



June 9th, 2020

TECHNICAL REPORT

Determination and Comparison of Heating Capacity and Savings of Towel Radiators

This report was prepared based on the request of the firm, ENOVER Energy and Thermal Systems, Co. and covers determination of heating capacity of towel radiator developed and constructed by ENOVER and comparison with the one existing in the market. There are two towel radiators to be tested; one of them is “Enover Towel EHP Radiator” and the other is Market Towel Radiator.

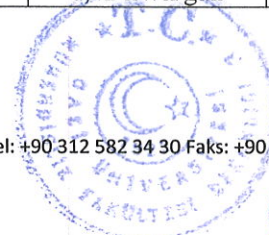
The report consists of six chapters (A-F). Part A covers the introduction of test room where the experiments are carried out and test samples, Part B test procedure and measurement methods, Part C heating capacity, total heat transfer coefficient, total thermal resistance, carbon dioxide emission caused by radiator production, energy consumption due to operation of the pump used in the circulation of water passing through the radiator, the amount of fuel spent for indoor air heating, and the calculation of energy use due to fuel consumption, Part D data obtained from test measurements and parameters calculated using this data, active working times of radiators, embedded energy, exergy and CO₂ values of radiators, Part E the embedded and operational fuel, energy and CO₂ emission savings to be achieved when using a ENOVER Towel EHP radiator in a house with seven radiators, Part F evaluation of test results. The advantages of using the ENOVER Towel EHP radiator over existing radiators and the savings achieved are summarized in Table-A.

Table A-1. The superiorities of ENOVER Towel EHP radiator over existing radiators

| | Radiator Weight | Heating Capacity | Heat dissipated per unit weight | Heat dissipated per unit weight per unit heat transfer area | Heat Transfer Coefficient |
|-------------|-----------------|------------------|---------------------------------|---|----------------------------|
| Superiority | -72 % | 0 % | +3,6 kat | +3,6 kat | +36 % |
| Value | 1,5 kg | 390 W | 260 W/kg | 440 W/m ² kg | 20,11 W/m ² .°C |

Table A-2. The savings of ENOVER Towel EHP radiator over existing radiators

| | Embodied Savings | | Operational Savings | | |
|--------|------------------|-----------------|---------------------|--------------|----------------------------|
| | Energy | CO ₂ | Fuel Consumption | Energy Usage | CO ₂ emission |
| Saving | 72 % | 72 % | 16 % | 16 % | 16 % |
| Value | 43 kWh | 68 kg | 40 L/gün | 0,42 kWh/gün | 121 g-CO ₂ /gün |



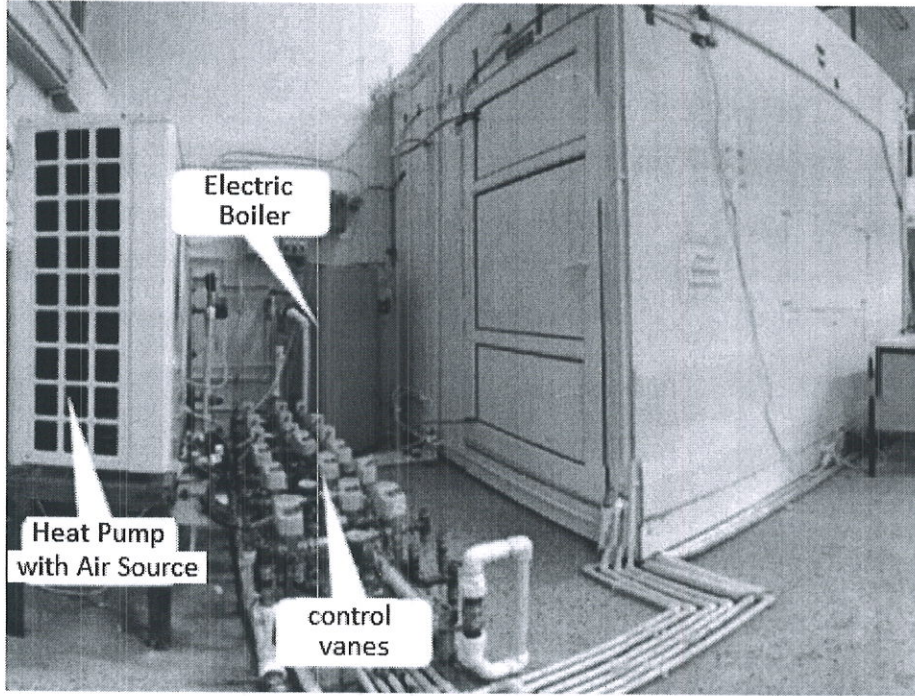
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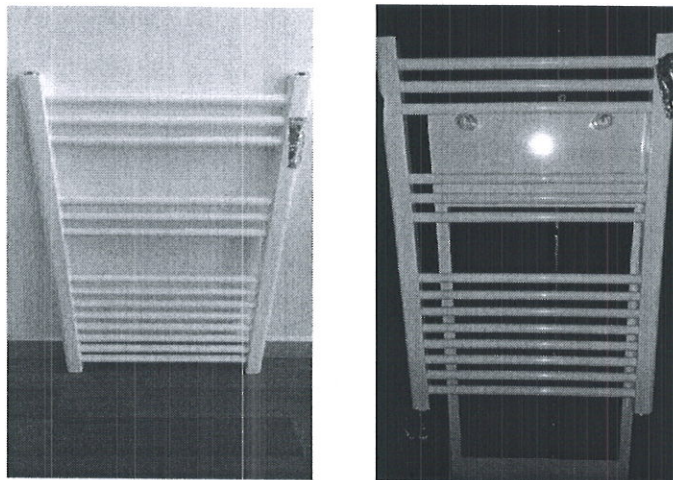
A. Introduction to Test Chamber and Test Specimens

Capacity determination tests were performed based on TS EN 442-2 Standard in the test chamber set up at the Thermal Science Laboratory of Mechanical Engineering Department of Gazi University in Ankara, Turkey. Test chamber was constructed according to ANSI/ASHRAE 138 Standard and was able to control the temperatures of air and its wall surfaces as shown in Picture 1.



Picture 1. View of Test chamber and its mechanical equipment

Test specimen: “Enover Towel EHP Radiator” and “Market Towel Radiator”.



Picture 2. Market Towel Radiator (a) general view (b) location of thermocouples

