HPH331

Ben Adam-Smith 00:00
This is House Planning Help episode 331. Hi there, I'm Ben Adam-Smith and this is the podcast for you if you're interested in self-build or retrofit. I'm exploring what houses we should be building in the 21st century and trying to break down the major roadblocks that may get in our way.

Ben Adam-Smith 00:18
Coming up in this session, my guest is Alan Clarke. We're concluding a mini-series that we're doing examining different professions: people that you might encounter on your self-build or retrofit journey. Today, under the spotlight, a mechanical services engineer. What exactly is that?

Ben Adam-Smith 00:35
First though, I always like to highlight other people doing good work, interesting work, and particularly if it relates to what we're all interested in, which is housing. So Facing Future is a nonprofit, they stand for the protection and preservation of life on earth. They want to raise awareness, change the status quo and amplify the voices of climate activists. So they do all sorts of content, but they've dedicated an episode of their video discussions that they put online every month to housing. And it's pretty good! In fact, a lot of the stuff, if you listen to our podcasts, I think everything in there, we have mentioned on a podcast with the exception of one thing. So let me tell you who's on there first of all. All of these people have been on the podcast before: Mike Coe, who first built the Cropthorne Autonomous House and then went on to build Portree Passivhaus, Lloyd Alter who wrote for Tree Hugger extensively. More recently, he's author of a book that looks into carbon footprints, and how we can all take a bit of responsibility ourself. And Chris Magwood: he's written possibly eight or nine books, all focusing on wonderful materials. But not only that, saying that you can have it all, it's about being intentional. And this is the bit that I've never heard before, he's saying he's really excited by what's happening recently. Developments with mycelium and how we might be growing our insulation in future. Maybe that's one for Google, and possibly one for my ideas list for the podcast. But we'll put a link in the show notes, if you want to check that out. Facing Future with their episode on housing.

Ben Adam-Smith 02:15
Let's get to our featured interview today. It's with Alan Clarke, who also has been on the podcast before. I've been doing some filming with Alan, he's a mechanical services engineer, and is actually as you're hearing this working on training material for another project. But I just thought this was interesting to mention this before we get going because Alan is very logical, very analytical, common sense, very good at looking at efficiencies and so forth. And I've been out on multiple different shoots over the years and never clocked this one. He said in the middle of our shoot, I think you're using your eyepiece on the camera the wrong way round. And I took a look at it because of course it's designed in a specific way, and had to agree with him. So of course, I changed to my other eye. And immediately I couldn't do it because I'd been doing it for so long. I couldn't make it work the other way around. But it just goes to show, it's a bit like Sherlock Holmes, that Sherlock Holmes will pick up on all the clues and

things. And I think that's very much what Alan does in the world of mechanical services and just looking for efficiencies. And that's why he's teaching all this stuff these days.

Ben Adam-Smith 03:22
So over the last couple of episodes, we've looked at different professionals that you might meet or need for your self-build or retrofit project. And today we're finishing that mini-series by looking at the role of a mechanical services engineer. So we'll explore what that means, what areas they cover, how we might interact with them and so forth. Firstly, I asked Alan, what is a mechanical services engineer?

Alan Clarke 03:50
Well in the design of buildings, this will cover the design of the heating system and ventilation system. And it could be some practices would just do mechanical services design and then there's also M&E or MEP, which will be Mechanical Engineering and Public Health, which would cover all the building services. So as well as the heating and ventilation, it will be the electrical services and the drainage, and of course, the plumbing as well.

Ben Adam-Smith 04:20
Is this a discipline within engineering?

Alan Clarke 04:24
Most of the people practicing it professionally would come from an engineering training. Yes. And you might be a chartered engineer to do this. Yeah.

Ben Adam-Smith 04:36
So when might we look to getting a mechanical services engineer on board?

Alan Clarke 04:45
So there's quite a choice of options with a domestic house sized project, particularly on the electrical design for instance. An electrical installer would be expected to be qualified and understand the regulations and understand how to install a system that is going to be in line with the wiring regulations and building regulations compliance. So you may not particularly need to get anyone else in to look at that. Similarly, but differently, there isn't quite the same level of qualification and supervision on ventilation services and heating services. So actually full ventilation systems in houses is a fairly new endeavor, new field. So there are now some qualifications just for installers and so on to work to. But you might also be looking at an engineer to design a whole system for you as well.

Ben Adam-Smith 05:46
What part of the building regulations are we talking about in this mechanical services section?

Alan Clarke 05:53
In England and Wales, this is Part F for ventilation. And basically, Part L covers energy of the house as a whole, so that would cover the heating system. That would also go on to include the installation and might include energy modeling of the building, as well.

Ben Adam-Smith 06:13
And when we're thinking about houses, we often have an architect on board, will they sometimes do this in-house?

Alan Clarke 06:21
It's unusual for an architect to go into much detail on the design of these things. I know one who would do a fairly detailed design, one or two, but it's more common for them to basically lay out the regulatory requirements and leave it to suppliers and installers to fill in the detail.

Ben Adam-Smith 06:44
And at what stage will the architect's designs be at before they would hand over to someone like you?

Alan Clarke 06:51
There's a couple of ways of thinking of this. So my particular field is Passivhaus buildings. And we have some requirements that architects new to this might not be really familiar with, in terms of integrating a mechanical ventilation system so that it works efficiently, is easy to maintain, and so on. So there's some spatial requirements. RIBA Stage 3, pre-planning would be a time to be coming in and actually thinking about where the main items of equipment are going to be located, and how the distribution through the building would work. So duct work is just a lot bigger than pipes and wires. So it's good to have a plan as to how that's going to work, although you wouldn't get into the detailed design at this stage. Now, also, if we're doing a Passivhaus, there's another wing to this sort of work, which is doing the energy consultancy, and Passivhaus energy modeling with PHPP. These could be two different people, it could be the same person, I could do one or I could do the other. But again, if you're doing something that requires an energy model, you ought to be doing that before you put planning application in. Because that might have knock-on effects on the form of the building, window sizes, and that kind of thing that will affect the external appearance.

Ben Adam-Smith 08:07
So when we're looking at ventilation, what sort of things are going to make it a really efficient system?

Alan Clarke 08:16
In terms of the overall system, in terms of energy efficiency, one of the key things is the MVHR unit. It's that actually an efficient piece of kit, with good heat recovery efficiency and quiet efficient fans. However, you can scupper the sort of fan performance by putting in ducts that are too small, then the fans have to work much harder, you use more energy running them, and you get more noise as the fans work harder as well. So that's kind of a lose, lose. So having a good approach to the design of the ductwork is important there to get an efficient system.

Alan Clarke 08:49
The other side on the heat loss, something that's not particularly recognised in the normal Part L calculation for building regulations, but is in the Passivhaus analysis, is looking at how long the ducts bringing cold air in and out of the building are and how well insulated they are. If we do the calculations accurately on those, we see that we want to keep those really as short as possible, within one or two metres length, which has serious implications on where you're going to put the ventilation unit and then

experience ????? for keeping it running optimally. It needs regular filter changes. That's not going to happen if it's in a dark, inaccessible loft. It needs to be somewhere where you can get to it and see what you're doing and it's safe to access. So there's a whole lot of strategic planning in order to get to the efficient system before you even start installing it.

Ben Adam-Smith 09:41
And then as well you've got where you're bringing the air into the building. You have to separate the ducts in a certain way, and what are your options there?

Alan Clarke 09:51
Going back to the basic principles of what we're trying to do with a balanced mechanical ventilation system with heat recovery is bring in fresh air and take out stale air, particularly from the smelliest parts of the building, which obviously, we don't want to take air from those into the cleaner places where we're spending more time. So we supply fresh air to the bedrooms, living rooms and study and such like. And we extract air from the wetter places as well with bathrooms, utility room and kitchen. And the point of the heat recovery system is that we pass that extract air through the MVHR unit, which has got a heat exchanger. That transfers practically all the warmth from that extract air to the incoming air. So that comes in with virtually no heat loss to the building and you get warm air coming in at room temperature that is not any warmer, but that's fine. And that means you don't feel cold drafts, you get high level of ventilation even through the coldest conditions, and get a nice fresh indoor climate as a result.

Ben Adam-Smith 10:59
How are you dealing with the ducting then when you are doing your designs? What makes it an efficient design?

Alan Clarke 11:06
There's a couple of things to the ducting. So you'd have your ventilation unit, say in a utility room, that might be an ideal sort of place. And you run ductwork from there to your bedrooms, living room. You'll also have ductwork connected from there to the bathroom, kitchen, and so on. And you kind of want similar sort of resistance to airflow from all those rooms. So if the ductwork is connected up with what we call a radial system with lots of separate ducts, then that's conceptually quite easy to see that you just run a duct to each room. But if you want more air to go to that room or from that room, you run two ducts. Also, if it's got a long way to go, then the resistance of running down that duct is higher. So you might increase the number of ducts to a distant room just to make it easier to get air from there to the MVHR.

Alan Clarke 11:56
The other system we use is what's called a branched system. So you then start with the biggest duct at the MVHR, it goes off to the first room, you tee off there to a terminal there, the duct carries on to another room and it tees off again, and so on. The main duct size reducing as you go along.

Alan Clarke 12:13

And in a normal sort of three bedroom house, we're probably starting with a duct size of 150-60 millimeters - that's six inches. And then just dropping down to 100 millimetres or four inches to individual rooms. If we're using the radial system with lots of ducts spreading out, they're generally on an outside diameter of 75 or 90 millimeters, which is a bit easier to thread through buildings, but you need more of them.

Ben Adam-Smith 12:40
Does that mean that the radial system is easier for a self-builder to install, because you need to have a little bit of planning, don't you if you're using rigid duct work, etc. threading them through posi joists?

Alan Clarke 12:52
I would say they both need some planning to be honest. I mean, this is one of the places where naturally you can go to a specialist supplier, there's probably half a dozen I would look to who can do a detailed design of a system and supply all their equipment. They could do that in a rigid ductwork system or a radial semi rigid system. So the semi rigid stuff comes in a big roll. When we say semi rigid, it's kind of not a flexible duct in that you can stand on it and squash it. It will maintain its shape. But it is bendable enough to get it round gradual corners so that as you're saying Ben, means you can thread it through floor joists easily, relatively easily. Once you've got the holes, they're big enough to get it through. If you take a three metre piece of steel duct, you find actually you've got a bit of a problem because you can't thread that in between the floor doors because it won't bend at all. So you might be pre inserting some bits of rigid duct as you go so that you don't have to try and thread things in later.

Ben Adam-Smith 13:57
And does some of this feed back into architects knowing what Passivhaus is all about? For example, we're talking about floor joisting being the steel web that's going to incorporate ducting. It gets to a point where the architects know all of this is coming so that bit's covered, or do you have to advise back?

Alan Clarke 14:18
I think the architects know it's coming, but they don't know exactly what's going to go where. So it's good also to have a plan, a layout plan, just showing where you want to get things. As actually interfacing with the structural engineer becomes an issue as well because you might have a basic strategy of there's 250 millimetre thick floor with plenty of room to run your ducts except for that full depth beam that goes across the middle of the open plan living area, which you can't get your ducts through. So you need to sort of coordinate with the structural plan as well.

Ben Adam-Smith 14:51
When we get to the actual rooms, we've got a variety of different ways the air can come into the room. So can you just describe a few of those and why they're different in different locations?

Alan Clarke 15:03
So we're looking to supply air into rooms in a way that you can't feel a draft. And if you've got a flat ceiling, the normal approach is simply the terminal is in the ceiling, and it kind of has a disc that spreads air out horizontally, so you don't feel the air blowing down on your head.

Alan Clarke 15:20
The other sort of supply valve you've got is one that's designed to go in a wall, which will then just throw out air horizontally. In a domestic situation, the air flows are relatively small in ventilation or air conditioning terms. So it mixes up with the room air quite quickly, you don't really have to worry too much about the airflow, and where it's going to go. So there's an air conditioning heritage of being quite concerned about, particularly with using cold air for air conditioning, whether it's going to suddenly drop really cold air on the back of someone's neck. But in a domestic situation with air going in at room temperature, it's relatively safe and easy to do without detailed analysis of the air flows or paths.

Ben Adam-Smith 16:04
How does this link in with moisture? Because that's one of the key benefits of living in a space that's got a mechanical ventilation system, you get moisture out of the places where you don't want it anymore. So how do you build that into your calculations and your planning?

Alan Clarke 16:23
I'd go back a couple of steps and recognise the fact that when we live in a house, we generate moisture/water vapour in many ways. Partly we just breathe and perspire, moisture evaporates from us in that way. But that's only like about a fifth of what we put in. Then showering, you obviously release water vapour into the air from the hot water. But then you dry yourself on a towel and the bathmat, they sit there they dry back out into the room as well. That's quite a big input of water vapour into the air. And cooking, you know boiling pan of pasta, there's a significant amount of water vapour going into the air there. Also, when your dishwasher is drying off the plates or you've washed them up in the sink, again, water is evaporating there.

Alan Clarke 17:14
And laundry, if you dry washing indoors, then you get water vapour evaporating from the clothes. And there's quite a lot if you've got, for the sake of argument, a six kilogram load of laundry, and it spins down to something that says it's 50% moisture content and that might be 1200 RPM spin, I don't know, depends on the type of fabric. But that basically means when it comes out it's 50% moisture, so that's another six kilograms of moisture that's got to go somewhere. And where that goes is into the air in your house if you dry it inside. Obviously, ideally you dry it outside. Or you might have a condensation tumble dryer again, but still, there'll be some moisture coming into the space.

Alan Clarke 17:59
So all this adds up, and what it seems to add up to roughly speaking is about two and a half litres of moisture per person per day. This obviously varies a lot depending on your lifestyle, laundry, and bathing and cooking habits. But that's a rough number that we have in mind. So left to its own devices, we will get pretty soggy in our houses.

Alan Clarke 18:24
So the way that moisture is taken out is through ventilation. Basically, at lower temperatures, you can get less water vapour in the air before it starts to condense. So even on a wet day today, if it's 10 degrees outside, the water vapour content of the air is relatively low, in grams per metre cubed of air compared to the water vapour content in a humid house. So simply by bringing in outside air, at

whatever condition it is, and exhausting the same volume of inside air, the inside air will have a higher water vapour content. That's how you get the water vapour out basically. We can do theoretical sums and look at just how much air we might be moving through the building in order to do that, again, assuming a normal average sort of water vapour generation per person.

Ben Adam-Smith 19:16
So what assumptions are you using? Or in your calculations you've talked about people, are they rules of thumb? How are you narrowing it down so that it does become more specific to the building?

Alan Clarke 19:29
Absolutely. When you look at any sort of domestic ventilation system, it's entirely on rules of thumb basically, or regulations and guidelines. We don't do a particular calculation for someone's particular lifestyle habits that would come about in a non domestic situation. Possibly you'd look at things from first principles, but here we're looking at normal sort of occupancy, normal lifestyles, and that's been integrated into the Part F building regulations in terms of guidance of what sort of ventilation flow rate you want. Based on a number of different sort of factors, one would be basically the number of people in the building. This is inferred from the number of bedrooms in Part F.

Alan Clarke 20:10
When we do a Passivhaus calculation, we're more specific and we do it on a per person basis. So we do that on a 30 metres cubed per hour per person, basically, as a fresh air ventilation rate. And normally pretty much everywhere, that will be the right amount of ventilation give or take. We don't have to be super precise, because the outside conditions are going to change a lot as well. So that just seems to be boiled down to a more or less a rule of thumb that will work like that.

Alan Clarke 20:38
Then you did mention about how we actually get the air out. So we do focus on the wet rooms. It's not actually that important to get too hung up on where we're extracting the air from in terms of moisture. Water vapour likes to get itself around the house quite quickly. So there has been a belief with intermittent extra fans in your bathroom, that by sucking hard when you have a shower or a bath, that they will manage to pull all the water vapour out. There's a lot of houses in the UK with intermittent ventilation fans where evidence is that doesn't work and their humidity levels are rather high. And they're at some risk of getting condensation and mould in places.

Alan Clarke 21:16
So what really works is running the ventilation all the time. And we do focus on extracting from the wetter areas, but it's the fact that the ventilation is always there, that really makes our MVHR houses such a good humidity all year round of not too high, not too low. There's kind of not much to be gained by turning the ventilation off at any point because you're not losing any heat through it. And if you need to shift a certain amount of air to get rid of moisture, then running the fans at a steady speed might be the more efficient way of doing it, rather than trying to get them to work really hard for a while and then back off. They might actually end up using more energy. So with this sort of approach where we're not losing heat as we do that ventilation, it does make sense to continue running it.

Ben Adam-Smith 22:05
Just looking at the benefits, what would you say the key benefits are? We may well have mentioned some of them already, but the benefits of good ventilation?

Alan Clarke 22:14
Primarily it's to your health, I think. Through living in an enclosed space, we generate a number of pollutants. Some are a side effect of this moisture we're talking about. So high moisture levels, very high moisture levels, you risk condensation and black mould, and that can be lethal in some cases. It's certainly not good for anybody. At lower levels, just a bit humid, we don't seem to mind and don't notice. But you'll also find that there are things like house dust mites that are also really happy in your bedroom and living away there and they shed allergens. And people often suffer from allergic reactions as in asthma from that kind of thing. So getting the humidity lower down to say about 50% relative humidity makes life pretty intolerable for these species, but we're fine with it. So that's a real boon to your health in just getting it a bit drier. And then we have much lower problems with allergies in the house.

Alan Clarke 23:15
Other areas, there's other things, it's the smelly stuff. There's all sorts of sources of smells, a lot of them are volatile organic compounds. And that also typically applies to a category of things that kind of used to be associated with something called Sick Building Syndrome. That came from carpets, vinyl flooring, possibly from your photocopier or laser printer as well, all sorts of, that's not the VOCs that's other stuff. But there's all sorts of chemicals in the air that inevitably come out of the products used in the building or the processes going on in there. And just by ventilating we dilute them and remove them from the air. So that's all good.

Ben Adam-Smith 23:54
Just before we move on from ventilation, is there anything else that's worth mentioning at this point, as we think of mechanical services engineer, ventilation, Passivhaus?

Alan Clarke 24:07
Yes, one of the snags that people have had with mechanical ventilation systems that haven't been designed with people taking this into account is the noise actually. Noise from the fans. If you've got something whirring away at night, that can be annoying, you might find it difficult to sleep with. Also, in terms of tenants on low incomes, they can hear something whirring away and are conscious that that must be using electricity, must be using their energy and their money. It might actually be quite a small amount as we've seen, but in our design of Passivhaus ventilation systems, we've got stringent targets on noise levels in rooms. This is going to be down to the sort of level where it's really not audible in the daytime, barely audible at night. Not everyone can hear it at all. So designing for low noise is important. Designing with suitably sized ductwork, as in on the larger side, reduces the noise input from the fans, but we still include silencers on both the supply ductwork and the extract ductwork from the MVHR. And that is kind of critical to getting a system that is easy to live with, and therefore is allowed to do the job that it's supposed to do.

Ben Adam-Smith 25:18

We started this whole conversation with ventilation for Passivhaus, but what would happen if you were just doing this on a normal building? How do they account for ventilation?

Alan Clarke 25:25
Well, building regulations allows you to do either a really bad job or not a bad job. And the bad job is kind of relying on the leakiness of the building to ventilate, which has never been proven to actually work. And because it was evidently not working in recent decades, we've now seen specifications required for even larger trickle vents than there used to be in windows to try and increase the leakiness of the building. And that means cold air drafts and higher heating bills. So people are inclined to close those vents anyway.

Ben Adam-Smith 26:06
So it's basically a hole in the wall that's up to the user to open and close it. That's their solution?

Alan Clarke 26:11
Yes, with as I said, there's those intermittent extract fans in the bathroom and kitchen, which you tend to be at liberty to use or not use, they tend to be noisy and irritating. And also, they run for a short period of time. So they're effective when they're running, but when they're not running, they're not effective. So they don't really do that much.

Alan Clarke 26:30
Then there's another approach, which is continuous mechanical extract ventilation, which actually has a lot to say in favour of it. It is a cheaper system to install. So here we just have either a central extract fan, running extracting air via duct work, mainly from the wet rooms, it might include some other rooms as well. Then there's what's called a decentralised mechanical extract, which looks like the normal intermittent fans really in the bathrooms and kitchens. And these are just designed to be quieter and run continuously. So that's the cheapest approach. Probable drawback is there's never any sort of thought about the total airflow through the building. And those little fans without any duct work are just inevitably going to be a bit noisier, and a bit more likely to be turned off.

Alan Clarke 27:21
Going back to the central mechanical extract system, with enough noise protection, that can maintain the same level of airflow through the building as an MVHR. So you can get the benefits in terms of removing the pollutants, removing the water vapour.

Alan Clarke 27:40
Some systems are very carefully designed with intake. So you still need some intakes, air intake points, but these are much smaller than the trickle vent used for the previous approach, because it's all pulled, air is pulled through by the extract fan so you don't need to have big openings.

Alan Clarke 27:58
And then they, some of them are controlled in relation to humidity in the building. So that seems to work alright. You don't have any there in the wet rooms, you don't want to be pulling air straight into the bathroom and out, you want to be pulling the fresh air into the bedroom. So with a humidity sensitive

intake, it might open up when you're in there, adding moisture to the room, and then close down when you're not. And that seems to work reasonably well. Just relying on particularly in a leakier building, you may not get the air coming through the bedroom where you'd like it to. So that doesn't always work as well as you'd like. In my experience, it doesn't really work as well as MVHR in terms of the freshness of the air that you feel and the nice environment in terms of not having stale smells, that kind of thing.

Ben Adam-Smith 28:44
Let's move on to heating now, and where do we start with this one?

Alan Clarke 28:51
Okay, so all the houses we build will then need some kind of heating system. Traditionally, heating engineers who do the installation have often been ok for putting in a gas boiler with radiators. That's a very resilient type of system in that the boiler probably has much more capacity than you really need but it can vary its output in response to the demand. And again, the radiators are quite powerful at high temperatures so they can quite easily heat a reasonably well insulated house. The controls are quite straightforward. Again, you just have thermostatic radiator valves and central controls on the boiler. So that system has not always needed that much oversight and thought if the heating engineer is just or installer is just sort of following the usual practice.

Alan Clarke 29:43
Coming into this both with Passivhaus projects and moving on to heat pumps as the heat source, it's kind of needed to bring a bit more thought to it. One of the aspects has been just looking at how you can trim the fat in the design with a Passivhaus, because obviously we need much less heating. The other aspect is looking at heat pumps where we've actually needed to give it a bit more thought in how you get a heating system that really works efficiently. Heat pumps are very good when they work well. When they're happy. There are cases where people have not had enough thought into the design of the heating system. So they might not have enough heating emitters, the radiators are too small, or maybe just one or two of the radiators are too small. But that's a problem because those rooms may not be warm enough. And then you have to run the heat pump at higher flow temperature, higher heating water temperature. And that really affects the efficiency badly on a heat pump, whereas it doesn't with a boiler.

Alan Clarke 30:46
So we get into more detail of working out what size heating emitters you need in different rooms, making sure that everything's gonna run. Again, heat pumps aren't able to vary their output so much up and down. So in the first place, you want to be more confident in what sort of heat load you've got, because you don't want to have a heat pump that's too small, but then you don't want to have one that's too big either. So knowing really what your heat load is, is a finer calculation than was needed with a combi boiler. So we do those to a high level of accuracy. At least with a Passivhaus as well, we know that it's going to be built to spec and they will perform as we expect. So that's good. And then we can also model what the heat output from the radiators will be at different water temperatures and that kind of thing. So we can have a system that really works as efficiently as it can.

Ben Adam-Smith 31:38

And the ones that you design are they wet systems, so you're still dealing with radiators and so forth?

Alan Clarke 31:44
Most of the systems we're doing are wet systems. It's not essential to do it that way. And part of it is cultural, I think that's kind of what people expect. We've got a reasonably long heating season, not so long in a Passivhaus. And we're expected to have fairly large quantities of water, hot water that is. And unlike a lot of other countries, most UK householders seem to want a bath, which is not easy to be done. You can't do that, you can do an electric shower, you can't do a bath instantly with hot water. So we're looking at hot water storage with heat pumps. And it's not entirely obvious to the rest of the world why did we do it this way, but it's a northern European thing, so I guess it fits the climate.

Alan Clarke 31:45
So you find in New York, you would put in a what you'd think of as an air conditioning system really, where there is a heat pump, but it's more called an air conditioner, really. And that connects to units, which are called fan coils, which blow air over the refrigerant heat exchanger, and they can either heat or cool the building. So there'll be heating in winter and cooling in summer and the heat pump outside will switch modes, but still use the same equipment to do that. But in the UK, that's quite unusual. We've used a couple of those in small buildings where we could get away with a large open plan living space. And then this single point heater is quite a cheap and simple way to do it, then you still need a separate hot water heater at that point.

Ben Adam-Smith 33:16
And when we're talking about these wet systems, you often see, say, most of the radiators downstairs. So is that just taking into account how airflow moves around and heat will rise or that sort of thing?

Alan Clarke 33:31
Yeah, this does seem to take into account how heat moves through the building. Also the temperatures that people like to live with. People often want their bedrooms to be cooler, but their bedrooms are upstairs. But we still are ending up with heat distributed through the building. One of the things with a heat pump is that it's got a sort of minimum output where it needs to be able to get heat out. So it's actually quite beneficial to have heat emitters spread through the building. So they can all take heat from the heat pump when it's running because the compressor's got a sort of minimum speed that it can run at. And there's not really any point in trying to focus that into one or two rooms and then assume the heat will spread through the building. It will do, but there's just not much to be gained at that point.

Alan Clarke 34:19
The other approach we've been using is underfloor heating. So this runs with a very low heating water temperature. So it is ideal for heat pumps in terms of running costs and efficiency. Now, traditionally installation costs of underfloor heating have been quite high. So we don't always use that for that reason, although there are some ways of sort of integrating that underfloor heating into the ground floor slab, which can make it quite an economical solution, particularly if the controls aren't particularly complicated. So that's where some of the money goes as well.

Ben Adam-Smith 34:58
So you mentioned a little while ago about a hot water cylinder, that that's often a good approach. So what considerations are there for hot water and cold water? Is this quite a simple one or any tips for efficiency?

Alan Clarke 35:12
Erm, yeah, there's a few things to think about here. One is, if you've got a hot water cylinder, to put it where you want your hot water to be used, because you're going to run pipes from that cylinder to the taps. I mean, you can't put it exactly where you want to use it. But if you've got a building with a, maybe a fairly central kitchen, and the bathrooms might be off the landing as well, for instance, the main ones, then you want to look at, can you get the hot water cylinder towards the centre of the plan, maybe in a utility room, and not off to the far end of the east wing, where the garage is, where the hot water has got to run down pipes all the way every time you open a tap.

Ben Adam-Smith 35:56
I'm sure I've told you about my parents place where I've timed it before, and it's about 30 seconds to get some hot water.

Alan Clarke 36:02
Okay. That's how we like it in Britain. Yeah, so thinking about the location and trying to make it fairly central because actually, I mean, it's, again, it's something we come up with in Passivhaus, it's, we basically take the heat load of the building down by about a factor of 10 compared to a normal building, and then suddenly you focus on, everything else becomes relatively important. So we've looked at the heat loss from the hot water pipes, we look at the heat loss from the hot water tank, all that kind of thing.

Alan Clarke 36:31
And so there's a few ways of looking at the heat loss from the pipes. And the number one is put the tank near the pipes, that's going to fix most problems, and then you're probably going to get a fairly short run of hot water to the tap. Most systems these days use what's called unvented hot water cylinders. So these don't have a header tank in the loft, they run a connect directly to the mains. The pressure is limited, but the pressure is pretty high, so you can get a good shower off them. It also means you don't need such large pipes to run to the taps. So with a roof tank, a tank in the loft, you needed pipes of 22 millimetres or sometimes even bigger to run a bath tap with any enthusiasm. Now, we can run everything in 15 millimetre pipes just branching to everywhere. Or another approach we're using which needs a bit more calculation and thought is a radial system with even smaller pipe work. 10 millimetre copper or 12 millimetre plastic will minimise the distribution losses on the hot water pipe work.

Alan Clarke 37:36
What we avoid doing, although some people are quite enthusiastic about it, is running hot water in a continuous circulation loop around all the hot water taps. This is good for avoiding the time delay to get hot water at the tap, but the heat loss from keeping that circulation loop hot all the time is inevitably quite a lot, even with the best insulation that you can practically apply. So that's best avoided in any

case, and certainly best avoided in a Passivhaus where a lot of the year you're not going to need any heating. And that's going to be heat you don't actually want in the building.

Ben Adam-Smith 38:14
Have we mentioned all the key areas that you as a mechanical services engineer for Passivhaus would overlook, oversee and build into your designs? Are those the key?

Alan Clarke 38:26
Those are the key areas, yes.

Ben Adam-Smith 38:30
Okay, what are you handing over then? If someone comes and hires you, I want you to do this job, what are they wanting at the end of this?

Alan Clarke 38:38
I suppose they're wanting a heating and ventilation system that works well and efficiently and doesn't cost too much to install.

Ben Adam-Smith 38:45
So a spec of the actual system?

Alan Clarke 38:48
Yeah. A spec of the actual plans. It depends a bit on how much other suppliers and so on are installing the system. So at the starting level, you want a sort of overall strategy and specification that is going to make sure that the place does meet the ventilation requirements, and it meets the ventilation requirements of the Passivhaus as well for a Passivhaus job. And that you will get the heating and hot water that you need. But you probably would not get more complication and expense that you don't need. So we have, some people might not really believe they need any heating. But we can look at the energy model and see that it's designed to need some heating, but not much. So how do we deliver that economically?

Alan Clarke 39:35
So in terms of what we might deliver then would be specifications in terms of the ventilation. It would certainly start with the flow rates and then it could include ductwork sizing and so on, or that could go to a specialist supplier who does detailed design and supply of the equipment on the heating side again.

Alan Clarke 39:57
One of the things with the introduction of heat pumps is a bit more focus on the training and rigour of heating system designs. So we are seeing heating engineers starting to take this on in more detail as well. But we could ourselves do the design of the heat emitter systems or the underfloor heating or something like that, and all the pipe work and so on. And also being confident in what size heating system you need in terms of heat pump size, hot water cylinder, and so on, and being able to specify that so you can get prices on what you want.

Ben Adam-Smith 40:33
And in terms of technical drawings, are there names for all these drawings that would then be passed on?

Alan Clarke 40:41
There's a couple of names, I guess. I mean, we generally, well, the architects might call as a general arrangement would be used as a background for a layout plan. Do you just want to lay out exactly show on a two dimensional plan where things are. Ductwork designers might prefer to work in a three dimensional model, because they've got quite significant sort of spatial requirements, might still boil that down to two dimensional plans for ease of seeing on site what you're doing. So that's the layout drawings might include sections. Details of the plant installation, for instance, where the MVHR goes, you might want to know the dimensions of where the holes go through the wall, might want to know how high the unit is off the floor, and all that kind of thing for internal planning. Similarly, with the pipe work and the radiators, you'd have both sort of layout plans just to show where things go physically in the building. The other side of that is you might have a schematic drawing, which doesn't relate sort of as a scale drawing instead, this is a diagram of how things connect together. So you've got much more room to spread out, where the control valves go, and so on. And you don't really worry about all the radiators and that kind of stuff, you just focus on exactly how you've connected together the, say, the heat pump, where you might have a filter in the system, a diverter valve and the hot water tank and all that kind of thing. So that's what's called a schematic drawing. You also get those for wiring. Again, you don't draw scale drawings, wiring, you just want to know what wire connects to what terminal, that's the key thing there.

Ben Adam-Smith 42:21
Are you working in a specific program or does each thing needs something different?

Alan Clarke 42:27
Personally, I work in Excel as a calculation method really. This is where PHPP is based. So that's it comes from that. I know there's other bespoke software, things like Heat Engineer, make software for heat for Hilo calculation and heating system design. If you're doing building regulations calculations, then you need to use SAP software, but that's a separate division from Passivhaus design. But nothing, not much else, really, I don't think. And then drawings just could be any CAD package. It could be, you know, some people work in a three dimensional one or a two dimensional one, that doesn't particularly matter. It's just whatever sort of drawing package either suits you or integrates with other members of the design team.

Ben Adam-Smith 43:15
What does your day look like? What tasks might you be doing? If we just said this a typical day with Alan or this one here, maybe you could just describe that so we could get an idea of how you're spending your time?

Alan Clarke 43:29

I think instead, I'll probably just try and talk about how we might spend our time on these particular jobs we do. The reason for that is that's now not all I do. So I've spent most of the last couple of weeks working on teaching and training materials, and, and so on.

Alan Clarke 43:44
But in terms of this sort of design process that you've got, it will involve a review of architects designs, maybe a chat or emails about exactly what their brief is, and what their requirements are. These days, it will probably be a Zoom video call with clients again, to just understand how they might be living in their house, what sort of things they've got in mind in particular.

Alan Clarke 44:12
So then when you get that sort of sketched out, you'd like to be able to sort of draw a line under the strategy. And then at this stage the architects are probably detailing up their plans going to Stage 4 construction information. And hopefully going with, you know, as much as is complete information as possible. But in time to still get it integrated, you want to look at laying out the building services, distribution really and emitters and ventilation terminals and all the key bits of plant on the layout drawings. And you'll also be drawing up a specification, which will both be the shopping list for the contractors for what equipment you want, and specify the particular requirements for the installation and workmanship, commissioning and that kind of thing.

Alan Clarke 44:12
So then we'll be getting into drawings. And at the first stage back in sort of possibly pre planning or when the planning drawings are just sort of there as a base, looking at where you're going to put key bits of ventilation and hot water kit. And if you've got a heat pump, where does that go outside there? It's really easy on a rural site with ground all around, it can be quite tricky in an infill plot in an urban area. So you need to think about what the constraints are there.

Ben Adam-Smith 45:39
Are there any reasons that things might be revised? So you send across plans, what might change?

Alan Clarke 45:48
All sorts of things change. There's, on the one hand, there's when people are designing houses as a client for the first time, they don't quite necessarily know what they're getting. And as it evolves, they kind of think more about what they really wanted. And so that ideally happens still at the drawing stage. It also happens when, because I think interpreting drawings into a three dimensional finished building is an acquired skill. So sometimes you also get people coming into the building site, as the walls go up they might be thinking, Oh, I don't want to do that like that, and start to change things. So that from a designer's point of view is maybe a bit of a hassle. But it can make sense for the owner of the house, though. So that can be sort of a bit of extra work, but it can be worthwhile.

Ben Adam-Smith 46:47
What makes a good mechanical services engineer versus one that you really don't want anywhere near your project?

Alan Clarke 46:55
I think it's got to be someone who listens and understands what you actually want, understands your priorities. It's great to come in well, it's not great, I mean, being ironic is, he could come in with a preconceived idea of a fantastically complicated, technically awesome bit of automated building controls so that, I don't know, the lights all respond to the time of day, they change their colour temperature as the sun moves around the sky, and they respond to your voice, and all sorts of things. But if the client wanted a light switch, and a bulb, that wasn't necessary. It's a waste of time and a waste of money. So you've got to understand what your brief is. And you want to, basically, to have some experience in the field and be able to look back at other projects and be sure of what has worked well. And use approaches that even though we're doing what seems to be quite innovative buildings, actually, we're looking round one this morning, and the ventilation systems all kind of just humming away. Absolutely fine. It's been pretty straightforward to design and install, because it's, it's not really new. We've done it before, the first time involved a lot of head scratching, but now it's fairly straightforward. And then I don't see any problems with that.

Ben Adam-Smith 48:20
Does that make life easier if you're almost part of a team of people who've worked before together, and you just, you know a lot about how each other works?

Alan Clarke 48:32
Absolutely, yes. So there's, on the one hand, there's architects who spend time or spend time working together, and particularly where they've been working on for instance, Passivhaus buildings, for a while. They'd be still not be numbers, types, people who aren't really going to get into the Passivhaus design spreadsheet and that kind of thing, but they still, after a bit of feedback from both of us, we kind of know which what each other wants in terms of the building design. And that makes things a lot easier. Can be the worst where the architect thinks they know what you want and insists on trying to design it when it's not what you want in terms of, for instance, services space and that kind of thing. Or they've decided that you really must have a roof pitch this way, because that will be optimum for solar collection that is really making life hard for a lot of other things. And turns out not to be that important for the solar energy either.

Ben Adam-Smith 49:35
Well, finally, is there anything else we haven't mentioned, or a closing thought? Something that would be good in this topic about what this particular role entails? Who it helps, what goes on?

Alan Clarke 49:47
I suppose overall, this is a bit of a can be seen as a bit of an optional role, and maybe it should be. Say there's things like a structural engineer has to follow certain codes. And in this country, certainly architects don't have the training and ability to deliver what's necessary for the building regulations and for the safety of the building. Areas of the heating and ventilation design sort of can be split off into separate packages, as the sort of design and build by various different subcontractors. I mean, that can appear to have benefits in terms of avoiding having someone else on the design team. Obviously, the downside is, they're probably not talking to each other as separate entities, and you don't get an integrated design. And particularly when we're talking about specialist houses, such as passive houses,

they're not familiar with how they respond and what sort of level of heating for instance, you're really going to need.

Ben Adam-Smith 50:53
So in that case, then, what would you say the core benefits of investing this money in this consultancy are?

Alan Clarke 51:04
They would be in basically getting a single point of contact to brief what the system would be and discuss what you need. And also then getting one person to oversee how systems work together, and keep a track on how it all gets commissioned, and it all seems to be working at the end as well.

Ben Adam-Smith 51:32
Well, Alan, really appreciate both the information and your time. Thank you very much.

Alan Clarke 51:37
All right. Nice to see you again, Ben.

Ben Adam-Smith 51:41
Get more in our show notes today, which you can find at houseplanninghelp.com/331. We always provide a summary for you, so you can whizz through the information once again and dig out the bits that you're interested in. Perhaps you have a comment, or you'd like to ask a question. Well, you can discuss it with us on social media, we'll give you the links, all within the show notes. Just scroll down to the bottom there. We also talked about Facing Future and that special episode on housing that they did. We'll put that at the bottom of the show notes as well. So all of that at houseplanninghelp.com/331.

Ben Adam-Smith 52:17
Well, if you enjoyed the podcast today, remember there are plenty more in the archives stretching back over a decade. But the other thing that we do is run The Hub. And this is the membership community that I try to spend as much time in as I can, particularly chatting with you about your projects. We have an office hour where you can check in with me. We have other calls as well where you can bring up your projects. In fact, I might as well mention one that we've just done; a live training with Guy Hargreaves, who is the homeowner of the Kinver project that we have featured extensively. It was one of our in depth video case studies. And I thought this could be a really good way to round things off. If anyone has any questions we get Guy on and Guy's brilliant. He's shared so much information: the good, the bad, and so forth. So he was really good. And what was interesting on this call, we also had Jason, who is pretty much about to embark on the identical project: a Victorian terrace house, mid terrace, same issues. So we wish him luck and hopefully you two chatting together will help you Jason on your journey. We've got the courses, we've got the forum, all of that. Take a look: houseplanninghelp.com/join.

Ben Adam-Smith 53:34
That's it for today. Thank you so much. The House Planning Help podcast is produced by Regen Media: content that matters.