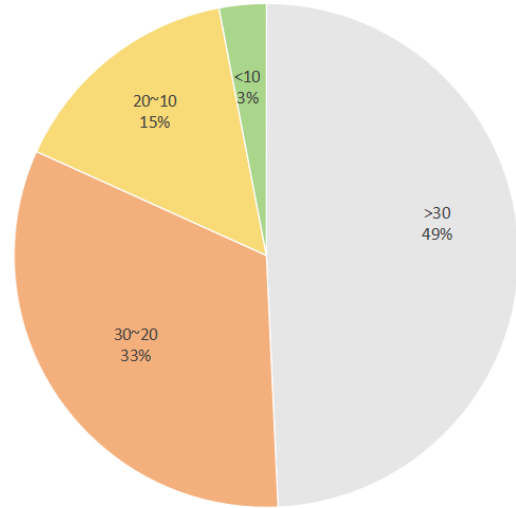


Figure 8: Schematic diagram of PPD distribution

III. CONCLUSIONS

A continuous month long inspection of the archive room yielded 8933 data points. The following conclusion can be drawn:

(1) During 98% of the measurement period, the temperature is not within the range specified in the industry standard JGJ25-2000. During 37% of the measurement period, the relative humidity remained within the range specified in the industry standard JGJ25-2000. And the rest of the time does not meet the industry standards. Taking into account both temperature and relative humidity, approximately 99.7% of the measurement time period does not meet industry standards.

(2) The average PMV is -1.14 ± 0.32 , indicating that the environment is significantly colder. The average PPD value is 33.96 ± 14.28 , indicating a significantly higher proportion of dissatisfaction with the environment.

(3) The temperature inside the archive room is significantly low, and consideration should be given to adding heating and other equipment to ensure the physical health of the personnel in the archive room and make the archive more friendly to the archives and indoor personnel.

REFERENCES

- [1]. Juan Li. Temperature and Humidity Testing and Thermal Comfort Analysis of University Archives Warehouse. International Journal of Computational Engineering Research, 2024, 4: 146-151.
- [2]. ISO 7730-2025, Ergonomics of the thermal environment — Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria, Edition 4, Technical Committee: ISO/TC 159/SC 5, 2025.