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# SOLUTION STADY FOR AN INSTALLATION OF MEASURING AND CONTROL OF DOOR PANELS AT TEMPERATURE AND HUMIDITY VARIATIONS

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**ABSTRACT**
*The work presents the main aspects that underlie the elaboration of the technical documentation for an installation of measurement and control of door sheets at temperature and humidity variations. The main systems composing such an installation are being analyzed: the heating system, the cooling system, the humidity producing system, the parameter control system, the metallic construction. For a more detailed presentation, calculus elements are presented for the components.*
*The studies and research were performed at the National Institute of Wood in Bucharest during a period in which the author of the present work was leading the laboratory activity for the door and window testing. The installation making the object of this study is part of the lab infrastructure and contributes in the establishing of the quality of wooden products.*

## 1. GENERAL CONSIDERATIONS

In order to perform the solution studies, much internal and international technical documentation was analyzed. The elaborated materials and the conclusions were structured into two chapters, as follows:

- the defining of the technical parameters
- the elaboration of the principle profiles

## 2. DEFINING OF THE TECHNICAL PARAMETERS

In order to define the technical parameters for the installation, the methodologies and the procedures used in the testing process of the door sheets at humidity and temperature variations were analyzed and studied.
These testing procedures and methods make the object of the following internal and international normative documents:

- SR EN 43:1985 Methods of door testing. The behaviour of door sheets placed in uniform successive climatic conditions at humidity variations
- SR EN 79: 1985 Methods of door testing. The behaviour of door sheets placed between two rooms of different climatic conditions
- STAS 9317/2-87 Joinery for civil and industrial constructions. Wooden doors. Methods for the verification of quality

It is considered that the installation that is to be constructed should produce a variation of the door sheets testing temperature between (3-50)°C. As compared to the values given in the internal and international testing methodologies , EN,(3-23)°C, it can be noticed that the values that are to be reached meet the intern and international requirements.
In terms of humidity variations, these are situated between (10-90)%. As compared to the values required on an intern and international plane (30-85)%, it can be noticed that the proposed values offer a larger variation possibility; adopted in order to meet a larger field of requirements in the concrete exploitation climatic conditions.
The laboratory testing will be performed as 7 day long testing cycles for the unfinished door sheets and as 23 day cycles for the finished ones.

## 3. PRINCIPLE SOLUTIONS (PROFILES) FOR THE ELABORATION OF THE INSTALLATION CONSTRUCTIVE MODEL

### 3.1. Principle profile of the climatic room (of the metallic construction)

For the elaboration of the constructive model, the functioning principle of the installation was taken into consideration - the realization of a uniform climatic medium on both sides of the door sheet for one testing cycle, or different climatic conditions on the sides of the door sheet during one testing cycle. In the first case a single testing room can be used, but for the second (with different humidities on the two sides of the door sheet), the mounting of the door sheet on the separation surface between two rooms is necessary.
Therefore, (fig. 1) presents the constructive model of the installation that can realize testing conditions for both situations.

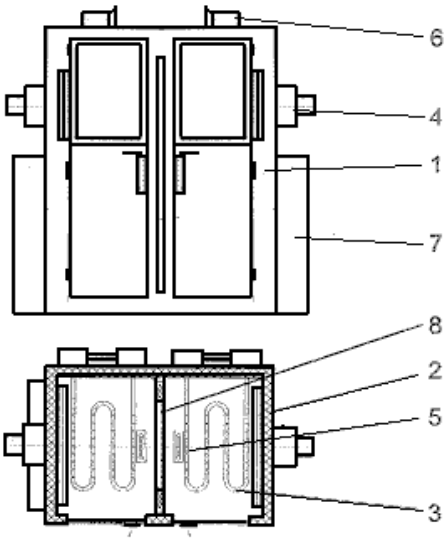


*Figure 1. Principle of the mettalic construction*
1 – enclosure, 2 – heating installation, 3 –cooling installation, 4 - humidity producing installation, 5 – ventilator, 6 – board with measurement and control devices, 7 - control board, 8 – testing product-door sheet.

The installation is composed of one climatic room (closed enclosure-construction) made of humidity-proof materials: aluminium, glass, etc. The enclosure is separated in the middle by a diaphragm made of aluminium structures (metallic profile) on which the tested door sheet is mounted, stiffened and tightened.
Thus, the climatic room is separated into two independent compartments in which different temperature and humidity conditions can be created. For the access to the door sheet assemblage and to verifications during the testing, each compartment is equipped with a separate door. The access doors of the climatic room and its walls are made of resistance

metallic structures of aluminum and of tightening structures made of layered glass or layered aluminium boards separated by insulating elements.
The installation is also composed of the humidity producing system, the temperature system and the system of measurement and control of the functional parameters. As part of the studies performed for the realization of the climatic conditions, many possibilities of producing temperature and humidity variations were analyzed:

- aerothermal and refrigerator conditioning
- Bisplit system conditioning
- ventilo - convector conditioning

### 3.2. Principle profile for aerothermal and refrigerator conditioning

This conditioning variant studied and presented in (fig.2) is the most simple in terms of functioning process.

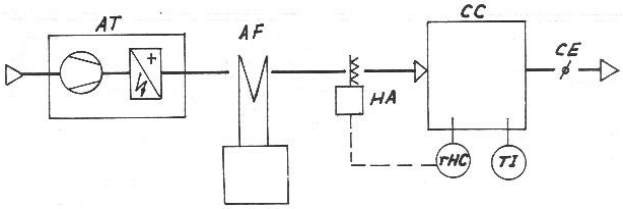


*Figure 2. Principle profile for aerothermal and refrigerator conditioning*

AT - aerothermal system, AF - refrigerator assembly, HA – humidifier, HC – humidistat, TI - thermometer indicator, CC – climatic room , CE – evacuation valve

The system is composed of an aerothermal system that realizes the heating of the air, a refrigerator assembly that can cool the air depending on the testing conditions, an air humidifier that produces humidity variations of the air, and instruments for the measurement and control of the parameters (humidistat and thermometer).
In this case the driving and the adjustments are mainly manual, therefore needing a more careful surveillance of the installation and of the testing cycle. This system also offers another advantage – the lower price of the equipment composing the installation.

### 3.3 Principle profile for the Bisplit system conditioning

This conditioning system is mainly automatic (fig.3). The temperature variation is produced by heating the air of the enclosure by means of an electric battery. The cooling is realized by using cooling fluid R22. The heating-cooling systems are interconnected and they function in an automatic cycle subordinated to the testing cycle.
The high degree of automatization of this system leads to a higher price of the necessary equipment.

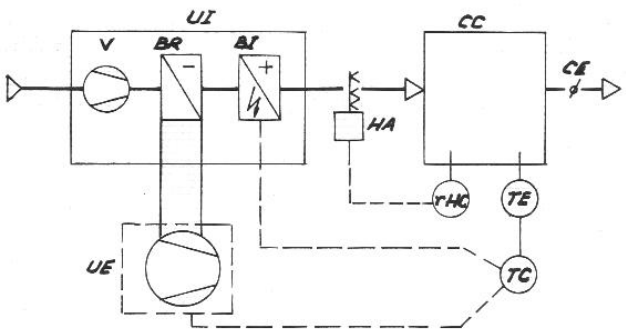


*Figure 3. Principle for bisplit system*

UI – interior humidity, V – ventilator, BR – cooling battery, BI – heating battery, UE – exterior humidity (cooling fluid R22), HA – humidifier, rHC – humidistat, TE – temperature sond[, TC – conditioning adjuster, CC – climatic room , CE – evacuation valve.

### 3.4. Principle profile for ventilo-convector conditioning

This conditioning variant in (fig.4) uses a water battery for air heating–cooling in the temperature variation process.

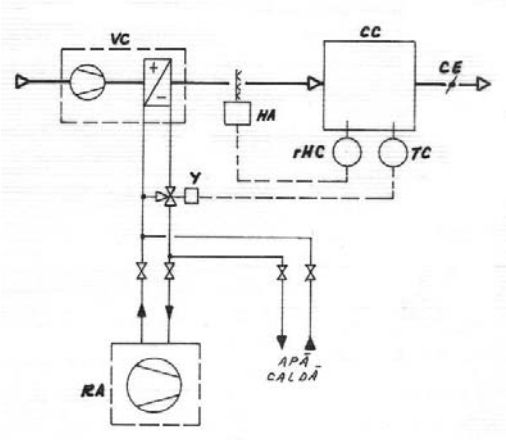


*Figure 4. Principle for ventilo-convector conditioning*

VC – ventilo-convector, HA – air humidifier,CC – climatic room, CE – evacuation valve, rHC – humidistat, TCTY – temperature adjustment loop, RA – refrigerator.

This procedure includes the connection of the whole system to an agent source (warm water) which reduces the functioning independency (this being conditioned by the actual existence of the above-mentioned source). In this case the conditioning is performed automatically, but the utilization of water as heating-cooling agent leads to a higher inertia of the process and to the utilization of the most expensive equipment.

## 4. CONCLUSIONS

By analyzing the variants of the conditioning systems, it can be concluded that the simplest variant is also the cheapest. From a technical point of view, an installation that is to function in a research laboratory needs to be of a high technical level, in our case a high automatization degree, this leading to the achievement of superior performances, in terms of testing cycle and of measuring precision, by the replacement of the human factor to a great extent.

In this sense variant 2, (Bisplit system conditioning) was proposed for detailed study and for the elaboration of execution documentation. This system is cheaper than variant 3 and presents a higher degree of independency in terms of heating–cooling agent.

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