HVAC Design: Recognize Proper HVAC Design and the Importance of Manual J & S with Alex Meaney

SPEAKERS
Kendra Seymour, Alex Meaney

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Alex Meaney
00:00
Number one question homeowners ask, the one I have is working, so why can't I just get one like that? Well, partly because of efficiency standards. When they made the one that you have, hopefully it lasted long enough that it was under some older efficiency standard which makes things work differently. The cheapest and easiest way to make an air conditioner work more efficiently is to make it a little worse at controlling humidity.

KS

Kendra Seymour
00:37
Welcome to the HVAC plus D mini class series brought to you by Change the Air Foundation. This series is made possible thanks to the generosity of our sponsor, Santa Fe Dehumidifiers. We are deeply grateful for their support, which helps us continue raising awareness and providing free resources so that more families can breathe safe indoor air. A quick reminder, this 12 part mini class series offers a consumer friendly overview of common HVAC plus D topics. It is not a replacement for professional advice. You can watch the full series on our YouTube channel or by visiting ChangeTheAirFoundation.org, and clicking on our resources tab. In part A of this two part episode, Alex Meaney helps us understand how your HVAC contractor should be selecting the right size system for your home, because bigger isn't always better. He'll explain what Manual J and S are, why they're important, and how to know if your contractor actually did them. You'll also learn what terms like sensible and latent heat really mean, and some warning signs that your system might be the wrong size. A bit about our guest, Alex Meaney is the owner of Mean HVAC Consulting and Design with an emphasis on consulting. He primarily provides training on HVAC design and general building science. Alex was the head of training for Wrightsoft for 17 years prior to starting Mean HVAC at the beginning of 2022. He works closely with the HVAC School, ESCO and ACCA, with whom he is EPIC Certified and has served on multiple advisory groups, manual, J, D, et cetera. Alex has spent nearly 20 years teaching HVAC design, primarily through hands on learning. In that time, he's taught hundreds of classes to over 10,000 professionals, and has flown over 1.5 million miles in the process. His goal is to improve the quality of HVAC installations through good design practices and a better understanding of the principles involved.

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Kendra Seymour
02:28
Alex, thank you again, so much for being here.

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Alex Meaney
02:31
My pleasure to be here as always.

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Kendra Seymour
02:33
Yeah, this is one of those areas where I'm so excited. I think most homeowners and renters and I was guilty of this too, have zero idea about the importance of manual, J, S, D and T. We're going to be breaking this into two parts, so listeners are going to want to make sure you come back for part two. But what happens is, and all of us hit this point, at sometime, if you're a homeowner, your HVAC system goes out on its last leg, it's time to replace. And you call a company and they say things like, well, we're just going to replace like for like, we're just going to put in the same size. Or they say things like, well, this is the size that we usually put in a home with your square footage and and really, a lot can go wrong. And so Alex, I'm so excited for you to take us through Manual J and manual S in the first part of your talk today.

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Alex Meaney
03:23
Yeah, I'm looking forward to it. So design process for an HVAC system is a little cyclical. You always start with a load calculation and pick equipment, but because delivering what the equipment can do is part of the ductwork and getting it through the rooms is the grills, and they all work together, right? This can be a somewhat linear process, but if something goes wrong in the process, sometimes you have to, like, go back through the circle, which kind of is a bummer. But for the first part of this, we are definitely going to focus on just the loads and equipment side of things, which, in a replacement situation, is most of what you're going to see, right? You already have your ductwork. It might even be like inside your walls and stuff. There's oftentimes not a lot you can do with that. And so this is generally the focus in a replacement scenario. But if you happen to live in an area where all the duct work is places you can get to, sometimes replacing the ductwork can be a very viable option and can be the best choice in these situations. And you don't know until you measure and do the math right, and that's what these things are about. Manual J is about the problem. It's your house is the problem. Your house is the thing that is absorbing the heat and losing the heat in the wintertime. It's also absorbing moisture and humidity. It loses moisture and humidity in the winter. But I don't know any gun we can throw in a throw in a humidifier. That's not that hard. Dehumidification is a little trickier, and so that's another aspect of this that we have to identify before we start proposing solutions to the problem. If we don't understand the problem, how do we solve it? Right? And so Manual J, which everybody always asks, So J stands for Joule, which is a type of unit of heat that we don't even use in the HVAC industry, by the way, we use BTUs in the US, and they don't use Joules' in Europe, they use watts, but yeah, that's where the name Manual J comes from. I guess manual B was already taken or something. So number one question homeowners ask the one I have is working, so why

can't I just get one like that? Well, partly because of efficiency standards that when they made the one that you have, hopefully it lasted long enough that it was under some older efficiency standard which makes things work differently. The cheapest and easiest way to make an air conditioner work more efficiently is to make it a little worse at controlling humidity. The total capacity of the system will be the same, but by using less of the outdoor unit which uses the most electricity and more of the indoor unit which uses less electricity, what ends up happening is things on the inside get a little warmer, and the manufacturers compensate by this by making them bigger. And that total works, but it changes the profile of what it's actually doing in your house. It's not, there's not as much water going down the drain for every run cycle that the thing has which which means it impacts how things are going to perform, right? And if your system is new enough that it wasn't built under a different standard, it has the same refrigerant, by the way, in the world right now, if your system is younger than 20 years old, it could have any one of three different types of refrigerant in the pipes, right? And so the chemical they run through there isn't even the same, right? It has different chemical properties, different physical properties. It does not perform the same way when they change things out. So putting something in just like the one you have, oh, yeah. So if your system is newer, the fact if, if your system was built on the current efficiency standards, it shouldn't be dead, right? Something killed it. A very good friend of mine, who also trains in the in the to HVAC contractors, likes to say, compressors don't die. They're murdered, right? Something, something has gone wrong here, and we need to identify what that is. Otherwise you're going to be replacing this thing too soon again. And that also starts with a load calculation. And my favorite example of this, because this will get somewhat talented professionals even what will sometimes happen is you will have two failures propping up a success, right? If you're failing, if you think of failing as like leaning in one direction, if all the failures are going in the same direction, everything collapses. But if one of the failures is going this way and the other one is going that way, you end up with a teepee, right? You end up with an A frame that holds itself up. That happens a lot of the time with an existing system that's oversized and under ducted. What happens when you don't get enough air through your system is it no longer has as much capacity. So on the label, it's this big thing in your house, it's not as big. It's not working as well, because we're starving it of airflow, and that means it's going to run longer. And also this, for anybody knows the refrigerant cycle, and it's technical, this is a little glib, but things get colder, or they get colder faster, however you want to say it, which means they're better at removing moisture when they are running. And so having not enough ductwork can mean that your current system is a dehumidifier that does some cooling, and so is keeping you perfectly comfortable. And then we switch it in for something that has one of these new, more powerful blowers on the inside. And that undersized ductwork is now not so undersized. We've got a more powerful blower. It's pushing here. It's pushing the right amount of air through for the size that you have, not the right amount of airflow for your house and for what it needs, right? So we're going to talk about load calculations, talking about heat right? Heat coming in, heat going out, and humidity coming in. And so we talk about humidity as a type of heat. Okay, sensible heat is the heat that affects the thermostat. Which this is the way to remember. It makes sense. You add heat to a room, the number on the thermostat goes up. That makes sense. Latent heat is hidden, right? Which is another latent, is another word for hidden, or unseeable. When you add humidity to a room, thermostat doesn't do anything, but we've trapped some heat in that evaporated water, and when we remove that water, it releases that heat. And so that's the hidden heat in the room. So when I refer to latent, I'm referring to humidity. When I refer to sensible I'm referring to temperature, right? So when somebody doesn't

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Kendra Seymour
10:03
Can I jump in. Is there,

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Alex Meaney
10:04
Yeah, please.

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Kendra Seymour
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Sometimes people think about this, and I live in a humid area, so 80 degrees in in the summer, in hot, humid Virginia, feels different than 80 degrees and like a dry, arid desert.

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Alex Meaney
10:19
Heck yes!

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Kendra Seymour
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Even though they are the same temperature that humidity. I often describe it as a walking into a wall. So when I'm uncomfortable in a home, it is more often like a humidity issue for me than it is

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Alex Meaney
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So the human body has an active cooling system to keep you comfortable, and it relies on evaporation. Okay, it's sweat, and the sweat evaporates from even if you don't feel sweaty, there's a little bit of evaporation happening off of the skin of your body. And when that evaporation happens, that's a cooling effect, okay? And so when you're in some place dry, your ability to evaporate the water that's on your skin, the sweat on your skin is actively regulating your own temperature, right? Your own feeling of comfort. As the humidity level in the room rises, the sweat has a harder time evaporating, right, because the humidity, you know, hot, humid to dry, hot to cold, things move from high concentration to low concentration, just in general. And so the higher the concentration of humidity is in the air, the less your sweat is able to evaporate, and the more it builds up on your skin. Feeling sweaty is not I'm hot, it's I'm hot and my sweat won't evaporate, right? And it's that second part that a humid environment creates for you, right? And so that's why it's a dry heat. Eventually, a dry heat is just heat, right? You know people, people who live in Arizona, roll their eyes when they hear like, oh, it's a dry heat. It's 115 you'll die but, but that humidity matters so much because your body's natural regulatory system for your own comfort relies on evaporation,

and when you short circuit the evaporation, you start short circuit your body's ability to control its own temperature, which is why it makes things so uncomfortable so quickly.

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Kendra Seymour
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Yeah, my last interruption, but the real life example here happened to me. We had to replace our system and and I made some mistakes, and it was the middle

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Alex Meaney
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Somebody did,

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Kendra Seymour
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Somebody did, and it was 72 degrees, but it was so humid in the house, the humidity was pushing high 60s. Doors were sticking. I was uncomfortable, and I was like, I am normally for the last eight years, I've been fine in our home at 72 degrees, and yet, with the new system, that was the only thing that changed. All of a sudden we started having all these problems. So this matters, folks, it really does.

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Alex Meaney
12:49
Yeah, and you may have, I may have no it's quite all right. And I may, by saying this, have accidentally scheduled myself for another appearance. But humidity is a tricky thing. When you lower that temperature from 75 which is the quote, unquote record, by the way, I keep my house at 72 when you lowered from 75 down to 72 if you do nothing to the amount of humidity in the air, if you just lowered the temperature and the humidity didn't change, the relative humidity just went up, right, right, which is a thing a lot of people like, they try to teach that in science class, but it's not one of those lessons that tends to stick. And so if you happen to be someone who likes a little bit cooler that that's a factor it, there's actually a lot of interesting things. If I let myself go down this rabbit hole, this video is going to be a whole lot longer than it should.

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Kendra Seymour
13:36
Well, and I will, I will just add for listeners, we have a whole episode, episode seven, with Tim De Stasio on dehumidification

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Alex Meaney
13:43
Cool.

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Kendra Seymour
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So we'll get into all of that then.

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Alex Meaney
13:46
He's gonna, he's gonna be doing the whole psychrometric thing. Yeah, that's is super fun. So And going forward, my apologies, there is going to be a weird gap here. I was going to record myself on a green screen for my face, on the on the slides, it didn't go so well. So there's a hole in all of my slides, if anybody is design focused and wonders what's going on. So when you're doing a load calculation, it breaks down. And I'm not gonna spend too much time on this, because a lot of people don't care. But heat comes in three ways, conduction, convection and radiance. Right? Conduction is just moving through the surface of the house. This is where insulation is doing the work, right? Convection is just literally convection. I've always thought of it like cheating. Convection is like you're holding something cold, I'm holding something hot, and we trade right? It's the air is literally trading out. You're trading out warm air for cold air, or cold air for warm air. And it has a big effect on the overall performance of the building in the winter and the humidity level in the house, that's where most of the humidity comes from, is the outside air. And then radiance is the tricky one. It's everywhere. And it's radiance happens between, not just the sun and the earth, not just between the fire and the body, but like between your body and your desk, right? It's happening everywhere at all times. And so it can make things a little kind of complicated. Yeah, so conduction is easy. Insulation, where insulation can get tricky, is more is not always well, more is always better, but not as better as it was. Okay, there is something called the law of diminishing returns. It's actually multiple laws of diminishing returns, if I have any, like math majors out there, but this is the inverse curve law of diminishing returns, and it's how insulation works. In in Manual J you don't use R values. You use something called a U value, which is just the inverse. Take the number one divided by the one you have, gives you the one you don't, and it creates a chart that looks like this. So if you have an R1 this is your problem. If you have an R2 your problem gets cut in half. And that's a big drop. If you have R20, and you double it to R40, that is not a big drop, right? And if you're not a graph person, the easiest way I can think of to explain this is with gas mileage. If you have an old beater pickup truck, it gets 10 miles to the gallon. It might cost you 100 bucks a week in fuel to commute. If you trade it up for a new pickup that's got the drop cylinder technology and gets 20 mpg, well, you've increased your MPG by 10, but you save 50 bucks a week. If you trade it in for a hybrid that gets 40, you save 25 bucks a week. Even though you increase your MPG by 20, you increase your MPG by by 40 to 80 miles per gallon. You gotta plug in. It saves you $12 and change. The more there is to save, the more you will save, right? And so a lot of not a lot, but some people will try to sell you, like more attic insulation. If you have R30 plus in your attic, adding more insulation your attic isn't gonna make much difference. It will make some difference, but it won't make much. If there's a part of your building has no insulation, and you can get insulation there, that's going to make a bigger difference, right? So convection, the trouble with convection is measuring what we call

infiltration and duct leakage. Those are the two names for we have for outside air coming in the house, whether it's coming through the ductwork or just naturally through the house, and that stuff is invisible air, and so it can be hard to quantify. In older homes, you can often look around and look for like dust and dirt in insulation in an attic space, and that you can do visual inspections that are not bad, right? There are certain types of homes that tend to have more opportunities for leakage, that can that can be a little unreliable, like split level homes, they're very interconnected in between the floors, and sometimes they don't properly block things off, and it makes them a problem. But a lot of times, a good visual inspection can help. Aside from that, you can break out the big guns and use something called a blower door test or a duck leakage test. Expect to pay for that as a homeowner. Those things aren't cheap. They require a lot of training. You can, we'll get to this in a bit. You can. You also might expect to pay a little bit for load calculation services, depending on the scenario. Radiance. It's the sun for our purposes anyway, that's the sun, and there are a ton of factors that go into it, right? You have which way your building is facing. If you live in a new home community and your neighbor has a different size system, good they're supposed to. They're on the other side of the street and the house is facing a different way. They have a different load, right? If my face and windows are facing mostly north, there's no direct sunlight that ever hits them. It's just the ambient light bouncing around out there. If they're facing dead West late afternoon is I've got a solar death ray hit in my house. It's going to be a very different animal. And so looking for things like, is the window shaded? Do they have awnings? Is there a porch? Is this where you typically keep your blinds? That can actually affect things? Now that's a hard one for a contractor to put in stone, because it's human behavior, but you, as a homeowner who's having issues with hot temperatures in a single part of your house, consider changing your window treatments, and it might improve things. By the way, dark colored blinds and drapes and blackout curtains, not good. It absorbs heat. You want a white backing reflecting the heat before it actually comes in. To do a better job of that. There's a reason why a lot of those higher end, more expensive blackout curtains, the back of them is white and sometimes even silvery. That's why. Also little warning to people who live in humid climates, they make this thing, this, this product called radiant barrier. It looks like a mylar balloon or tin foil that they staple up to the rafters of your house to reflect back the heat from your attic and make things cooler up there. If you live in a humid climate, that is a dangerous thing to do. Your duct are up there, most likely in a humid climate. We tend to do that in humid climates and the ducts themselves have a surface temperature, and if that surface temperature gets below the dew point of the air in the attic, you start to get condensation and dripping water on your ceilings. Changing, a IE, lowering the temperature in the attic, which has nothing to do with the humidity will lower the temperature of the surface temperature of those ducts, and can cause a humidity problem. Okay, now we've all been conditioned, including guys in the HVAC industry before you, you know, like rag on your local HVAC contractor. These guys often pay good money to learn crappy rules of thumb. The state of the industry is not awesome in that, in that, right? And so everybody is conditioned to think in terms of square footage. I mean, the Department of darned Energy has got us thinking in terms of square footage. They put those labels on the window units. I wish they would get rid of those, because heat doesn't come through the floor. A little bit does, and if you have, like, a really bad floor, possibly a lot of heat does, but rarely is there much heat coming through the floor, right? It's usually the walls, in the windows and the ceiling and the ducts and those types of things. And so the actual floor area means almost nothing to the calculations, right? So this, if this is a two ton house, if we take that as a given, we pretend that there is such a thing as a two town house. There isn't, by the way, but if, if we pretend that there is, and we say that this is a two ton house, right? And then we we had a another one, then we would need four tons to kill it, and another one would be six tons, and another one would be eight tons, right? Well, if you smushed them all together, you don't need eight tons. You need about five and it's because these outside walls that had windows and

heat coming through them are now inside walls and have no heat coming through them. Same square footage, eight tons goes to five tons. Square footage, rules, cannot work, right? Not that they don't. They cannot work. It's physically impossible. Heat does not come through the interior walls. It comes from the outside. So sort of a million dollar question for Manual J if I'm a homeowner anyway, is, how do I know my contractor did a load calculation right? Most of the time, it's about the tools for me, when they come in and they start using, you know, they're measuring things with their lasers or their tape measures, their you can use a lighter or a laser pointer to look at windows to see if there's a Low E coating. They might have some infrared reading tools to test insulation. Like there's some things you can do. The more of these things they're using, the more time it takes, the more expense on the tools, the more you could expect to have to pay for that level of detail, right? But they're measuring things and they're writing them down, and the more things they're using to measure, the better. They're most likely going to be using some kind of computerized report, whether a tablet or even a phone. There are some certified Manual J apps that you can use on your phone. They're not super quick, so that they're done like that. That's a bit of a red flag, but it can be done.

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Alex Meaney

22:46

And there are a lot of tools out there, multiple now, and I'm going to ruffle some feathers with this one that they'll show you a very cool looking thing that shows you an image of their house in Google Maps or some other satellite image, and a lot of numbers, right? And they've and then they've already done it before they walked in the house and they say, oh yeah, we did that calculation for if they didn't do it. After looking at your house, they didn't do it. Okay? Satellite imagery does not have X-ray vision. It does not know how you know whether any improvements have made, been made of the house. They tend to go by the year of the home. And by the way, the older the house is, the more likely it is to have question mark, insulation, not poor insulation. We didn't regulate it. It doesn't mean we didn't use it. You can have a house built in 1950 where they didn't have to insulate, but they did, right, and so look, darn it, right. If they walked up and they already know red flag. Okay, so let's say they've done the load calculation. Awesome. Now Manual S, that's the next step. Why? Well, because the load calculation doesn't tell you tonnage, because tonnage isn't really a thing. The solution is Manual S, and manual s is about matching this up. You will hear the term ton a lot, and somebody's probably done this in one of their presentations, or will do it again. But the term ton is supposed to mean 12,000 BTUs and 400 cfm, by the rule of thumbs, they teach in the HVAC industry. Neither of those things are true. A ton refers to how much heat it takes to melt a ton of ice over the course of a day. And back when we used ice melting systems in the 1800s you would size system by tons of systems by tons of ice. At a certain point, we created refrigerant based cooling, and we still size them that way, because by tons per day became BTUs per hour. And if you do the math, it works. It's like 11,900 change. So we call it 12,000 but we don't use ice in modern heating and cooling, right? If you live in a hot climate, a system will not do as well. If you live in a cooler climate, systems do better. And we have this thing called AHRI that tells us. Note the quote fingers here, in case it doesn't make the cut, that what the capacity of a system is. They use conditions that are okay, 95 degrees outside, fairly normal. I'm going to give you that one, right? That's a pretty common temperature for a hot day. Now, it's not a common hot day where I'm in Boston, but we mean it's going to be 92 degrees where I am today, right? That's warmer than our design temperature the but so I'll give you that one. I shouldn't, but I will. Now, if you live in Arizona, this is a big problem. The real problem, though, and this, this is a little hard to wrap your head around, but they use a warm, wet, indoor return condition. So if this is the hot part of an air

conditioner, if you've stood near condensing unit, near a condensing unit running you've know, just hot air blasting off of it, this is the cold part. Okay, we don't need to understand the refrigerant cycle for this. We just need to know this is the cold part right here. And so, oh, you can't see my cursor there. This is the cold part right here. There we go. So the cold part on the inside, if you obviously, if it's the cold part, and we blow warm air across it, its job is to warm up. So if you blow cold air across it, it's not gonna be able to warm up very well. If you, if you blow hot air across it, it's able to warm up really well. This is the thumb on the scale. Systems perform better in the AHRI laboratory than they do in the real world period, because nobody's keeping their house under these conditions, okay. If you live in well, if you live in Virginia, you're probably getting somewhere between 10 and 11,000 BTS per ton, but it depends on the matchup. There is no rule. There is no law or regulation of standards like you know. They have those little you know, verification labels on gas pumps that the, you know us, Department of Weights and Measures has verified that a gallon is a gallon. Yeah, we don't have that in HVAC. Nobody's verifying a ton. I can call the system a two ton system, and then have it not do anywhere near that. No one can sue me. Okay, now they can not buy it. So there's some market pressure. But the way market pressures work is they chip away at it, and they chip away and so it's pretty common for most climates, for it to be somewhere between 10 and 11,000 if you go to Arizona, try eight to 9000. It's super hot outside, and it's super dry inside, and both of those things affect the performance. There are so many contractors in the in the greater Phoenix area who do their first load calculation and go no way, because they look at the BTUs, and they look AHRI, and there's no way that that system would ever work in that house. They're right. It's because that system doesn't give them anywhere near that many BTUs. If they looked up the detailed data, they would see, oh, this thing sucks at doing air conditioner in air conditioning in a hot climate. I have to pick a bigger one. So they're right, they have to pick a bigger one. But it's not the load that's the problem. It's the performance of the system. So the first clue we should have that this stuff is not the right stuff AHRI is they don't split it up into sensible and latent. It's you have to pay attention to humidity and and temperature control separately. Make sure you're aware of both. If you're not, if you lump them together, you're going to get burned. Heating is easier, usually, mostly depending on the situation. Heating is usually like we make fire. Now, if you got a heat pump, outdoor temperature does affect things. And also, if you go to the top of a mountain, altitude can affect things pretty significantly. Luckily, those are usually just multipliers for every system across the board in a given area, but oftentimes in high altitude climates, the contractor has to go from like 4000 feet to 8000 feet in the day. So it can get a little tricky that way. So the job is to match them up. And the rules are fairly simple. You got to have enough of your temperature control and moisture removal, right? You got to have enough moisture removal period. The trick is not having too much temperature control. Too much is bad. Bigger is not better. I'm going to say that again, bigger is not better. Okay, heating is easier. Just don't have way too much. It's he bigger is not better here either. But, like, it's less harmful, because it's about time, right? When you run a system that has a bunch of ability to control the temperature, it will control the temperature. When we look at the ratings of a system, this is for when it runs for an hour. Okay, I get 30,000 sensible and 10,000 latent if it runs the whole time. BTUs are per hour. And so the thing has to run for an hour for it to do that, okay? And the refrigerant cycle is a cycle when it turns on, it's not instantly as cold as it's going to get and as efficient it's going to get. And so maybe the first 5, 10 minutes, it does no humidity control, right? And the next five minutes, maybe it's 15% humidity control. And eventually it actually gets to higher than the 25% total that it does, because it often is making up some loss on the back nine, right on the back half hour. And so we actually very rarely know how bad it gets when a system shorts cycles, because they don't give ratings for the first 15 minutes of a system cycle. They rate it for an hour. So if we're not running close to an hour, we don't even know what the thing is doing. It might be okay. It might suck. We don't know. You're rolling the dice. And then there's highway

miles versus city miles. It's a pretty, pretty obvious one, right? Cars, HVAC systems, there's a lot of similarities when it comes to stuff like this. Efficiency, and yeah, this is another one. You want highway miles. You don't want city miles. Also, the more your system runs, the more the air in your house is circulating. And so that's that's a win as well. So one of the things that can make manual S difficult, I'm going to try to make you feel sorry for your contractors that you're hiring a little bit because even if you try to do this on your own, which I unfortunately have a very full plate, I can't help homeowners do this stuff on my I can refer you people maybe, but I don't have the bandwidth to do that. I'm busy teaching the guys who are working on your house. But if you try to do this on your own, finding the actual information that tells them what the performance will be is sometimes difficult, and, believe it or not, sometimes impossible. It is not a requirement. Is not a law that they publish the information they need. It is a law that the contractor has to use that publish information. But what that means is the only person who can get in trouble is the contractor. The manufacturer can't get in trouble. The inspector can't get in trouble, right? And so like some of the mini split brands that are available, widely available to homeowners, the ones you can just buy on Amazon, they don't publish data that tells you how good it is at humidity control. Some of them don't publish data that tells you how good it is at cooling when it gets very heating, when it gets very cold, gets very cold outside, like, they'll tell you the temperature at which it stops. That they don't tell you, like, well, what was the capacity right before it stopped? Right? Bad data is a big problem in the industry. So when it comes to performance data, some just suck. You'll see, and they make it look official, right? You look at that one you can buy on Amazon, and it says all of this, right? But there isn't enough information here to make any smart decisions whatsoever, right? It looks complete and there will be people out there wave your hand out and, oh, it's variable. It'll be fine. No, no, no, no, no, no, right? Like it has a little brain in it that is telling it how to run, and sometimes it's telling it to run in the most efficient way possible, so that they can sell more of them.

AM

Alex Meaney

32:26

It'd be nice if they ran in the most effective way possible, but they wouldn't be as efficient. And manufacturers believe it's going to cause them to sell less when that's true, because it's hard to understand effective versus efficient. And so they they dumb it down, and they sell crappy stuff, sometimes. Some are better. Like this is a major brand, and it gives me at least, it gives me how good it is at humidity control, but only at its full capacity. It doesn't tell you it's not, it's not the sensible they call it the sensible heat factor. What's the percentage that's sensible, and how much is humidity? That's one of them. What happens when it's only running 80%? Well, we're not telling we don't publish that data. Sorry, some manufacturers do do a very good job. Guess what? They tend to be a little more expensive. Yeah, not all of them. There's a couple brands that are value ish, right? Like they're not, they're not selling direct to homeowner, but they're a little less expensive, and they still publish plenty good data, but a lot of the guys who do full published data tend to be at the higher end of the spectrum. So when it comes to sizing systems, the one that can get very confusing, and there's been a huge push for in the industry is heat pumps, right? There's lots of different kinds of heat pumps, the traditional mini splits, right? The traditional heat pump, you get these multi split systems where you got all different kinds going on in there. So variable capacity does not equal magic. Okay, yes, it should match with the load of the building pretty well, but it doesn't necessarily match with the dehumidification needs of the building. And also, you could live in a climate where your needs for one season way outstrip the needs for another, more often than not, this is northern climates who need a lot of heating and not nearly as much as much cooling, and so it feels like magic when your load, if this is

the range of capacities, this is low cooling, high cooling, low heating, high heating. If the summertime, your building needs this much, and it's within that range, and in the wintertime, it needs this much, and it's within the range, that's, that's, yeah, it's magic, man. That's going to work wonderfully. Okay, if you're in Virginia, this will be near perfect. You size the thing, and you are right up near the maximum on cooling, so that on off days, it can ramp down when it needs to, but it can be right up there without it being way oversized. You still can oversize these things, because if this lives down here, we don't know how it performs down there, a lot of cases, and it's dangerous, but you don't quite have enough heating capacity, because Virginia is not a hot climate, it's a green grass climate, a warm climate. Your winters get cold, but if you end up not having quite enough from your heat pump, you can add an electric strip heater, which is very inefficient, but also runs very little, right? And so this is near perfection for this stuff. So performance wise, if I try to use electric strip heat in my neck of the woods with something that's nowhere near what I need. It's going to rely on that electric strip heat a lot more, right? And so this is where dual fuel systems can be very useful, right? If I my next system will be a heat pump, it would. It's a long story. Why it isn't a heat pump. My next system will be a heat pump, but I'm still going to have a furnace, right? Because it is just, I live in a place have a 25 cents a kilowatt hour. Kilowatt hour electric bill, right? There are places where heat pump electricity all the way makes sense until some very big numbers start rolling down the pipeline. But at twice the national average electric rates, I have to be very careful with my electric bill. And so the furnace kicks in when it gets to 30 degrees outside, or whatever the temperature is. Sometimes it's really cold. You might set it to 10, but having that extra gear, if you live in an area where you spend a lot of hours under 10 degrees, that can be a potential solve for this heat pump problem. The problem is that some of the energy companies don't want you to put this in, and they're dangling a big chunk of money in front of you to do this. Let's remember it's the power companies who are offering you this money. Okay? So if the problem they caused was that you are able to keep your house comfortable, but you had to spend a lot of money on electricity, that's not a problem to them. Okay, guys, you have to look out for yourself when it comes to this stuff. This is not as generous as you think it is. Okay, these companies are spending millions of dollars. They're saving billions so they don't have to upgrade energy grids and build power plants. Yes, we're making them save this money. It's a weird let's not get into why. It's very complicated, but honest to goodness, the money they are giving you saves the money in the long run, and if it can help you use more of their product, they're not going to be that mad at it. So if you're somewhere in here where it's like, okay, well, the thing is kind of oversized. This is this is not great, but if you're within 30% of that max, you'll be okay. It's this that we run into up North a lot, right? This is very likely to have dehumidification issues. So Tim, what's the solution to that? Fast forward to the new to his episode, you can add a dehumidifier, right? There's there's things you can do. And this is just straight up unacceptable. If you are at any point, your the load of your building is below what the minimum capacity of this thing is. It's never running, and that's not good for it. And so it's also not good for your house. You want to avoid that. The the budget for these things can be kind of tight. There's the mini split things, so they'll sometimes push you into the one outdoor unit with multiple indoor units. Problem with that is, these don't ramp down the same way this does. Right this outdoor unit can go down more, first of all, than the most of that's probably not true of literally everyone. But broadly speaking, these can then can run lower, if they need to, than these. And what they don't tell you is, and sometimes I'll tell the contractor this, the individual units can only run down as low as this, whatever this number is. So if this is a third, a third, a third, and only one of them calls it's going to get half. What are they? And that's, that's more than a third. What is it? It's given more cooling than it actually is designed for. They actually have to bleed off some refrigerant into the ones that aren't running to make that happen. And so the ability of your indoor units to actually ramp down is severely hindered by using this type of system. There are applications where they absolutely work, but there are a

lot of applications where these would have worked and this won't. So sometimes when the money is not there, this might not this may seem like the ideal option. If you don't get the sense that they're running the numbers and or know what's happened when these call alone, you could be in trouble. Okay, so if you're in a cold and humid climate, Virginia would count in this, but it's kind of like the bottom of this. You're the Southern Virginia is the bottom of what is called climate zone four, which is what we generally consider cold slash humid. New York is the bottom of climate zone five, which is squarely cold humid. So. Uh, be aggressive when you're sizing a heat pump. Make it when it comes to heating, go ahead and make it smaller. Okay? Because heating loads, when you do the calculations for heating, you're doing very worst case stuff, Manual J does not look at internal loads in the winter time. Doesn't look at the thermal mass of the home holding on to heat it. Doesn't look at the sun heating up your home in the winter. Doesn't look at any of that. And so generally speaking, heating systems tend to outperform the load calculation by a pretty good margin. As for the sizing rules, this is, again, talk to Tim about this, adding a dehumidifier to a to a design with a variable speed heat pump can get you out of the woods. And if you prove that you're going to add the dehumidifier, you actually pass code. What doesn't pass code, but is the spirit of the code is where you you as a contractor, tell the homeowner, we might need that dehumidifier. Maybe it's going to cost as much it's going to go here. It's going to, you know, this is what like. It's all on paper here. We might have to pull the trigger on this. Everybody is on the same page. We're not going to put anything that's going to be in the way. Let's see how it goes. Is a very smart way. It's what I would do in my home, and doesn't exactly meet the code, but can be a way to save money, because it's often not the problem that we know the thing won't perform. It's often the problem that we don't know if it will. So I'm firmly of the belief, even though the code says this isn't quite okay, find out before you go. Don't prescribe a solution until you have a problem. That's what I'm saying. If you're in a hot, dry climate, or hot climate, I should say, or a dry climate, you can, you can just relax. It's there are very few major problems that you'll have to worry about. And how do you know that a contractor is doing Manual S their paperwork should have some very complicated looking things in here. You could also ask them questions.

AM

Alex Meaney

42:05

I'm a big believer, if there's extra time, I forgot to mention this, if there's extra time in the in our second session, little little bit of advice on how to deal with salespeople is something I tacked in. And I always like to bait a salesperson right like when I when I'm looking for a financial advisor, I will tell them I'm getting old, which means this is not necessarily a bad investment anymore. So I can't use this trick, but if you're in your 20s or 30s and you walk into a financial advisor's office, I've been thinking about annuities. If they proceed to sell you an annuity, they are bad. They are. They are not a fiduciary. They're, they're they're taking advantage. They get paid a lot of money selling annuities, but they're not good investments for young people. I like to test a customer. So you could test a contractor. I think we want a bigger one. And if they're like, Yep, absolutely here, here's a five ton. That is a good way to know that. Like, I'm not taking that bit, right? They were way too eager to sell me something for more money, and so giving them that like opportunity, give them that rope to hang themselves, can be a good way. Now, if they start using a lot of terms, it's hard to explain this stuff to homeowners without it going over their heads, and that can also be a little bit of a red flag. So be aware that if you put them in this technical mode, you may not understand everything they're about to say, but if they don't jump on board for the thing that would cost more that, that's a pretty good indicator.

KS

Kendra Seymour

43:27

Alex, this was fantastic. And first, I do want to say thank you so much. I know you're doing this. You don't actually work direct with with homeowners and renters. You are out there training some of the best and the brightest in the field with to really elevate the industry. So thank you for what you're doing and taking your time today. Share with us, because it's so you're so engaging to watch, and you do really good job of making some of this accessible. So I think some of the takeaways that I heard is, you know, definitely bigger is not better, which is hard in our society, we tend to want the bigger TV, the bigger car and and there. That's good news, right? Because that cost more, bigger is not Not, not necessarily better. And you want to ask for the Manual J. And I love that you gave. It's a way to kind of vet a little bit like, are you doing this? What does that look like? Can I see the paperwork? That's something you want to ask for the the Manual S sounds like not everyone, right? Like you said, if you're in a hot or dry climate, that that may not be a requirement, correct?

AM

Alex Meaney

44:29

No, it's more like sizing a heat pump is easy, okay, right? The big, the big downside is, those are the situations where you can just, oh, it didn't fit in the in the zone, I'll add electric strip, heat. Perfect. Or I'm in a very dry climate, I might have dehumidification issues. You're in a very dry climate, like you don't want to be massively oversized, but the potential for comfort issues are minimal. I will also say that when it comes to providing the paperwork, I, sort of have, I teach contractors don't give away paperwork to potential customers. Give away sample paperwork, right? But either charge them money for that paperwork, or they can have it when they buy from you. Because this is, this is costly, right? For these guys to go to my classes, they have to take two days off work, which, by the way, is by far the bigger expense, and pay 500 bucks, not to mention $500 worth of software, not to mention the cost of the tools they would use to measure and identify things. And the time it takes to do that, like that's that all adds up in a very, very big way. If they aren't getting paid for it, they're not going to do it, and if they're doing it so quickly and crappily that they can afford to give it away, that can be a warning flag. Now be aware, there are a lot of wonderful mechanics who are bad business people who will give it away, but the fact that they won't is not if you haven't paid them and they won't, that is not necessarily a red flag.

KS

Kendra Seymour

46:00

Yeah, but I'm glad you brought that up, because that's a message that I really want homeowners to to pay attention to. Is the people doing this, if they're doing it right, they deserve to be paid for their time. It's not fast. I want you to plan for that, and I promise you by paying to have this done and knowing that it's done right and done well, you're going to kind of future proof, hopefully any problems you know that may come from not having a properly sized unit or things done well, because troubleshooting those things after the fact, I can't remember who I was speaking with with one of the other classes, and he's like, I can't tell you. It breaks my heart when I tell them, we have to take out the entire unit, brand new system, three years old. And wow, if you had, you know, had the right company do it, and you, you paid them for their time for that, you could have had a different system, and you wouldn't even be in this position. So I love that you did

that, and I'm not, I don't mean to put you on the spot, but if you had to guess how often when a homeowner calls and says, hey, I need a new system it's not working. Do you think companies are running like a Manual J and S, and we're going to get into D and T and the other one? Is it well

AM
Alex Meaney
47:09
And sometimes practice or not really, sometimes manual D and T aren't necessary. Okay, Manual J definitely, very much is. And there are shortcuts around Manual S. They're always you're always doing work. The local contractors always doing work in their own area. The their own area. The outdoor temperature is the same, and just about everybody's keeping their house at 75 degrees. There is a lot of similarities here. So we can be very familiar with what our systems do when we narrow the range of things that we sell. We're not a company that sells every single brand under the sun, or if you want a different brand, we have to like it's going to take. We'll have to get back to you on that. We have to look into it. And so it's really the Manual J, that's like the thing you can't fake. It can be hard to tell somebody who really knows their equipment from somebody who didn't do a Manual S, but when, when they're not taking the steps of measuring things and writing them down is the key. And what percentage varies so wildly by region, it's not even funny. And so, you know, there's a reason they call it the Wild West. Like there are areas where this stuff just doesn't apply, and there are areas where people's feet are held to the fire. It's very hard to pin down. I would say, nationally, in retrofit specifically, 30% is probably, like, aggressive, but not, but not on like, it wouldn't shock me, right? If there was like, good numbers behind you said, Oh, 30% are, yeah, I believe it, I'd say probably closer to 20% are doing everything right, yeah, right, maybe, maybe even 10.

KS
Kendra Seymour
48:41
Yes. This is something you have to advocate for. And again, like the other takeaway, this isn't guesswork. This is data. You guys are scientists and mathematicians when it's done, right? I think there's comfort. I'm a numbers person myself in that. So, yeah, these are data driven decisions, which I think is is a big takeaway for people. It's not like buying your refrigerator, where you just go pick out one and plop one in and it fits in any house, and it doesn't matter your unique home matters. And I love that you you said your neighbor may have a different size unit,

AM
Alex Meaney
49:17
same damn house. You know, in one of those communities where we live in the same house. All it needs to do is face a different direction.

KS
Kendra Seymour
49:22
Yep. So all those things matter. Alex, thank you so much for being here. I can't wait for part two with you. We're going to get into Manual D and T. So I hope everyone listening come back and listen to that part, because we put it all together then. And I can't wait to hear your tips at the end of this next part for how to

maybe suss out if the person you know selling you the service and equipment is is maybe the right person for you. So awesome. Thank you so much, Alex.

AM

Alex Meaney
49:52
Awesome. Thank you.

KS

Kendra Seymour
49:53
And if you don't want to miss another episode, the best way to stay up to date is to hit that like and follow button, and you can head on over to ChangeTheAirFoundation.org, and sign up for our newsletter, because you get great information like this, plus free guides, downloads and resources sent directly to your inbox. Thank you so much, everyone. We hope to see you in the next one.