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LLH

HVAC System Design for Low Load Homes

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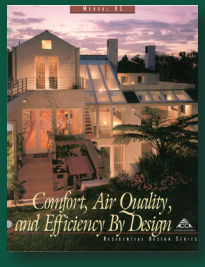
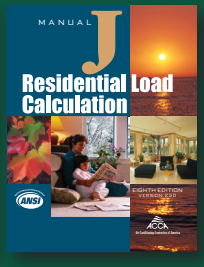
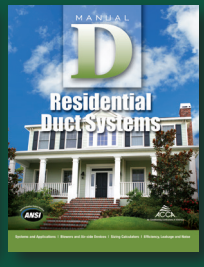
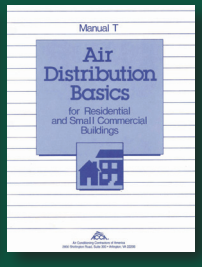
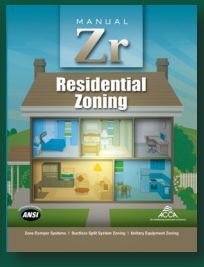
Manual LLH provides information for augmenting the instructions provided in varied ACCA residential design manuals.

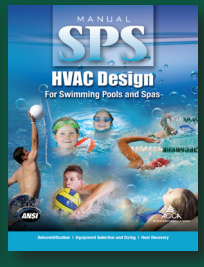












Manual LLH
HVAC System Design
for Low Load Homes

First Edition, Version 1.0

ISBN # 978-892765-65-9

The First Edition of ***Manual LLH***—2019 is the
*Air Conditioning Contractors of America (ACCA) procedure for designing HVAC comfort systems for residences that have small **Manual J** loads per square foot of conditioned floor area.*

Although energy efficient homes benefit from ***Manual LLH*** concepts, ***Manual LLH*** is not about how to design energy efficient dwellings.

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Preface

By John Sedine

Congratulations!

If you purchased this Manual—or, are considering purchasing it—then you are way ahead of your competition. Let's look at a very real scenario that is reflective of the type of issues addressed in this Manual:

Mr. and Mrs. Johnson stopped by to show you a plan for a new home that they want to build. You have been providing their HVAC service for the past 5 years on a home that they purchased 8 years ago. They trust you and they have confidence in you as you have been helping them work through a number of comfort issues in their existing home. They plan to live in their new home for a long time and do not want to live through the same comfort issues. They also hope to lower their energy bills and hired a local architect to design their new home. The architect advised them that their new home would comply with the 2018 International Energy Conservation Code (IECC) and the 2018 International Residential Code (IRC). For their comfortable, energy-efficient new home, the house plans indicate the following characteristics:

A single-story, 2,000 SqFt, three-bedroom, two-bathroom, slab on grade home with an attached two-car garage.

The building envelop benefits from upgraded floor insulation, energy efficient windows, foam insulation on the walls and attic roof ('encapsulated attic'), and an air sealing package; all of this enhances occupant comfort while lowering HVAC-related energy costs.

Historically, in your northern market, you would normally install 60,000 Btuh of heating and 30,000 Btuh of cooling. This works well when operating the central HVAC system at 1,000 cfm to meet the 0.5 Cfm/SqFt target airflow; (0.5 Cfm /SqFt airflow provides for good air movement within a basic track home). However, something tells you that this house is very different, and that you had better do a ***Manual J***® before discussing the HVAC system options with the Johnsons and their architect.

After doing the ***Manual J***, you find that the tight house has very low loads; there is only 30,800 Btuh of winter heat loss and 12,500 Btuh of summer heat gain. The first thing that goes through your mind is … what did I do wrong? So, you recheck, and then re-recheck your calculations again. However, all this rechecking only makes you satisfied that the load calculations are correct. Now, your thoughts fly to the recognition that a nominal one-ton, central system only provides around 400 Cfm of blower airflow. Yet, you would like to have 1,000 Cfm to obtain proper air distribution and mixing within the home. Then you realize next that your sensible to latent cooling heat ratio is way out of whack (significantly lower than normal, indicating that indoor relative humidity will exceed your target value). You wonder if you can find an evaporator coil and condensing unit in the needed size … and if/when you do, what if the selected equipment doesn't have enough latent cooling capacity to meet the latent cooling requirement? Finally, it dawns on you that the outdoor air needed for mandated ventilation is much larger than you would use for 400 Cfm equipment—so what are the consequences?

For identifying HVAC solutions that address scenarios like the one above … aren't you happy that you decided to buy this Manual?

Acknowledgments

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Introduction

Manual LLH provides practical approaches for applying today's HVAC equipment offerings to residential construction that—based on their ***Manual J*** ® load calculations—are determined to have low cooling and / or low heating requirements. Being a low load home (LLH) does not necessarily mean that a home is an energy efficient dwelling. Indeed, many condominium and apartment units built in the past two decades—often being of small footprints (say 1,200 SqFt and less) and only having one or two exposed walls—are not recognized as being particularly energy efficient housing; but, many such units do exhibit very low cooling and / or heating loads. Additionally, with the national building code changes of the past few code cycles—that is, with home envelopes becoming tighter and tighter—we find that 'builder grade' homes:

- Built 20 years ago might have a cooling load of 600–1,000 SqFt per ton of cooling;
- Built 10 years ago might have a cooling load of 800–1,200 SqFt per ton; and
- Being built today might have a cooling load of 1,000–1,400 SqFt per ton.

With efficiency provisions in the IRC and the IECC Code, it is common today to encounter ***Manual J*** cooling loads, for new home constructions, that exceed 2,000 SqFt of conditioned floor area per ton of cooling. Depending on location, the corresponding heating load for a low load home ranges from 5 Btuh (say, Homestead, FL) to 15 Btuh (say, Duluth, MN) per square foot of conditioned space.

Manual LLH Guidance

Manual LLH deals with the unique HVAC design issues of low load homes and identifies equipment options / approaches that are currently available in today's marketplace to address these issues. This Manual is not intended to be a 'stand-alone' guidance document. ACCA's existing manuals: ***Manuals J*** ® / ***D*** ® / ***S*** ® / ***T*** ® / ***Zr*** ® / ***SPS*** ® / ***RS*** ® / etc. provide explicit instructions on the interactive HVAC design process (i.e., load calculations, duct design, equipment selection, grille/register selection and placement, zoning, dehumidification, etc.) for residential applications. ***Manual LLH*** refers to specific sections within these documents for guidance that applies to the low load scenario.

As time progresses, it is anticipated that more OEM equipment offerings (e.g., 20,000 Btuh furnaces, one-ton central cooling, etc.) will become available in the marketplace and this Manual will continue to be relevant for applying same in low load homes.

Manual LLH Audience

Manual LLH audiences include HVAC practitioners (licensed and unlicensed system designers such as contractors, professional engineers, and 'no-stamp' consultants) as well as installers who are expected to correct field-encountered problems. Vo-tech instructors and students are an important learning audience. Utility people and code officials are a regulating and oversight audience. However, the overarching intent is to provide HVAC practitioners with a contractor / designer / installer friendly presentation that succinctly deals with core concepts and provides easy to follow guidance.

Using This Manual

Manual LLH Part 1 details how to use the HVAC system design process you already understand and brings in additional considerations to address the specific challenges associated with low load homes—low total airflow (a room air mixing problem), equipment low latent capacity (an indoor humidity control problem), and relatively high home ventilation requirements (an equipment selection problem). Part 2 contains 'example solutions' using equipment options available today. However, not all of the solutions identified in Part 2 of this Manual are appropriate for all homes, or, in all areas of the country. And, some of the solutions can fall short on satisfying homeowner comfort expectations. Your experience and insight will be needed to ascertain the right trade-offs between equipment selection (sophistication and effectiveness) and homeowner comfort. The Part 3 Appendices provide ancillary details and information to enhance your application of core issues and concepts.

For ***Manual LLH*** use, HVAC practitioners are expected to know industry terminology, have basic math skills, be able to find information in OEM-produced tables of engineering data, read friction charts, use duct slide rules, be familiar with ***Manuals J*** / ***D*** / ***S*** / ***T*** / ***Zr*** / ***SPS*** / ***RS*** / etc. procedures, and be familiar with the attributes of various types of systems and equipment offered today by equipment manufacturers.

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