EVALUATION OF COOLING LOAD BY TETD/TA METHOD

Amit Raj Sharma*

Kapil Chopra**

ABSTRACT

The primary function of an air conditioning system is to maintain the conditioned space at required temperature, moisture content with due attention towards the air motion, air quality and noise. The required conditions are decided by the end use of the conditioned space, e.g. for providing thermal comfort to the occupants as in comfort air conditioning applications, for providing suitable conditions for a process or for manufacturing a product as in industrial air conditioning applications etc. The reason behind carrying out cooling and heating load calculations is to ensure that the cooling and heating equipment designed or selected serves the intended purpose of maintaining the required conditions in the conditioned space. Design and/or selection of cooling and heating systems involve decisions regarding the required capacity of the equipment selected, type of the equipment etc. By carrying out cooling and heating load calculations one can estimate the capacity that will be required for various air conditioning equipment. For carrying out load calculations it is essential to have knowledge of various energy transfers that take place across the conditioned space, which will influence the required capacity of the air conditioning equipment. Cooling and heating load calculations involve a systematic step-wise procedure by following which one can estimate the various individual energy flows and finally the total energy flow across an air conditioned building. In this research cooling load is estimated by TETD method of seminar hall of N.C College of Engg, Israna (Panipat).

*Lecturer, Department of Mechanical Engineering N.C.C.E. Israna, Panipat.

**Lecturer, Department of Mechanical Engineering S.G.I. Samalkha, Panipat.

INTRODUCTION

Cooling load calculations may be used to accomplish one or more of the following objectives:

a) Provide information for equipment selection, system sizing and system design.

b) Provide data for evaluating the optimum possibilities for load reduction.

c) Permit analysis of partial loads as required for system design, operation and control.

This course provides a procedure for preparing a manual calculation for cooling load. A number of published methods, tables and charts from industry handbooks, manufacturer's engineering data and manufacturer's catalog data usually provide a good source of design information and criteria in the preparation of the HVAC load calculation. It is not the intent of this course to duplicate this information but rather to extract appropriate data from these documents as well as provide a direction regarding the proper use or application of such data so that engineers and designers involved in preparing the calculations can make the appropriate decision and/or apply proper engineering judgment.

COMPONENTS OF COOLING LOAD

The total building cooling load consists of heat transferred through the building envelope (walls, roof, floor, windows, doors etc.) and heat generated by occupants, equipment, and lights. The load due to heat transfer through the envelope is called as external load, while all other loads are called as internal loads. The percentage of external versus internal load varies with building type, site climate, and building design. The total cooling load on any building consists of both sensible as well as latent load components. The sensible load affects the dry bulb temperature, while the latent load affects the moisture content of the conditioned space.Buildings may be classified as externally loaded and internally loaded. In externally loaded buildings the cooling load on the building is mainly due to heat transfer between the surroundings and the internal conditioned space. Since the surrounding conditions are highly variable in any given day, the cooling load of an externally loaded building varies widely. In internally loaded buildings the cooling load is mainly due to internal heat generating sources such as occupants, lights or appliances. In general the heat generation due to internal heat sources may remain fairly constant, and since the heat transfer from the variable surroundings is much less compared to the internal heat sources, the cooling load of an internally loaded building remains fairly constant. Obviously from energy efficiency and economics points of view, the system design strategy for an externally loaded building should be different from an internally loaded

building. Hence, prior knowledge of whether the building is externally loaded or internally loaded is essential for effective system design.

MATHEMATICAL FORMULATION AND ANALYSIS

In the present work TETD/TA method has been used. Through this method hourly cooling load have been determine for different material of roof and walls. All these parameters have been determined for different building materials, different convective heat transfer coefficients on inside and outside surface, different surface conditions and with varying outside climate conditions

DESCRIPTION OF THE MODEL

Our model is a seminar hall in N.C.College of Engg,Israna (Panipat) having longitude 76^{o}E,latitude 30^{o}N of size 12.65m length,12.29m breadth and 3.66m height having walls made of bricks with plaster on inner and outer side of north,south,east and west wall and roof is of concrete,mud puska.plaster and tiles.24% area of the north wall is of glass.There are two wooden door in the south wall.There are three window opening in the glass area.Walls are facing to north,south,east and west. Corridor is provided on south side and on east and west side there are adjoining rooms which are condioned.So direct radiations reach from only north and south side.

Time(Hour)	Sensible Cooling Load (W)	Latent Cooling Load(W)	Total Cooling Load(W)
1	13215.47	12600	25815.47
2	11948.42	12600	24548.42
3	11032.59	12600	23632.59
4	10298.84	12600	22898.84
5	9897.37	12600	22497.37
6	10573.48	12600	23173.48
7	11228.10	12600	23828.10
8	12183.74	12600	24783.74
9	28072.92	27866	55938.92
10	32039.74	27866	59905.74
11	36747.04	27866	64613.04
12	40256.86	27866	68122.86
13	43786.15	27866	71652.15
14	46812.61	27866	74678.61
15	48908.07	27866	76774.07
16	47340.02	27866	75206.02
17	33314.23	12600	45914.23
18	30864.95	12600	43464.95
19	27020.73	12600	39620.73
20	24782.42	12600	37382.42
21	22197.24	12600	34797.24
22	19436.45	12600	32036.45
23	16700.61	12600	29300.61
24	14670.55	12600	27270.55

REFERENCES

1. ASHRAE, 1997. ASHRAE Handbook of Fundamentals, New York. American Society of Heating, Refrigerating, and Air-Conditioning Engineers.
2. M.S. Hatamipour a, H. Mahiyar b, M. Taheri,Evaluation of existing cooling systems for reducing cooling power consumption.
3. Jorge L. Alvarado, Wilson Terrell, Jr., Michael D. Johnson , Passive cooling systems for cement-based roofs.
4. Refrigeration and Air-conditioning by C.P.Arora.
5. SP 41, Handbook on functional requirements of building (Other than industrial buildings), Part 1-4, Bureau of Indian Standard (1988)
6. A Thesis on Study and Evaluation of Passive Measures to create comfort conditions in buildings by Vijay Kumar Bajpai.