Heat Load Calculation for Corporate Offices [Internship]

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Abstract - This paper is based on the practical knowledge and hands-on experience gained during industrial training at SARA HVAC in the field of HVAC system installation, operation, and maintenance. The study mainly focuses on common problems such as improper installation, poor maintenance practices, and failure to follow safety and energy standards, which can reduce system efficiency and increase operating costs. Proper installation methods, testing procedures, refrigerant piping, and electrical connections were carried out to improve the overall performance and reliability of HVAC systems.

During the training period, practical exposure was gained through work on residential and commercial HVAC projects. The activities included installation of split and central air conditioning systems, piping work, electrical wiring, testing, and system commissioning. Importance was also given to safety precautions, proper use of tools, teamwork, and coordination during project execution. This project helped in improving practical understanding and technical knowledge of HVAC systems. It also increased confidence in handling real-world engineering tasks and highlighted the importance of energy-efficient systems and proper installation practices in the HVAC industry.

Keywords - HVAC systems, Air conditioning systems, HVAC installation work, Refrigerant pipe installation, Energy saving in HVAC, System testing and commissioning

I. INTRODUCTION

1]About -The company focuses on providing quality HVAC services with strong attention to customer satisfaction and long-term client relationships. It specializes in air conditioning design, installation, and maintenance solutions for residential and commercial projects while ensuring both performance and aesthetic appeal.

The organization has trained technical staff and uses modern software tools for load calculations, equipment selection, duct design, and project scheduling. With experienced project teams and proper management systems, the company aims to deliver reliable HVAC solutions within required quality standards and project timelines.

2] Objectives of the Internship-

- To gain practical knowledge and hands-on experience in HVAC system installation, operation, and maintenance. - To understand the working of air conditioning, ventilation, and refrigeration systems used in residential and commercial projects.
- To improve technical skills related to ducting, piping, wiring, system testing, and commissioning.
- To assist engineers and technicians during project execution and troubleshooting activities.
- To learn safety practices, industry standards, and proper use of tools and equipment.
- To develop teamwork, communication, time management, and professional working skills.
- To understand the importance of energy-efficient and reliable HVAC solutions in modern engineering applications.

• *Work Carried Out During Internship*

During the internship, HVAC requirements were received from clients for residential and commercial applications. Initial work involved detailed site inspection and feasibility analysis to understand the cooling requirements and installation conditions. Architectural layouts and site drawings were reviewed while considering factors such as room dimensions, ceiling height, window orientation, ventilation

conditions, occupancy load, insulation, and heat-generating equipment.
Based on the collected data, heat load calculations were performed to estimate the required cooling capacity in terms of tonnage. After load estimation, suitable HVAC equipment and air conditioning systems were selected according to site requirements, energy efficiency, and operational performance.

The execution phase included coordination of installation activities such as mounting of indoor and outdoor units, refrigerant copper piping, condensate drain piping, ducting support, electrical wiring, and control connections. System testing, pressure checking, vacuuming, gas charging, and commissioning procedures were also carried out to ensure proper functioning of the HVAC system.

Regular monitoring and inspection were conducted during execution to maintain installation quality, safety standards, and project timelines. The work was completed through final performance verification and successful project handover to the client.

1. It plays a key role in construction by helping maintain comfortable indoor temperatures in buildings.
2. It helps save energy by reducing the need for excessive heating or cooling.
3. It is important in electronics, as it helps devices release heat and avoid overheating.
4. It is widely used in engineering to design efficient machines and systems.

II. . HVAC SOLUTIONS

1] Air Conditioning Systems
Types of Air Conditioners:
a) Window AC
A compact air conditioning unit installed in a window or wall opening. It is mainly used for small rooms and residential applications.
b) Split AC
Split air conditioners consist of an indoor unit and an outdoor unit connected through refrigerant piping. These systems are commonly used in homes, offices, and shops due to quieter operation and better efficiency.
c) Multi-Split AC
In this system, multiple indoor units are connected to a single outdoor unit, making it suitable for spaces with multiple rooms.
d) Cassette AC
Cassette air conditioners are mounted on ceilings and are mostly used in commercial spaces such as offices,
e) Tower AC
Tower AC units are portable high-capacity systems generally used in large halls, event spaces, and commercial areas.
f) Central Air Conditioning System
Central AC systems provide cooling to an entire building through a network of ducts. These systems are commonly installed in malls, hotels, hospitals, and large commercial buildings.

2. Chiller Systems
showrooms, and restaurants for uniform air distribution.

III. RESEARCH GAP

In many HVAC projects, more importance is given to theoretical design and machine selection, while practical site conditions and installation-related challenges are often not studied in detail. Incorrect heat load calculations and improper tonnage selection can lead to poor cooling performance, higher power consumption, and reduced system efficiency. Also, there are limited studies based on real site work that combine site inspection, load calculation, equipment selection, installation, testing, and commissioning together. This project focuses on practical HVAC work and real-time calculations carried out during actual project execution to better understand system performance and improve overall efficiency.
Chillers are centralized cooling systems mainly used in large commercial and industrial applications. They

remove heat from water and circulate chilled water through piping systems for cooling purposes.

Types of Chillers

a) Air-Cooled Chiller

This type of chiller uses surrounding air for heat rejection. It is easier to install and maintain.

b) Water-Cooled Chiller

Water-cooled chillers use cooling towers for heat rejection and provide higher efficiency for large-scale applications.

3] Air Coolers

Types of Air Coolers

a) Desert Cooler

Used for larger areas and suitable for dry climatic conditions.

b) Personal Cooler

Small-sized cooler designed for individual room use.

c) Tower Cooler

Vertical-shaped cooler with compact design and better air circulation.

The project work was completed step by step, starting from site visits and understanding the client requirements. During the site inspection, different factors such as room size, ceiling height, ventilation conditions, window locations, and occupancy were observed to understand the cooling requirement of the area.

4] Ducted HVAC Systems

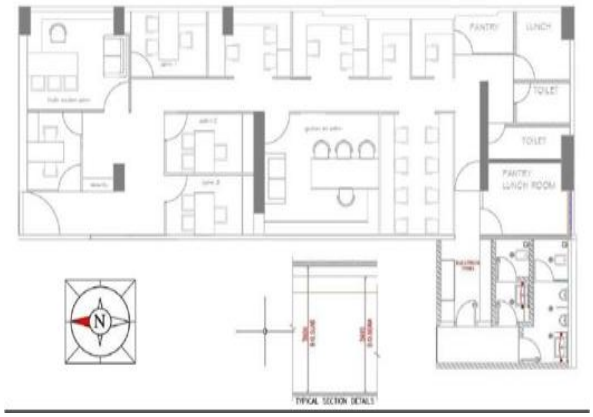
- Supply ducts
- Return ducts
- Dampers
- Diffusers
- Grilles

5] VRF / VRV Systems

6]Ventilation Systems

- Natural ventilation
- Mechanical ventilation
- Exhaust ventilation systems

III. RESULT AND DISCUSSION



After collecting the required site data, heat load calculations were carried out to estimate the cooling capacity and suitable tonnage required for the space. Based on these calculations, appropriate HVAC systems and equipment were selected according to the site conditions and application.

SR. NO.	Space Description	Area To be Airconditioned	As per Heatload		PROPOSED INDOOR UNIT							IDU Performance factor	Delivered IDU Capacity
		(Sq.Ft)	TR	CFM	IDU MODEL	TYPE	TR	CFM	QTY.	TOTAL TR	TOTAL CFM		
1	cabin	60	0.65	240	VHW-10	N	0.80	274	1	0.8	274	0.91	0.73
2	Meeting room	114	1.42	545	VHW-20	N	1.70	586	1	1.7	586	0.91	1.55
3	Staff room	253	2.23	859	DSD30	IDUs	2.50	1000	1	2.5	1000	0.91	2.28
4	0	0	0.00	0	0.00	0.00	0.00	0	0	0.0	0	0.91	0.00
5	0	0	0.00	0	0.00	0.00	0.00	0	0	0.0	0	0.91	0.00
6	0	0	0.00	0	0.00	0.00	0.00	0	0	0.0	0	0.91	0.00
		427.0	4.3	1644.2					3	5.0	1860		4.6

ODU (HP)	0
ODU (TR)	0
IDU (TR)	5.0
DIVERSITY	#DIV/0!

Assumption :

1 Inside Condition : 24 Deg C +/-1 Deg F
RH - Around 55%
2 Out Side Condition : 38 Deg C
3 Lighting Load - 1.0 to 1.25 Watts / Sq.ft
4 Fresh Air - 1 Air change or 5cfm per person whichever is higher
5 Equipment Load Considered 150watts / PC.
6 Occupancy consider as per standards/Architect comment
7 Exposed Glass Single Pane inside ventian blind or Roller Shade.
8 Floor Above is considered Airconditioned & Floor below is considered NON Airconditioned
9 Top Floor Roof Considered underdeck insulation with 50 mmthermocole sheets Factor 1 0.93 Factor 2 0.98

0	HP	
0	TR	
#DIV/0!	Diversity	
0.00	Derated ODU TR	
5.0	Total Nominal IDU TR	
0.91	IDU Performance factor	
4.55	IDU Capacity @ diversity	
4.30	Total IDU TR as per heatload	
ok	Result	

The next stage involved practical installation work, including refrigerant piping, mounting of indoor and outdoor units, electrical wiring, drain connections, and basic duct-related work. System testing procedures such as pressure testing, vacuuming, gas charging, and final commissioning were also performed to check proper working and cooling performance.

PROPOSED INDOOR UNIT						
IDU MODEL	TYPE	TR	CFM	QTY.	TOTAL TR	TOTAL CFM
VCC-10	COMPACT CASSETTE	0.80	325	1	0.8	325
VFC-18	FLOOR CUM	1.50	618	1	1.5	618
DSD-48	ductable idus	4.00	1600	1	4.0	1600
VFC-18	FLOOR CUM	1.50	618	1	1.5	618
VCC-10	COMPACT CASSETTES	0.80	325	1	0.8	325
VCC-10	COMPACT CASSETTES	0.80	325	1	0.8	325
VCC-10	COMPACT CASSETTES	0.80	325	1	0.8	325
				7	10.2	4136
				ODU (HP)	12	
				ODU (TR)	9.6	
				DIVERSITY	106%	

The overall results showed that proper planning, correct installation methods, and accurate load calculations helped in achieving better cooling efficiency and reliable system operation. The internship also helped in improving practical knowledge, technical understanding, teamwork, and confidence in handling real HVAC projects and site activities.

IV. CONCLUSION

This internship gave practical knowledge and real site experience in HVAC system installation, operation, and maintenance. The work helped in understanding how HVAC projects are carried out from site inspection and heat load calculation to system installation and final commissioning.

During the internship, practical exposure was gained in refrigerant piping, electrical wiring, unit installation, testing, and troubleshooting activities. It also showed the importance of proper planning, safety practices, teamwork, and correct installation methods for achieving good cooling performance and system efficiency.

Overall, the experience improved technical understanding, problem-solving skills, and confidence in handling real HVAC projects. It also helped in connecting classroom knowledge with actual industrial working practices in the HVAC field.

REFRENCE

[1] ASHRAE Handbook – HVAC Systems and Equipment.

[2] Principles of Heating, Ventilation and Air Conditioning by Ronald H. Howell.

[3] HVAC installation and maintenance manuals used during industrial training.

[4] Site observations and practical work carried out during internship activities.

[5] Manufacturer catalogues and technical specifications of air conditioning systems and HVAC equipment.

[6] ISHRAE guidelines for air conditioning and ventilation systems.

[7] Online technical resources and HVAC design references related to load calculation and system commissioning.