# Some aspects of historical monument buildings central heating

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**Abstract.** The monument buildings are special buildings which were not originally designed to be heated to the required parameters nowadays. Old solutions for central heating of such buildings were based on the use of low pressure steam as a heat, with natural return of condensate and use of cast iron heating radiators, or natural running hot air. In the performance halls, the warm air was introduced at the base of the seats and was discharged at the top thereof, or was introduced through the channels stipulated in masonry. Churches, most of the time, they were not equipped with heating systems. This work intends to analyze the main modern solutions for heating historic monument buildings, that does not affect their character, examples applied to some buildings in Romania, the Transilvania County, to which the authors have had important contributions .

## 1 Introduction

Most of the historic monument buildings were either unheated (eg churches), or equipped with local or central heating systems without meeting the comfort requirements we are accustomed to today.
When it is desired to rehabilitate historical monument buildings, attempts are made to obtain indoor thermal comfort parameters as close as possible to current requirements, taking into account the existing constraints on such buildings.
The present paper aims to analyze the solutions adopted for the heating of 4 historical monument buildings built in the 19th century, related to the rehabilitation projects, to which the author contributed.


Banffy Castle in Sancrai, Alba County

## 2. Technical solutions

The technical solutions for the heating of the four buildings will be presented..

### 2.1 Banffy Castle in Sancrai, Alba County

The construction of Sancrai Castle began in the early 19th century, in the Renaissance style, but the subsequent expansions brought baroque and neoclassical elements. The historical documents indicate the completion of the works in 1805. It was successively owned by the noble families Kemeny and Banffy in Transylvania.
The building has been undergoing changes over time, and in the period 1947-2005, it has been designated as a center for social assistance for children with disabilities.

From 1997 until 2011, when the restoration work began, the building was abandoned. The construction has a built area of 781 square meters.
The basement of the building is made of natural brick, dating from the first stage of the castle's construction.
The space has a kitchen, hallways, bathrooms, exhibition spaces, warehouses.
Ground floor includes conference rooms, halls, warehouses, sanitary groups.
The attic, which was newly created, in the attic space, with the rehabilitation, includes a generous conference room, office, sanitary groups.
The existing heating system before rehabilitation was physically degraded, with a long life span, not working.
A new heating system was constructed, with cross-linked polyethylene pipes, buried, in a basement protection tube

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and for aesthetic reasons, from copper to the rest of the rooms.
The boiler house includes 2 gas-fired condensing boilers
In the rooms, the heating is done in the following way: on the ground floor, static, cast iron-like buildings, suitable for this building, which meet the aesthetic requirements of the building, on the underfloor are trench heating, and in the attic and in less aesthetically demanding areas are steel radiators.

### 2.2 George Cosbuc Municipal Cultural Center Bistrita

The building is located in the city of Bistrita, Albert Berger street, no. 10.

The building was built in 1893, following a project by Viennese architect Peter Paul Brang. It includes a large showroom, and 3 smaller halls, offices and spaces for various group activities. It is built on 3 levels


George Cosbuc Municipal Cultural Center Bistrita

The building is on the Historic Monuments List and is part of the protected city complex. Exact dates from the beginning of the construction of this cultural institution can not be specifically stated, because documents that would prove this are hardly to find.
The building spans three levels (S + P + 1) on a compact rectangular plane
The initial ventilation and heating solution provided a system through which the air was captured through the tunnels located under the basement of the building, through the rooms where it was heated by means of some heat registers of the pipes. By heating the air, the difference in pressure required by the thermosiphon effect is achieved. For the handling of treated air and recirculated air, masonry tubes were used.
Following the subsequent work on the building, this facility was demolished, the air treatment rooms were demolished, and the wall ducts and fresh air capture tunnels were dismantled.
Due to the specific problems imposed on this building with the last rehabilitation, the existing ventilation system used the existing ductwork and, where these are not sufficient, or by the initial modifications to the objective, the tubes disappeared to fit the additional ductwork and were used masking panels.
Existing ventilation ducts and tunnels were released from debris, the formed structures that obstructed their section were refurbished by cleaning, disinfection and protection works.
With the new technical solution, in the showroom, the air that passes through a treatment plant is filled with existing rooms under the stage and gradings, rooms that function as overpressure chambers.
The air preparation is provided by the air-handling units that have been installed in their spaces and the circulation of the fresh air from the outside, the recirculated air and the treated air is done through the rectangular-shaped tubing of the same size as the connections to the objects existing fan coils or tubes).
The calculations resulted in a fresh air volume of 11000 mc / h, and for cooling a thermal output of 137.5 kW.
For air conditioning, the heating medium is warm water, and the cooling medium is cooled water prepared in the cooling unit.

### 2.3 Lucian Blaga National Theater Cluj-Napoca

The project deals with the works for the heating installations at the "Construction and installation capital repair at the Lucian Blaga National Theater in Cluj-Napoca". The technical documentation was drafted in 2002 and was revised in 2007. Unfortunately, the execution of the works has not been done until today.
The building has a height regime of S + P + 2E. Rehabilitation of indoor installations is necessary because the construction is old and they are physically and morally wasteful.
At the moment, ventilation and thermal comfort are provided in the showroom with hot air distributed through a pressure chamber located below the showroom, with the discharge holes located under the seats in the hall. The extract air is discharged through a discharge hole located in the ceiling of the showroom, which is provided with a butterfly-type circular valve, with a mechanical manipulator.
The internal heating system with cast iron radiators used low-pressure steam produced in boilers. Entrance halls and adjoining showrooms, as well as other spaces where spectators have access, are fitted with cast iron radiators. They are under-dimensioned in relation to the heat losses of the respective spaces, as a result of which there is a feeling of cold in the cold season. The heating of

actors, rehearsal rooms, offices and administrative rooms is also done with cast iron heaters. Many of these heaters have an advanced degree of wear, some of which are even out of use, and various improvisations have been made instead. Under these conditions, the distribution system is unbalanced and can no longer operate at full capacity. Warming up of warehouses is currently taking place in heating registers, physically and morally outdated.
The Euphorion Hall, located at the basement of the building and arranged as a showroom, is heated by two Split Air Conditioners, which, because of their empirical choice, can not cover the room's heat demand and due to overloading they lead to high electric energy consumption.
The existing boilers produced low-pressure steam for both heating and hot water preparation. Steam for heating was produced in the two existing boilers running on gas, with a capacity of 460 kW each, which were in good condition. Steam for the preparation of hot water was produced in a boiler with an advanced degree of physical and moral wear. The hot water supply was made in a horizontal coil with a coil which no longer provided safety due to the high degree of wear.
Meanwhile, the thermal plant has been rehabilitated and moved to another place, so as not to be located under crowded spaces. Steam was quenched as heat, at this time hot water is used.
Although the building rehabilitation project was completed in 2007, the execution of the works has stalled, rehabilitating only the exterior of the building.

### 2.4 Union Hall Alba Iulia

The Union Hall building has the height regime S + P + E and it is situated in the locality Alba-Iulia str. Mihai Viteazu nr. 12, Alba County. The construction was originally built between 1898 and 1900 as a military casino (Casino) for the local military garrison ceremonies. It had from the beginning a monumental character marked by the romantic style of the end of the century and the Western-European influences. Between 1919 and 1922, after the Great Union of 1918, the building received modifications that amplify the building's sparkling character by increasing its size, attaching a huge portal to the entrance, interior decoration with gold leaf and monumental frescoes (portrait of King Ferdinand and Queen Mary ), oak leaves, etc., reasons to remember the great event of the National Union. Between 1967 and 1968, the building is redecorated and refunctionalized, being part of the exhibition circuit for the 50th anniversary of the Great Union, inaugurated on November 28, 1968. Redevelopment has destroyed the original frescoes, replacing them with others that had to glorify the existing regime at that time. Still structural modifications were made in concrete to body A. Currently, the building is intended for the museum circuit that is unfolding on the ground floor, and partially on the basement basement. The latter also owns the majority of museum stores.

The side wings are intended for the southern conservation, restoration of museum objects, books, offices, archives and archaeological sites, and the northern side to the educational spaces, but also to the archaeological institute.

The heating of the studied building was ensured by the existing boilers in the "thermal power plant" destination of the National Union Museum, a building separate from the studied building. The boiler was equipped with 3 boilers, each with a thermal output of 270 kW using gas. From there through the pipes installed in the ground, the heating of the Unirii Hall and of the other rooms was ensured, the Unirii Hall Building not having its own boilers. Also, the capacity of the thermal power plant is under-dimensioned, not insuring the thermal agent demand. the 2 buildings, the Union Museum and the Union Hall. The existing heating system before rehabilitation shows a high degree of wear and tear, the operation was faulty, therefore the required thermal comfort parameters were not guaranteed, and from aesthetic point of view it was totally inadequate. The heating system was totally redeveloped.

The thermal plant in the National Museum of the Union was equipped with a boiler to serve only the building of the Union Hall.

The heating pipes between the central heating system of the Union National Museum and the Union Hall building have been replaced with new preinsulated pipelines, mounted directly into the ground. At the entrance to the studied building was installed a fully equipped distributor with collectors. In order to ensure a better circulation of the heating medium and necessary comfort conditions, pumps have been installed on the newly designed heating circuits.
All heating radiators have been replaced with new steel and cast iron radiators. In the Unirii Hall were fitted skirting heating, covered with grills and adjacent to the cast-iron radiator windows. In the rooms with the destination "exhibition" were placed cast iron heating radiators. Inside the hall there were also retro-cast iron radiators in order to be in tune with the building's destination and for a pleasant visual impact.
The heating system was made of copper pipes.
Static radiators have hot water as heating medium.

## 3. Conclusions

The heating of monument buildings can not always provide thermal parameters similar to a typical building, due to the limitations of their specificity. Most of the time, the tire of these buildings can not be provided with thermal insulation, so heat loss can not be greatly reduced. Also, the aesthetics of these buildings can not be changed by inappropriate technical solutions. Therefore, when choosing heating solutions, the existing constraints must be taken into account.

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