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Additional Loads: Thermal Stores

Introduction

Changes introduced to The Building Regulations, Approved Document L1 (2002) 'Conservation of fuel and power in dwellings' have increased the requirements for the energy efficiency of buildings, including the performance of hot water and central heating systems. Requirement L1 highlights the need to limit the heat loss from hot water vessels, to provide hot water systems which are energy-efficient, and to provide information and services which enable the building occupier to maintain the system in such a manner as to use no more energy than is reasonable in the circumstances. These changes place a greater emphasis on the overall system control and performance, thus giving rise to the development of products that are able to meet the required levels of efficiency.

The fully integrated Thermal Store as shown in Figure 1, presents a method of providing a more centralized and integrated hot water and central heating system. The industry claim numerous benefits over the conventional hot water cylinder and cold water storage tank arrangement, however it is the energy efficiency of the product which has given rise to the increased use of thermal stores in new build house construction. Thermal stores combine the hot water cylinder and cold-water tanks into one convenient and efficient water store. This arrangement places increased load on the supporting floor. Thermal stores are produced in various capacities with full weights ranging from about 170kg to 280kg, by comparison, a typical conventional hot water cylinder weighs only 110kg (this latter load is accounted within the 1.5kN/m^2 imposed load normally allowed for in the domestic dwellings). So it is important that the increased load from thermal stores is recognized and accounted for by the Floor Designer.

Figure 1. Thermal Store

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The aims of this Technical Bulletin are firstly to illustrate how to calculate the applied load from thermal stores and how to apply this additional load to the floor scheme, and secondly to show a method of detailing the floor directly below the thermal store so as to distribute the load uniformly.

It is important that the developer provides to the floor designer all information about the thermal store at the time of quotation. If no specific manufactures model number is available, then the full capacity and the actual base footprint area of the store are required by the floor designer. It is suggested that the load allowed for the thermal store is shown on the quotation drawings.

Thermal Store Load Calculation and Application

The following example is based on the applied load from a *Gledhil BoilerMate 2000 BM 185* thermal store which has a weight when full of 215kg, and a base footprint of 595mm x 595mm. The BCI-Joist floor has been designed with a load of 0.75kN/m^2 *(dead load, long term)* + 1.5kN/m^2 *(imposed load, long term).*

- Firstly, calculate the total load of the thermal store.

  (Weight) (Gravity) (Load)
  215kg x 9.81/1000 = 2.1kN …Ans (A)

- Next, calculate the total imposed load which has been allowed on the floor.

  (Area) (UDL)
  0.595m x 0.595m = 0.35m^2 x 1.5kN/m^2 = 0.525kN …Ans (B)
  (If the thermal store has a cylindrical footprint, assume that it is a square with each side equal to the diameter)

- Next, calculate the additional load to be applied to the floor

  Additional Load = Eqn (A) - Eqn (B)
  = 2.1kN - 0.525kN = 1.575kN …Ans (C)

So, the additional load that needs to be applied to the floor in the area of the thermal store is 1.575kN. It is unlikely that the floor decking will adequately support the total 2.1kN load of the thermal store, so it is necessary to consider either adding trimming member within the floor, or specifying adequate spreaders on top of the floor deck to distribute the load evenly into the floor joists. The number of trimming members to include within the floor scheme is based on the size of the footprint of the thermal store as shown in Figure 2. The extra load to be added to the floor joist design is shown in Figure 2 as four red dots, each red dot represents a point load of 1.575/4kN = 0.394kN. The individual point loads of 0.394kN should be apportioned into the adjacent joists relative to the distance between the location of the point load and the joist. Apply the additional loads to the BCI Joist floor design, and indicate the magnitude of the loads allowed on the quotation drawings.

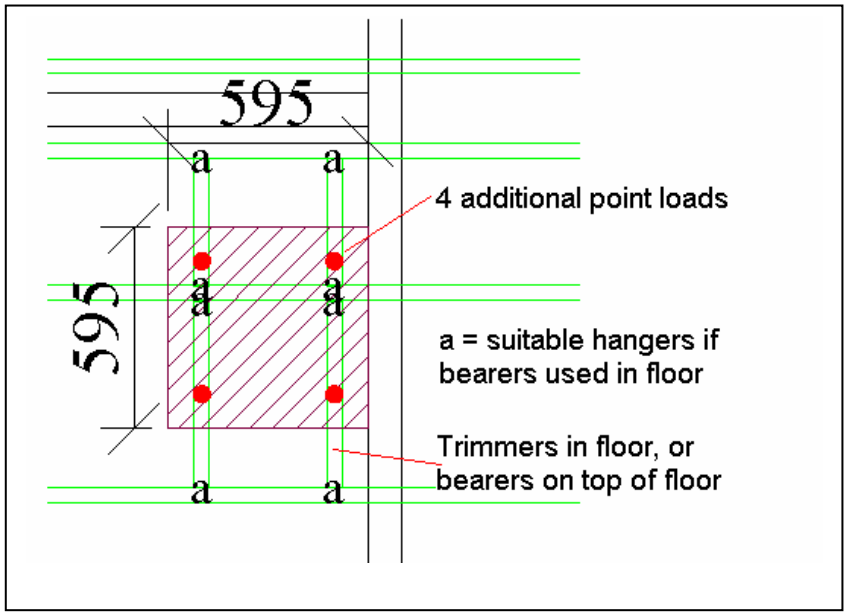

Figure 2. The position & number of additional loads dependant on the size of the thermal store footprint. Position loads 100mm from the extent of the footprint.

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