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ULOs for developing curricula

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Setting up national qualification and training scheme for craftsmen in the Czech Republic and developing the further offer of training courses in Slovakia, Austria and Bulgaria.

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Introduction

Catalogue of Learning Outcomes includes compendium of knowledge, skills and responsibilities that the learner is supposed to possess after finishing CraftEdu training programme. All contents relate to EQF level 3. The catalogue includes 8 Units of Learning Outcomes (ULOs) each for a different construction vocation set in the project documentation and modified by consortium members in the course of workshops and other project meetings of WP2. The occupations are:

- 1) HVAC installer
- 2) Carpenter
- 3) Electrician (High-voltage)
- 4) Installer of windows and doors
- 5) Hydro-insulator (roofs and foundations)
- 6) Electrician (Low-voltage)
- 7) Chimney sweeper – Installation of chimneys and chimney liners
- 8) Chimney sweeper – Inspection technician

In the report were used the following definitions, introduced in the Council recommendation¹:

- “**knowledge**” means the outcome of the assimilation of information through learning. knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the EQF, knowledge is described as theoretical and/or factual;
- “**skills**” means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments);
- “**responsibility**” and autonomy’ means the ability of the learner to apply knowledge and skills autonomously and with responsibility.

Method

The ULOs in this document were developed in number of consecutive steps.

1. **Identification of nZEB-related topics that are needed for craftsmen education were identified.** Various sources were used, namely Fit-2-nZEB, StavEdu and other H2020 and Build-up-skills projects. Inclusion of particular topics was discussed among consortium partners.
2. Comparison of selected topics with national craftsmen’ professional standards issued by national qualification authority. The objective was to **find gaps in national standards regarding nZEB topics.**
3. Afterwards **identified topics were compiled into final ULO nomenclature**, i.e. knowledge, skills, responsibility and autonomy.
4. Finally, these **topic-oriented ULOs were attached to individual professions.**
5. Throughout the process, **validating workshops** were held to check for possible omissions and to keep consistency.

¹ COUNCIL RECOMMENDATION of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning (2017/C 189/03)



National selection of professions

Individual professions are to be localised based on need and local context in each partner country. Profession assignment is depicted in following table.

Table 1 Profession assignment

No.	Profession	Assignment			
		CZ	SK	AT	BG
P1	HVAC Installer	X			
P2	Carpenter	X	X		
P3	Electrician (high-voltage)	X	X		
P4	Installer of windows and doors	X	X	X	X
P5	Hydro-insulator	X	X	X	X
P6	Electrician (low-voltage)	X	X		
P7	Chimney sweeper (installation)	X			
P8	Chimney sweeper (inspection)	X			

National specifics

This section presents local differences and peculiarities of national ULOs and professions.

Slovakia

In 2012 and 2013, Slovakia participated in the Build Up Skills Pillar I project managed by EACI (now EASME) to analyse a status quo in the level of competencies available in the sector of buildings, future needs and obstacles for improvement and investments in the skills and knowledge of human resource in the sector of buildings. Although the Pillar I project was aimed at craftsmen and on-site workers in the sector of buildings, Slovak BUS team used this opportunity to address also several middle and senior level professionals, as the needs in this area are of same urgency and need to be addressed should the objectives in the energy efficiency of buildings and in the use of renewable energy sources be delivered. Moreover, taking into account the specific situation in Slovakia, not addressing the needs in middle and senior level professions in the sector of buildings would undermine the effectiveness of achieving the expected impact of the action focused on craftsmen and on-site workers.

The agreed and endorsed BUS National Roadmap have anticipated leadership of employers in the process, with support of universities, accreditation bodies (ministries in charge of education), file managers of relevant governmental policies (ministries in charge of energy policies, including achievement of EU 2020 targets, ministries in charge of the construction sector etc.), social partners and suppliers of services related to preparing and delivering construction works, construction materials, machinery, technology and equipment that is essential for achieving the set objectives.

In implementing the Roadmap, StavEdu - National Qualification and Training Scheme was set up for Craftsmen and On-site Workers on Energy Efficiency and Use of Renewable Energy Sources in Buildings (resulting from the BUS StavEdu project supported by Intelligent Energy Europe).

The StavEdu scheme offers 10 cross-trade training programmes of further education and training of craftsmen and on-site workers in the field of buildings on energy efficiency and use of renewables in



buildings. The key objective of the cross-trade training programmes is developing the key competencies of craftsmen and on-site workers in the field of buildings needed for energy renovation of buildings and construction new buildings to the standard of near zero energy buildings. The training has 3 phases:

- Inception training focused on main issues of compliance (standards, technology requirements, legislation) identified by company experts;
- Theoretical part of the training;
- Practical training.

In Slovakia, the professions to be tackled were selected through a survey among the ZSPS members and other stakeholders. It resulted from the stakeholders' dialogue that was facilitated by the StavEdu project. The need to develop specific programmes for hydro insulator, window installers, electricians (for high- and low-voltage specialisations) and carpenter were specified (Key Objective 1, Report on Stakeholders' Dialogue, page 9, Table 3).

It was further fine-tuned by a survey carried out within the H2020 NewCom project (GA No. 754148), particularly for hydro insulator and the focus on flat roofs. In Slovakia, the flat roofs expanded through extensive construction of multi-family apartment housing using prefabricated elements. In the 1970th and 1980th, flat roofs started to be used also in the construction of single-family houses. In the case of public administrative buildings, it is the most used type of roof. From 1990th, flat roofs have been almost not used, but they are re-emerging due to more stringent energy efficiency requirements and the consequent implementation of passive house concept.

The lack of quality in flat roofing led to low trust towards flat roofs and the leaking roofs were named as one of the most frequent problems in Slovakia during the NewCom survey among the experts. This is why the focus of the project in relation to hydro insulator will be on flat roofs.

Czech Republic

There has been strong demand on behalf of the Czech chamber of light envelopes to include window installer to the Czech selection of professions. This change was agreed by the national team and hence all professions are included in Czech localisation. Moreover, hydro-insulator profession was enhanced so that it now consists of two sub-divisions: substructure and roofer hydro-insulator.

Both chimney-related professions in Czech Republic focus mainly on security issues related to chimney equipment such as fire protection and specific technical standards that need to be kept. This keeps them busy and according to representatives of their guild, there is little space to add another responsibilities to this already undermanned occupation with extensive duty under the law. On the other hand, technical norms of chimney equipment and installation are already so demanding that proper execution on-site suffice to keep fulfil nZEB energy efficiency requirements.

Austria

The installation of windows in Austria is increasingly carried out by smaller, independent installation companies and there is a high demand for quality assurance and improvement, especially when replacing windows during renovation. The situation is aggravated by the fact that - especially with small projects - the planning and coordination of the execution by an architect or a site manager is missing and especially the necessary preliminary and ancillary services are not optimally coordinated and provided. Also the assembly personnel often lack the appropriate qualification. The well-known window manufacturers in Austria react to this situation by carrying out their own product-specific training courses, which they want to make compulsory for the fabricators of their windows and doors. However, these measures do not include the increasing number of windows that are being installed



on the construction site in the refurbishment sector using windows directly from wholesalers or building material dealers without the manufacturers having any influence.

In the area of flat roof construction and waterproofing, in Austria there is also a great need for training and further education. The largest training provider in Austria is the "Institut für Flachdachbau und Bauwerksabdichtung" (IFB), which itself or in cooperation with educational institutions (e.g. building academies) tries to cover the demand. Within this project, in close cooperation with the IFB, the development of modules, which are particularly relevant to nZEB – topics, "Green roof as a contribution to climate change adaptation", "Integration of renewable energy systems in flat roofs" as well as "Renovation of flat roofs to nZEB standard" are planned. The existing training materials will be extended to include ULOs and adapted for incorporation into the e-learning system or newly developed for these modules.

Bulgaria

In Bulgaria, there is strong demand for increasing the quality of the works related to the right installation of windows and doors and keeping up to the requirements related to achieving sufficient airtightness and conditions allowing adequate performance of mechanical ventilation systems. Despite intensive activities for continuous improvement of the State Educational Standards for the related professions, there is no significant progress in this direction. This is evidenced both by the practice, with specific highly visible failures associated with the implementation of the National Programme for Energy Efficiency, and by the validation discussions performed with representatives of the branch associations, the Bulgarian Construction Chamber, and individual producers and distributors of nZEB-compatible products and components.

The requirements and units of learning outcomes for Windows Installer (Specialty 5820404 „Joinery and Glazing“) as specialization within profession 582040 Builder-Installer (EQF3) are set with Ordinance No 6 of 9 January 2012 on the acquisition of qualification for the profession "Builder-Installer", in force since 31.01.2012, issued by the Ministry of Education, Youth and Science. In 2018, a project for amendment of the stated educational standard for this profession has been approved by the Governing Council of the National Agency for Vocational Education and Training but has not been confirmed in the national coordination process. In both documents, however, there is a clear lack of focus on the requirement for achieving of airtightness which is crucial for quality nZEB-level construction. This is why it is expected that contributions from CraftEdu could be of great significance in the process of improving the standard and the underlying educational plans and programmes.

The requirements and units of learning outcomes for Hydro-insulator are part of Specialty 5820405 "Building Insulation" under the same profession 582040 Builder-Installer (EQF3). Similarly, they are subject to update and adaptation within the same process, with much improved focus on the basic hydro-insulation ULOs in the draft document. However, nZEB-related results from the learning process pertaining achievement of airtightness and cross-craft understanding related to the operation of the mechanical and electrical installations are yet again not clearly defined. Additionally, the ULOs defined by CraftEdu in the Hydro-insulator section are also applicable to other professions and specialties under the Bulgarian VET system as for example profession 582030 "Builder", specializations 5820307 " External cladding and flooring" and 5820312 "Roofs".



1. HVAC Installer

Airtightness

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the necessity of airtightness, vapour control and windtightness in a building and the multitude of benefits they bring</p> <p>knowledge on facts, principles, processes and general concepts on the critical importance of coupling airtightness with ventilation (“<i>build tight-ventilate right</i>”)</p> <p>knowledge on facts, principles, processes and general concepts on the principle of an airtight layer (red pencil method and single airtight layer)</p> <p>knowledge on facts, principles, processes and general concepts on typical weak points in the case of airtightness, vapour control and windtightness</p> <p>knowledge on facts, principles, processes and general concepts on the difference and relationships between vapour control, airtightness and wind resistance</p> <p>knowledge on facts, principles, processes and general concepts on the role of dew point as a risk factor in determining likelihood of condensation and mould formation</p> <p>knowledge on facts, principles, processes and general concepts regarding the Importance of introducing a vapour control layer to reduce the potential for transfer of vapour from inside, through the envelope towards the exterior</p> <p>knowledge on facts, principles, processes and general concepts relating to the principle of increasing permeability of vapour</p>	<p>cognitive and practical skills required to explain the importance of airtightness, windtightness and vapour control in buildings</p> <p>cognitive and practical skills required to explain the difference between air-tightness and ‘breathability’ and distinction between ‘airtight’ yet ‘vapour open’</p> <p>cognitive and practical skills required to explain the principle of the pressurisation test method and explain the benefits of completing both positive and negative pressurisation tests</p> <p>cognitive and practical skills required to operate fans (such as ‘wincon’) to create a pressure difference between inside and outside for the purposes of pre-checking airtightness in advance of the official pressurisation tests</p> <p>cognitive and practical skills required to identify leaks in a building envelope using a variety of methods including smoke-sticks and thermography where practicable</p> <p>cognitive and practical skills required to achieve high levels of airtightness ($n_{50} \leq 1.0$ ac/hr) using a broad variety of materials and methods including specialist skills in dealing with challenging 3-D connections as well as penetrations and transition points in the envelope</p> <p>cognitive and practical skills required to identify the airtight layer and its constituent parts in drawings and buildings</p> <p>cognitive and practical skills required to seal elements such as wooden joists which penetrate</p>	<p>responsibility for formulating a logical procedure/sequence of work with reference to airtightness</p> <p>responsibility for completion of tasks related to correctly prepping surfaces for application of airtight applications (dust removal, priming, applying base layers) in order to ensure long-term maintenance of airtightness and vapour control</p> <p>responsibility for completion of tasks related to ensuring absolute continuity of the three key layers providing vapour control, airtightness and windtightness and without tears or unsealed penetrations</p> <p>responsibility for and confidence to question the application of bogus airtightness materials proposed by others which might fail in the longer term</p> <p>responsibility for and confidence to stop progress on project advancement if necessary if construction details and / or materials being proposed are regarded as being risky</p> <p>responsibility for completion of tasks related to identification of when it is best suited to carry out interim airtightness tests, based on the principle of being able to fix leaks before areas are closed up</p> <p>responsibility for completion of tasks related to preparation of construction project for arrival of airtightness tester to ensure optimal use of the tester’s time.</p> <p>responsibility for completion of tasks related to applying tapes, membranes and flexible sealants which do not compromise the</p>



<p>diffuse layers from inside to outside (“drying-out”)</p> <p>knowledge on facts, principles, processes and general concepts relating to different approaches that can be used to regulate and control air, vapour and wind movement including materials best-suited to different construction types (membranes versus plasters versus specialist sheeting)</p> <p>knowledge on facts, principles, processes and general concepts relating to the use of appropriate materials for the control of air flow and vapour movement and avoidance of materials (such as impermeable plastics) which could cause significantly adverse effects with respect to vapour trapping</p>	<p>the insulation layer into a cold exterior wall and the potential for rot over time arising from mould and condensation</p> <p>cognitive and practical skills required to explain the importance of the q50 value in large buildings</p> <p>cognitive, practical and communication skills required to bring co-workers (who might be older and ‘more experienced’) on-board regarding the importance of dealing appropriately with airtightness</p>	<p>quality of aesthetic finishes on exposed surfaces (a common example being too much tape overlapping on window frames which will not be covered later by subsequent finishes) and thus left exposed requiring subsequent removal</p>
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Mechanical Ventilation with Heat Recovery (MVHR)

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the benefits of including a controlled ventilation system in a DER</p> <p>knowledge on facts, principles, processes and general concepts on the principles of heat recovery from exhaust air and tempering of fresh air</p> <p>knowledge on facts, principles, processes and general concepts about use of MVHR’s in DER in terms of noise levels, electrical energy requirement for the fans and impact on reduce heating and / or cooling demand</p> <p>knowledge on facts, principles, processes and general concepts on the two most common ducting arrangements used in residential ventilation systems (trunk-and-branch as well as octopus) and the impact these systems will</p>	<p>cognitive and practical skills required to sketch a schematic layout of the key components of a home MVHR system</p> <p>cognitive and practical skills required to install an MVHR in a home including key components such as heat exchanger, ducting, supply and exhaust registers, condensate drain and post heater</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers to ensure optimal flow rates in the spaces in which they serve and to avoid potential annoyance or irritation to occupants due to inappropriate positioning of registers</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers such that flow rates are unlikely to be adversely affected by occupants unwittingly placing furniture, storage or other</p>	<p>responsibility for suitably locating the MVHR unit considering most especially ease of access for the homeowner for the purposes of changing the filters but also positioning close to the thermal envelope thereby minimising the length of thermal bridges created by the two ducts which connect to the exterior</p> <p>responsibility for avoidance of using inappropriate ducting materials which could adversely impact on pressure losses, ease of cleaning and creation of noise and turbulence</p> <p>responsibility for full execution of the ventilation system design including provision of all specified ancillary components such as sound attenuators, filters for extract registers and fire and smoke dampers</p> <p>responsibility for completion of tasks related to ensuring that all connections are completely</p>



<p>have on the need for sound attenuators</p> <p>knowledge on facts, principles, processes and general concepts on the preferred duct types to ensure smooth air flow and avoiding sagging or kinking</p> <p>knowledge on facts, principles, processes and general concepts on the key components of a balanced ventilation system with heat recovery in drawings and buildings</p>	<p>impediments over or close to them</p> <p>cognitive and practical skills required to securely fix the routing and positions of ducts and registers so that there is minimal risk of adjustment or movement post-occupancy which would compromise their performance</p> <p>cognitive and practical skills required to carefully route ducts through the project to avoid excessive pressure losses which would result in increased fan energy use and possible risk of increased noise for occupants arising from the increased turbulence</p> <p>cognitive and practical skills required to thoroughly and completely insulate the two air ducts which connect to the exterior through the thermal envelope in order to minimise any adverse thermal bridge effect</p> <p>cognitive and practical skills required to secure a completely airtight seal of the two external air ducts at the locations where (a) they connect to the MVHR unit and (b) where they penetrate the thermal envelope</p> <p>cognitive and practical skills required to appropriately position the supply and exhaust air grilles where they exit from the conditioned space with special emphasis on avoiding short-circuiting of air flow (and resulting possible contamination)</p> <p>cognitive and practical skills required to select appropriately sized mesh coverings for external ducts openings so that they do not clog over time with small particles</p> <p>cognitive and practical skills required to measure volumetric flow rates at registers and to adjust supply and extract registers to deliver the required</p>	<p>airtight and that the two air ducts which penetrate the envelope are entirely and completely insulated with vapour tight insulation</p> <p>responsibility for completion of tasks related to ensure excellent hygiene during installation especially preventing soiling of ducts and registers through dust and debris</p> <p>responsibility for completion of tasks related to routing of condensate drain to appropriate disposal point</p> <p>responsibility for installation of correct filters in the outdoor air side and extract air side</p> <p>responsibility for hygienic protection of the filters prior to commissioning the system from risks presented by contaminants and / or moisture / humidity</p> <p>responsibility for completion of tasks related to ensuring that the duct network can be easily cleaned in the future should the need arise</p> <p>responsibility for ensuring that the homeowner knows why they should replace the MVHR filter at regular intervals and how they can replace them</p> <p>responsibility for dealing with queries and concerns from homeowners once they move in and are getting used to the MVHR system (taking the initiative to follow-up with the homeowner to make sure that everything is working well)</p>
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	volume flow rate as per the system design	
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Heating and cooling

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on what constitutes interior 'comfort' in both winter and summer with respect to temperature and relative humidity</p> <p>knowledge on facts, principles, processes and general concepts on the differences between heating and cooling 'demand' and heating and cooling 'load'</p> <p>knowledge on facts, principles, processes and general concepts on the differences in demand and load levels for heating and cooling in older (inefficient) dwellings and those of deep energy retrofit projects</p> <p>knowledge on facts, principles, processes and general concepts on heating high performance homes via the mechanical ventilation with heat recovery using a 'post-heater'</p> <p>knowledge on principles and general concepts on the difference between latent and sensible cooling</p> <p>knowledge on principles and general concepts on what constitutes 'overheating' and what passive measures can be used to reduce risk of overheating</p> <p>knowledge on facts, principles, processes and general concepts on insulation of pipework and the significant influence of this on energy consumption, especially when heating and cooling generators are located outside of the thermal envelope</p>	<p>cognitive and practical skills required to sketch a schematic layout for a heating and / or cooling system for a single family dwelling</p> <p>cognitive and practical skills required to accomplish tasks related to installation of replacement heating and cooling equipment for high performance homes</p> <p>cognitive and practical skills required to accomplish tasks related to ensuring continuity of vapour tightness of pipework where required</p>	<p>responsibility for completion of tasks related to upgrading of heating and cooling systems</p> <p>responsibility for completion of tasks related to thorough and complete insulation of pipework, including all fittings, junctions and valves as well as through-envelope penetrations</p> <p>responsibility for completion of tasks related to appropriate placement of the thermostat(s) which regulates the operation of the heating and / or cooling system.</p>



Domestic Hot Water

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the energy demand of DHW production in a typical family home</p> <p>knowledge on facts, principles, processes and general concepts on the most efficient means of producing DHW, whether from a boiler or furnace, heat pump technology, electric resistance, solar thermal, solar electric or hybrid of the above</p> <p>knowledge on facts, principles, processes and general concepts on the significant losses from poorly insulated DHW pipes and that up to 50% of these losses cannot be used as free 'passive' heat gains</p> <p>knowledge on facts, principles, processes and general concepts on clustering rooms which use DHW in an effort to keep pipe-runs short which minimises heat losses</p> <p>knowledge on facts, principles, processes and general concepts regarding impact of using low-flow showerheads in reducing DHW demand</p> <p>knowledge on facts, principles, processes and general concepts on the potential energy contribution of heat recovery from drainwater</p> <p>knowledge on facts, principles, processes and general concepts on the losses from DHW storage tanks and the importance of continuous insulation</p> <p>knowledge on facts, principles, processes and general concepts on the significant contribution potential by solar thermal collectors towards DHW production and the challenges</p>	<p>cognitive and practical skills required to sketch a schematic layout for a DHW system for a single family dwelling</p> <p>cognitive and practical skills required to accomplish tasks related to installation of an efficient DHW production, storage and circulation system, including the possible linking with a heating system and / or a solar thermal collector</p> <p>cognitive and practical skills required to install a DHW time and temperature control system</p> <p>cognitive and practical skills required to accomplish tasks related to full and complete insulation of DHW pipe network and confidence and commitment required to encourage and convince others on the building site to pursue excellence in execution of insulation of pipework</p> <p>cognitive and practical skills required to retrofit low-flow showerheads to reduce DHW demand</p> <p>cognitive and practical skills required to accomplish tasks related to installation of drainwater heat recovery system</p>	<p>responsibility for completion of tasks related to full and complete insulation of the entire network of DHW pipes, including all junctions, connections, valves and awkward parts of the system that are typically left uninsulated</p> <p>responsibility for completion of tasks related to full execution of the specification for insulating DHW pipes including thermal conductivity and thickness of insulation materials used.</p> <p>responsibility for reporting anomalies in best practice in relation to efficient DHW systems</p>

<p>presented by the 'winter gap' in heating dominated climates</p> <p>knowledge on facts, principles, processes and general concepts on the energy consumption of DHW circulation pumps</p> <p>knowledge on facts, principles, processes and general concepts concerning the very real health and safety risks caused by Legionella</p>		
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Specific topic for the craft

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge of orientation in standards, technical documentation and documentation for installation and repair of HVAC equipment</p> <p>knowledge of reading of machine and technical drawings of HVAC equipment</p> <p>knowledge of reading of design and technological documentation of HVAC equipment</p> <p>knowledge of checking of the correctness of the prescribed technological process of assembly and repair of HVAC equipment</p> <p>knowledge of assembling of parts of HVAC equipment</p> <p>knowledge of measurement of piping parts</p> <p>knowledge of assembling of individual components of HVAC equipment, including incorporation into steel structures</p> <p>knowledge of assembly and disassembly of HVAC equipment seals</p> <p>knowledge of assembly and disassembly of HVAC insulation</p>	<p>skill to choice of work procedure, aids and spare parts for assembly and repairs of HVAC equipment</p> <p>skill to defining the procedure of work for assembly and repair of HVAC equipment</p> <p>skill to choice of aids and tools for assembly and repair of HVAC equipment</p> <p>skill to selection of spare parts for repair of ventilation equipment</p> <p>skill to manual machining and processing of metal and non-metallic materials by cutting, filing, drilling, grinding and bending</p> <p>skill to achieve the desired dimensions and shape by measuring, manual machining and processing</p> <p>skill to use rationally tools and aids for manual machining and processing of metal and non-metallic materials</p> <p>skill to use manual mechanized tools to increase the productivity of manual machining and processing of metal and non-metallic materials</p>	<p>responsibility for maintenance and repair of HVAC equipment</p> <p>responsibility for Implementation of routine maintenance and adjustment of HVAC equipment operation</p> <p>responsibility for diagnostics of HVAC equipment failure</p> <p>responsibility for diagnosing fan blade wear due to cavitation</p> <p>responsibility for execution on the basis of diagnosed failures and defects Repair of HVAC equipment by replacement of defective part or group (block)</p> <p>responsibility for implementation of functional tests of HVAC equipment</p> <p>responsibility for choice of suitable method of functional testing of HVAC equipment according to documentation of HVAC equipment</p> <p>responsibility for performing a functional test of the assembled HVAC equipment</p> <p>responsibility for analysis and evaluation of results of testing of HVAC equipment</p>

2. Carpenter

Airtightness

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the necessity of airtightness, vapour control and windtightness in a building and the multitude of benefits they bring</p> <p>knowledge on facts, principles, processes and general concepts on the critical importance of coupling airtightness with ventilation (“<i>build tight-ventilate right</i>”)</p> <p>knowledge on facts, principles, processes and general concepts on the principle of an airtight layer (red pencil method and single airtight layer)</p> <p>knowledge on facts, principles, processes and general concepts on typical weak points in the case of airtightness, vapour control and windtightness</p> <p>knowledge on facts, principles, processes and general concepts on the difference and relationships between vapour control, airtightness and wind resistance</p> <p>knowledge on facts, principles, processes and general concepts on the role of dew point as a risk factor in determining likelihood of condensation and mould formation</p> <p>knowledge on facts, principles, processes and general concepts regarding the Importance of introducing a vapour control layer to reduce the potential for transfer of vapour from inside, through the envelope towards the exterior</p> <p>knowledge on facts, principles, processes and general concepts relating to the principle of increasing permeability of vapour</p>	<p>cognitive and practical skills required to explain the importance of airtightness, windtightness and vapour control in buildings</p> <p>cognitive and practical skills required to explain the difference between air-tightness and ‘breathability’ and distinction between ‘airtight’ yet ‘vapour open’</p> <p>cognitive and practical skills required to explain the principle of the pressurisation test method and explain the benefits of completing both positive and negative pressurisation tests</p> <p>cognitive and practical skills required to operate fans (such as ‘wincon’) to create a pressure difference between inside and outside for the purposes of pre-checking airtightness in advance of the official pressurisation tests</p> <p>cognitive and practical skills required to identify leaks in a building envelope using a variety of methods including smoke-sticks and thermography where practicable</p> <p>cognitive and practical skills required to achieve high levels of airtightness ($n_{50} \leq 1.0$ ac/hr) using a broad variety of materials and methods including specialist skills in dealing with challenging 3-D connections as well as penetrations and transition points in the envelope</p> <p>cognitive and practical skills required to identify the airtight layer and its constituent parts in drawings and buildings</p> <p>cognitive and practical skills required to seal elements such as wooden joists which penetrate</p>	<p>responsibility for formulating a logical procedure/sequence of work with reference to airtightness</p> <p>responsibility for completion of tasks related to correctly prepping surfaces for application of airtight applications (dust removal, priming, applying base layers) in order to ensure long-term maintenance of airtightness and vapour control</p> <p>responsibility for completion of tasks related to ensuring absolute continuity of the three key layers providing vapour control, airtightness and windtightness and without tears or unsealed penetrations</p> <p>responsibility for and confidence to question the application of bogus airtightness materials proposed by others which might fail in the longer term</p> <p>responsibility for and confidence to stop progress on project advancement if necessary if construction details and / or materials being proposed are regarded as being risky</p> <p>responsibility for completion of tasks related to identification of when it is best suited to carry out interim airtightness tests, based on the principle of being able to fix leaks before areas are closed up</p> <p>responsibility for completion of tasks related to preparation of construction project for arrival of airtightness tester to ensure optimal use of the tester’s time.</p> <p>responsibility for completion of tasks related to applying tapes, membranes and flexible sealants which do not compromise the</p>

<p>diffuse layers from inside to outside (“drying-out”)</p> <p>knowledge on facts, principles, processes and general concepts relating to different approaches that can be used to regulate and control air, vapour and wind movement including materials best-suited to different construction types (membranes versus plasters versus specialist sheeting)</p> <p>knowledge on facts, principles, processes and general concepts relating to the use of appropriate materials for the control of air flow and vapour movement and avoidance of materials (such as impermeable plastics) which could cause significantly adverse effects with respect to vapour trapping</p>	<p>the insulation layer into a cold exterior wall and the potential for rot over time arising from mould and condensation</p> <p>cognitive and practical skills required to explain the importance of the q50 value in large buildings</p> <p>cognitive, practical and communication skills required to bring co-workers (who might be older and ‘more experienced’) on-board regarding the importance of dealing appropriately with airtightness</p>	<p>quality of aesthetic finishes on exposed surfaces (a common example being too much tape overlapping on window frames which will not be covered later by subsequent finishes) and thus left exposed requiring subsequent removal</p>
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Mechanical Ventilation with Heat Recovery (MVHR)

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the benefits of including a controlled ventilation system in a DER</p> <p>knowledge on facts, principles, processes and general concepts on the principles of heat recovery from exhaust air and tempering of fresh air</p> <p>knowledge on facts, principles, processes and general concepts about use of MVHR’s in DER in terms of noise levels, electrical energy requirement for the fans and impact on reduce heating and / or cooling demand</p> <p>knowledge on facts, principles, processes and general concepts on the two most common ducting arrangements used in residential ventilation systems (trunk-and-branch as well as octopus) and the impact these systems will</p>	<p>cognitive and practical skills required to sketch a schematic layout of the key components of a home MVHR system</p> <p>cognitive and practical skills required to install an MVHR in a home including key components such as heat exchanger, ducting, supply and exhaust registers, condensate drain and post heater</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers to ensure optimal flow rates in the spaces in which they serve and to avoid potential annoyance or irritation to occupants due to inappropriate positioning of registers</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers such that flow rates are unlikely to be adversely affected by occupants unwittingly placing furniture, storage or other</p>	<p>responsibility for suitably locating the MVHR unit considering most especially ease of access for the homeowner for the purposes of changing the filters but also positioning close to the thermal envelope thereby minimising the length of thermal bridges created by the two ducts which connect to the exterior</p> <p>responsibility for avoidance of using inappropriate ducting materials which could adversely impact on pressure losses, ease of cleaning and creation of noise and turbulence</p> <p>responsibility for full execution of the ventilation system design including provision of all specified ancillary components such as sound attenuators, filters for extract registers and fire and smoke dampers</p> <p>responsibility for completion of tasks related to ensuring that all connections are completely</p>

<p>have on the need for sound attenuators</p> <p>knowledge on facts, principles, processes and general concepts on the preferred duct types to ensure smooth air flow and avoiding sagging or kinking</p> <p>knowledge on facts, principles, processes and general concepts on the key components of a balanced ventilation system with heat recovery in drawings and buildings</p>	<p>impediments over or close to them</p> <p>cognitive and practical skills required to securely fix the routing and positions of ducts and registers so that there is minimal risk of adjustment or movement post-occupancy which would compromise their performance</p> <p>cognitive and practical skills required to carefully route ducts through the project to avoid excessive pressure losses which would result in increased fan energy use and possible risk of increased noise for occupants arising from the increased turbulence</p> <p>cognitive and practical skills required to thoroughly and completely insulate the two air ducts which connect to the exterior through the thermal envelope in order to minimise any adverse thermal bridge effect</p> <p>cognitive and practical skills required to secure a completely airtight seal of the two external air ducts at the locations where (a) they connect to the MVHR unit and (b) where they penetrate the thermal envelope</p> <p>cognitive and practical skills required to appropriately position the supply and exhaust air grilles where they exit from the conditioned space with special emphasis on avoiding short-circuiting of air flow (and resulting possible contamination)</p> <p>cognitive and practical skills required to select appropriately sized mesh coverings for external ducts openings so that they do not clog over time with small particles</p> <p>cognitive and practical skills required to measure volumetric flow rates at registers and to adjust supply and extract registers to deliver the required</p>	<p>airtight and that the two air ducts which penetrate the envelope are entirely and completely insulated with vapour tight insulation</p> <p>responsibility for completion of tasks related to ensure excellent hygiene during installation especially preventing soiling of ducts and registers through dust and debris</p> <p>responsibility for completion of tasks related to routing of condensate drain to appropriate disposal point</p> <p>responsibility for installation of correct filters in the outdoor air side and extract air side</p> <p>responsibility for hygienic protection of the filters prior to commissioning the system from risks presented by contaminants and / or moisture / humidity</p> <p>responsibility for completion of tasks related to ensuring that the duct network can be easily cleaned in the future should the need arise</p> <p>responsibility for ensuring that the homeowner knows why they should replace the MVHR filter at regular intervals and how they can replace them</p> <p>responsibility for dealing with queries and concerns from homeowners once they move in and are getting used to the MVHR system (taking the initiative to follow-up with the homeowner to make sure that everything is working well)</p>
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	volume flow rate as per the system design	
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Heating and cooling

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on what constitutes interior 'comfort' in both winter and summer with respect to temperature and relative humidity</p> <p>knowledge on facts, principles, processes and general concepts on the differences between heating and cooling 'demand' and heating and cooling 'load'</p> <p>knowledge on facts, principles, processes and general concepts on the differences in demand and load levels for heating and cooling in older (inefficient) dwellings and those of deep energy retrofit projects</p> <p>knowledge on facts, principles, processes and general concepts on heating high performance homes via the mechanical ventilation with heat recovery using a 'post-heater'</p> <p>knowledge on principles and general concepts on the difference between latent and sensible cooling</p> <p>knowledge on principles and general concepts on what constitutes 'overheating' and what passive measures can be used to reduce risk of overheating</p> <p>knowledge on facts, principles, processes and general concepts on insulation of pipework and the significant influence of this on energy consumption, especially when heating and cooling generators are located outside of the thermal envelope</p>	<p>cognitive and practical skills required to sketch a schematic layout for a heating and / or cooling system for a single family dwelling</p> <p>cognitive and practical skills required to accomplish tasks related to installation of replacement heating and cooling equipment for high performance homes</p> <p>cognitive and practical skills required to accomplish tasks related to ensuring continuity of vapour tightness of pipework where required</p>	<p>responsibility for completion of tasks related to upgrading of heating and cooling systems</p> <p>responsibility for completion of tasks related to thorough and complete insulation of pipework, including all fittings, junctions and valves as well as through-envelope penetrations</p> <p>responsibility for completion of tasks related to appropriate placement of the thermostat(s) which regulates the operation of the heating and / or cooling system.</p>



Specific topics for the craft

Knowledge	Skills	Responsibility/Autonomy
<p><i>basic knowledge</i> of requirements for physical properties and processes in roof construction including vapour transfer</p> <p><i>knowledge</i> and <i>comprehension</i> of construction drawings and technical documentations, reading the detailed drawings of the rough carpentry</p> <p><i>knowledge</i> and <i>comprehension</i> of the technical documentation for the manufacture, assembly, disassembly and maintenance of the formwork, scaffolding and auxiliary structures</p> <p><i>knowledge</i> of manufacturing wood elements carpentry constructions</p> <p><i>knowledge</i> of the physical properties of wood</p> <p><i>knowledge</i> in processing and machining of structural elements</p> <p><i>knowledge</i> of surface treatment of structural elements (pickling, glazing, painting, ...)</p> <p><i>knowledge</i> of building structures connection</p> <p><i>knowledge</i> and <i>overview</i> of types of fasteners and their use and proper assembly</p> <p><i>knowledge</i> of structural statics and their loads</p> <p><i>knowledge</i> of types of roof structures</p> <p><i>knowledge</i> of the principle of making openings in the roof structure</p> <p><i>knowledge</i> of regulations and technical standards in construction</p> <p><i>knowledge</i> of occupational safety and fire protection in construction</p>	<p><i>skill</i> to read and understand the implementation drawings of carpentry structure</p> <p><i>skill</i> to use appropriate documentation to solve a given task</p> <p><i>skill</i> to correctly measure, schedule and scribe the timber elements of carpentry structures</p> <p><i>skill</i> to surveying and checking the condition of the building before the manufacture and installation of any rough carpentry</p> <p><i>skill</i> to calculate the consumption of wood materials and fasteners</p> <p><i>skills</i> for manual and mechanical material processing</p> <p>Manual <i>dexterity</i> and <i>skill</i> during assembly</p> <p><i>skill</i> to perform inspection measurements and functional tests of building structures</p> <p><i>skill</i> to deal with people, communicate with customers and fitters on construction sites</p> <p><i>skill</i> to deal with air-tight membranes, tapes and sealing for the proper implementation of the air-tight layer.</p>	<p><i>responsibility</i> for conduct during the operations</p> <p><i>responsibility</i> to design of work processes for the manufacture, assembly, disassembly and repair of any rough carpentry</p> <p><i>responsibility</i> for the correct position and checking parameters of the construction to the manufacture and assembly of carpentry structures</p> <p><i>responsibility</i> to assessing the quality of carpentry materials using available means</p> <p><i>responsibility</i> for static stability and structural stability</p> <p><i>responsibility</i> for work safety and fire safety</p> <p><i>responsibility</i> for the correct use of mechanical tools and machinery</p> <p><i>responsibility</i> for the correct use and maintenance of tools, tools and equipment for assembly work</p> <p><i>responsibility</i> for the implementation of the airtight-layer of the roof structures to make vapour transfer possible</p>

3. Electrician (high-voltage)

Airtightness

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the necessity of airtightness, vapour control and windtightness in a building and the multitude of benefits they bring</p> <p>knowledge on facts, principles, processes and general concepts on the critical importance of coupling airtightness with ventilation (“<i>build tight-ventilate right</i>”)</p> <p>knowledge on facts, principles, processes and general concepts on the principle of an airtight layer (red pencil method and single airtight layer)</p> <p>knowledge on facts, principles, processes and general concepts on typical weak points in the case of airtightness, vapour control and windtightness</p> <p>knowledge on facts, principles, processes and general concepts on the difference and relationships between vapour control, airtightness and wind resistance</p> <p>knowledge on facts, principles, processes and general concepts on the role of dew point as a risk factor in determining likelihood of condensation and mould formation</p> <p>knowledge on facts, principles, processes and general concepts regarding the Importance of introducing a vapour control layer to reduce the potential for transfer of vapour from inside, through the envelope towards the exterior</p> <p>knowledge on facts, principles, processes and general concepts relating to the principle of increasing permeability of vapour</p>	<p>cognitive and practical skills required to explain the importance of airtightness, windtightness and vapour control in buildings</p> <p>cognitive and practical skills required to explain the difference between air-tightness and ‘breathability’ and distinction between ‘airtight’ yet ‘vapour open’</p> <p>cognitive and practical skills required to explain the principle of the pressurisation test method and explain the benefits of completing both positive and negative pressurisation tests</p> <p>cognitive and practical skills required to operate fans (such as ‘wincon’) to create a pressure difference between inside and outside for the purposes of pre-checking airtightness in advance of the official pressurisation tests</p> <p>cognitive and practical skills required to identify leaks in a building envelope using a variety of methods including smoke-sticks and thermography where practicable</p> <p>cognitive and practical skills required to achieve high levels of airtightness ($n_{50} \leq 1.0$ ac/hr) using a broad variety of materials and methods including specialist skills in dealing with challenging 3-D connections as well as penetrations and transition points in the envelope</p> <p>cognitive and practical skills required to identify the airtight layer and its constituent parts in drawings and buildings</p> <p>cognitive and practical skills required to seal elements such as wooden joists which penetrate</p>	<p>responsibility for formulating a logical procedure/sequence of work with reference to airtightness</p> <p>responsibility for completion of tasks related to correctly prepping surfaces for application of airtight applications (dust removal, priming, applying base layers) in order to ensure long-term maintenance of airtightness and vapour control</p> <p>responsibility for completion of tasks related to ensuring absolute continuity of the three key layers providing vapour control, airtightness and windtightness and without tears or unsealed penetrations</p> <p>responsibility for and confidence to question the application of bogus airtightness materials proposed by others which might fail in the longer term</p> <p>responsibility for and confidence to stop progress on project advancement if necessary if construction details and / or materials being proposed are regarded as being risky</p> <p>responsibility for completion of tasks related to identification of when it is best suited to carry out interim airtightness tests, based on the principle of being able to fix leaks before areas are closed up</p> <p>responsibility for completion of tasks related to preparation of construction project for arrival of airtightness tester to ensure optimal use of the tester’s time.</p> <p>responsibility for completion of tasks related to applying tapes, membranes and flexible sealants which do not compromise the</p>



<p>diffuse layers from inside to outside (“drying-out”)</p> <p>knowledge on facts, principles, processes and general concepts relating to different approaches that can be used to regulate and control air, vapour and wind movement including materials best-suited to different construction types (membranes versus plasters versus specialist sheeting)</p> <p>knowledge on facts, principles, processes and general concepts relating to the use of appropriate materials for the control of air flow and vapour movement and avoidance of materials (such as impermeable plastics) which could cause significantly adverse effects with respect to vapour trapping</p>	<p>the insulation layer into a cold exterior wall and the potential for rot over time arising from mould and condensation</p> <p>cognitive and practical skills required to explain the importance of the q50 value in large buildings</p> <p>cognitive, practical and communication skills required to bring co-workers (who might be older and ‘more experienced’) on-board regarding the importance of dealing appropriately with airtightness</p>	<p>quality of aesthetic finishes on exposed surfaces (a common example being too much tape overlapping on window frames which will not be covered later by subsequent finishes) and thus left exposed requiring subsequent removal</p>
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Mechanical Ventilation with Heat Recovery (MVHR)

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the benefits of including a controlled ventilation system in a DER</p> <p>knowledge on facts, principles, processes and general concepts on the principles of heat recovery from exhaust air and tempering of fresh air</p> <p>knowledge on facts, principles, processes and general concepts about use of MVHR’s in DER in terms of noise levels, electrical energy requirement for the fans and impact on reduce heating and / or cooling demand</p> <p>knowledge on facts, principles, processes and general concepts on the two most common ducting arrangements used in residential ventilation systems (trunk-and-branch as well as octopus) and the impact these systems will</p>	<p>cognitive and practical skills required to sketch a schematic layout of the key components of a home MVHR system</p> <p>cognitive and practical skills required to install an MVHR in a home including key components such as heat exchanger, ducting, supply and exhaust registers, condensate drain and post heater</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers to ensure optimal flow rates in the spaces in which they serve and to avoid potential annoyance or irritation to occupants due to inappropriate positioning of registers</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers such that flow rates are unlikely to be adversely affected by occupants unwittingly placing furniture, storage or other</p>	<p>responsibility for suitably locating the MVHR unit considering most especially ease of access for the homeowner for the purposes of changing the filters but also positioning close to the thermal envelope thereby minimising the length of thermal bridges created by the two ducts which connect to the exterior</p> <p>responsibility for avoidance of using inappropriate ducting materials which could adversely impact on pressure losses, ease of cleaning and creation of noise and turbulence</p> <p>responsibility for full execution of the ventilation system design including provision of all specified ancillary components such as sound attenuators, filters for extract registers and fire and smoke dampers</p> <p>responsibility for completion of tasks related to ensuring that all connections are completely</p>



<p>have on the need for sound attenuators</p> <p>knowledge on facts, principles, processes and general concepts on the preferred duct types to ensure smooth air flow and avoiding sagging or kinking</p> <p>knowledge on facts, principles, processes and general concepts on the key components of a balanced ventilation system with heat recovery in drawings and buildings</p>	<p>impediments over or close to them</p> <p>cognitive and practical skills required to securely fix the routing and positions of ducts and registers so that there is minimal risk of adjustment or movement post-occupancy which would compromise their performance</p> <p>cognitive and practical skills required to carefully route ducts through the project to avoid excessive pressure losses which would result in increased fan energy use and possible risk of increased noise for occupants arising from the increased turbulence</p> <p>cognitive and practical skills required to thoroughly and completely insulate the two air ducts which connect to the exterior through the thermal envelope in order to minimise any adverse thermal bridge effect</p> <p>cognitive and practical skills required to secure a completely airtight seal of the two external air ducts at the locations where (a) they connect to the MVHR unit and (b) where they penetrate the thermal envelope</p> <p>cognitive and practical skills required to appropriately position the supply and exhaust air grilles where they exit from the conditioned space with special emphasis on avoiding short-circuiting of air flow (and resulting possible contamination)</p> <p>cognitive and practical skills required to select appropriately sized mesh coverings for external ducts openings so that they do not clog over time with small particles</p> <p>cognitive and practical skills required to measure volumetric flow rates at registers and to adjust supply and extract registers to deliver the required</p>	<p>airtight and that the two air ducts which penetrate the envelope are entirely and completely insulated with vapour tight insulation</p> <p>responsibility for completion of tasks related to ensure excellent hygiene during installation especially preventing soiling of ducts and registers through dust and debris</p> <p>responsibility for completion of tasks related to routing of condensate drain to appropriate disposal point</p> <p>responsibility for installation of correct filters in the outdoor air side and extract air side</p> <p>responsibility for hygienic protection of the filters prior to commissioning the system from risks presented by contaminants and / or moisture / humidity</p> <p>responsibility for completion of tasks related to ensuring that the duct network can be easily cleaned in the future should the need arise</p> <p>responsibility for ensuring that the homeowner knows why they should replace the MVHR filter at regular intervals and how they can replace them</p> <p>responsibility for dealing with queries and concerns from homeowners once they move in and are getting used to the MVHR system (taking the initiative to follow-up with the homeowner to make sure that everything is working well)</p>
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	volume flow rate as per the system design	
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Domestic Hot Water

Knowledge	Skills	responsibility/Autonomy General capabilities?
<p>knowledge on facts, principles, processes and general concepts on the energy demand of DHW production in a typical family home</p> <p>knowledge on facts, principles, processes and general concepts on the most efficient means of producing DHW, whether from a boiler or furnace, heat pump technology, electric resistance, solar thermal, solar electric or hybrid of the above</p> <p>knowledge on facts, principles, processes and general concepts on the significant losses from poorly insulated DHW pipes and that up to 50% of these losses cannot be used as free ‘passive’ heat gains</p> <p>knowledge on facts, principles, processes and general concepts on clustering rooms which use DHW in an effort to keep pipe-runs short which minimises heat losses</p> <p>knowledge on facts, principles, processes and general concepts regarding impact of using low-flow showerheads in reducing DHW demand</p> <p>knowledge on facts, principles, processes and general concepts on the potential energy contribution of heat recovery from drainwater</p> <p>knowledge on facts, principles, processes and general concepts on the losses from DHW storage tanks and the importance of continuous insulation</p>	<p>cognitive and practical skills required to sketch a schematic layout for a DHW system for a single family dwelling</p> <p>cognitive and practical skills required to accomplish tasks related to installation of an efficient DHW production, storage and circulation system, including the possible linking with a heating system and / or a solar thermal collector</p> <p>cognitive and practical skills required to install a DHW time and temperature control system</p> <p>cognitive and practical skills required to accomplish tasks related to full and complete insulation of DHW pipe network and confidence and commitment required to encourage and convince others on the building site to pursue excellence in execution of insulation of pipework</p> <p>cognitive and practical skills required to retrofit low-flow showerheads to reduce DHW demand</p> <p>cognitive and practical skills required to accomplish tasks related to installation of drainwater heat recovery system</p>	<p>responsibility for completion of tasks related to full and complete insulation of the entire network of DHW pipes, including all junctions, connections, valves and awkward parts of the system that are typically left uninsulated</p> <p>responsibility for completion of tasks related to full execution of the specification for insulating DHW pipes including thermal conductivity and thickness of insulation materials used.</p> <p>responsibility for reporting anomalies in best practice in relation to efficient DHW systems</p>

<p>knowledge on facts, principles, processes and general concepts on the significant contribution potential by solar thermal collectors towards DHW production and the challenges presented by the 'winter gap' in heating dominated climates</p> <p>knowledge on facts, principles, processes and general concepts on the energy consumption of DHW circulation pumps</p> <p>knowledge on facts, principles, processes and general concepts concerning the very real health and safety risks caused by Legionella</p>		
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Heating and cooling

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on what constitutes interior 'comfort' in both winter and summer with respect to temperature and relative humidity</p> <p>knowledge on facts, principles, processes and general concepts on the differences between heating and cooling 'demand' and heating and cooling 'load'</p> <p>knowledge on facts, principles, processes and general concepts on the differences in demand and load levels for heating and cooling in older (inefficient) dwellings and those of deep energy retrofit projects</p> <p>knowledge on facts, principles, processes and general concepts on heating high performance homes via the mechanical ventilation with heat recovery using a 'post-heater'</p> <p>knowledge on principles and general concepts on the</p>	<p>cognitive and practical skills required to sketch a schematic layout for a heating and / or cooling system for a single family dwelling</p> <p>cognitive and practical skills required to accomplish tasks related to installation of replacement heating and cooling equipment for high performance homes</p> <p>cognitive and practical skills required to accomplish tasks related to ensuring continuity of vapour tightness of pipework where required</p>	<p>responsibility for completion of tasks related to upgrading of heating and cooling systems</p> <p>responsibility for completion of tasks related to thorough and complete insulation of pipework, including all fittings, junctions and valves as well as through-envelope penetrations</p> <p>responsibility for completion of tasks related to appropriate placement of the thermostat(s) which regulates the operation of the heating and / or cooling system.</p>

<p>difference between latent and sensible cooling</p> <p><i>knowledge</i> on principles and general concepts on what constitutes 'overheating' and what passive measures can be used to reduce risk of overheating</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on insulation of pipework and the significant influence of this on energy consumption, especially when heating and cooling generators are located outside of the thermal envelope</p>		
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Specific topics for the craft

Knowledge	Skills	Responsibility/Autonomy
<p><i>knowledge</i> on facts, principles, processes and general concepts of OHS, work hygiene, creation and protection of environment</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on safety regulations in electro engineering, protection against electric shock, standards and principles of first aid and CPR</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of measuring and evaluation and knowledge of basic measuring devices</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of solutions of electric and electronic circuits. Functions and operation of electric machines, devices and systems</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of creation of technical drawing and documentation of energy equipment</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on methods of assembly, operation and repairs of cable</p>	<p><i>cognitive and practical skills</i> required to make basic project documentation of electrical equipment and installations</p> <p><i>cognitive and practical skills</i> required to identify the electrical material according to the purpose of the equipment, taking into account the attributes and processing method</p> <p><i>cognitive and practical skills</i> required to perform an independent analysis and solution of problems from electro technical practice</p> <p><i>cognitive and practical skills</i> required to solve basic circuits of direct and alternating current</p> <p><i>cognitive and practical skills</i> required to choose, with regard to technical and economic requirements, proper procedures and solutions</p> <p><i>cognitive and practical skills</i> required to operate at an appropriate level and diagnose the operability and functionality of the systems with measuring devices</p>	<p><i>responsibility</i> for quality of their work</p> <p><i>autonomy and determination</i> in solving the tasks and problems and analyse them</p> <p><i>responsibility</i> for precise and professional communication and work in team</p> <p><i>responsibility</i> for working disciplined and deliver the tasks as specified</p> <p><i>responsibility</i> for and confidence to stop progress on project advancement if necessary if installation details and / or materials being proposed are regarded as being risky</p> <p><i>responsibility</i> for creation of proper project documentation electrical equipment and installations</p> <p><i>responsibility</i> for proper functionality of solar electric or hybrid collectors installations</p> <p><i>responsibility</i> for proper functionality of the preparation for the e-cars</p>

<p>lines, protections and signalling systems</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on operation of electric devices</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of application of the principles of electricity use and cooperation with customers</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on issues of electric heat and light with knowledge in the field of lighting thermal equipment</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on principles and methods of designing of electric installations of residential and industrial wiring</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on standards, electro technical tables and catalogues</p> <p><i>knowledge</i> functionality of solar electric or hybrid collectors</p> <p><i>knowledge</i> of functionality of the preparation for the e-cars</p>	<p><i>cognitive and practical skills</i> required to attend and operate the devices as prepared</p> <p><i>cognitive and practical skills</i> required to use programs for processing technical documentation in electrical engineering</p>	
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4. Installer of windows and doors

Airtightness

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the necessity of airtightness, vapour control and windtightness in a building and the multitude of benefits they bring</p> <p>knowledge on facts, principles, processes and general concepts on the critical importance of coupling airtightness with ventilation (“<i>build tight-ventilate right</i>”)</p> <p>knowledge on facts, principles, processes and general concepts on the principle of an airtight layer (red pencil method and single airtight layer)</p> <p>knowledge on facts, principles, processes and general concepts on typical weak points in the case of airtightness, vapour control and windtightness</p> <p>knowledge on facts, principles, processes and general concepts on the difference and relationships between vapour control, airtightness and wind resistance</p> <p>knowledge on facts, principles, processes and general concepts on the role of dew point as a risk factor in determining likelihood of condensation and mould formation</p> <p>knowledge on facts, principles, processes and general concepts regarding the Importance of introducing a vapour control layer to reduce the potential for transfer of vapour from inside, through the envelope towards the exterior</p> <p>knowledge on facts, principles, processes and general concepts relating to the principle of increasing permeability of vapour</p>	<p>cognitive and practical skills required to explain the importance of airtightness, windtightness and vapour control in buildings</p> <p>cognitive and practical skills required to explain the difference between air-tightness and ‘breathability’ and distinction between ‘airtight’ yet ‘vapour open’</p> <p>cognitive and practical skills required to explain the principle of the pressurisation test method and explain the benefits of completing both positive and negative pressurisation tests</p> <p>cognitive and practical skills required to operate fans (such as ‘wincon’) to create a pressure difference between inside and outside for the purposes of pre-checking airtightness in advance of the official pressurisation tests</p> <p>cognitive and practical skills required to identify leaks in a building envelope using a variety of methods including smoke-sticks and thermography where practicable</p> <p>cognitive and practical skills required to achieve high levels of airtightness ($n_{50} \leq 1.0$ ac/hr) using a broad variety of materials and methods including specialist skills in dealing with challenging 3-D connections as well as penetrations and transition points in the envelope</p> <p>cognitive and practical skills required to identify the airtight layer and its constituent parts in drawings and buildings</p> <p>cognitive and practical skills required to seal elements such as wooden joists which penetrate</p>	<p>responsibility for formulating a logical procedure/sequence of work with reference to airtightness</p> <p>responsibility for completion of tasks related to correctly prepping surfaces for application of airtight applications (dust removal, priming, applying base layers) in order to ensure long-term maintenance of airtightness and vapour control</p> <p>responsibility for completion of tasks related to ensuring absolute continuity of the three key layers providing vapour control, airtightness and windtightness and without tears or unsealed penetrations</p> <p>responsibility for and confidence to question the application of bogus airtightness materials proposed by others which might fail in the longer term</p> <p>responsibility for and confidence to stop progress on project advancement if necessary if construction details and / or materials being proposed are regarded as being risky</p> <p>responsibility for completion of tasks related to identification of when it is best suited to carry out interim airtightness tests, based on the principle of being able to fix leaks before areas are closed up</p> <p>responsibility for completion of tasks related to preparation of construction project for arrival of airtightness tester to ensure optimal use of the tester’s time.</p> <p>responsibility for completion of tasks related to applying tapes, membranes and flexible sealants which do not compromise the</p>

<p>diffuse layers from inside to outside (“drying-out”)</p> <p>knowledge on facts, principles, processes and general concepts relating to different approaches that can be used to regulate and control air, vapour and wind movement including materials best-suited to different construction types (membranes versus plasters versus specialist sheeting)</p> <p>knowledge on facts, principles, processes and general concepts relating to the use of appropriate materials for the control of air flow and vapour movement and avoidance of materials (such as impermeable plastics) which could cause significantly adverse effects with respect to vapour trapping</p>	<p>the insulation layer into a cold exterior wall and the potential for rot over time arising from mould and condensation</p> <p>cognitive and practical skills required to explain the importance of the q50 value in large buildings</p> <p>cognitive, practical and communication skills required to bring co-workers (who might be older and ‘more experienced’) on-board regarding the importance of dealing appropriately with airtightness</p>	<p>quality of aesthetic finishes on exposed surfaces (a common example being too much tape overlapping on window frames which will not be covered later by subsequent finishes) and thus left exposed requiring subsequent removal</p>
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Mechanical Ventilation with Heat Recovery (MVHR)

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the benefits of including a controlled ventilation system in a DER</p> <p>knowledge on facts, principles, processes and general concepts on the principles of heat recovery from exhaust air and tempering of fresh air</p> <p>knowledge on facts, principles, processes and general concepts about use of MVHR’s in DER in terms of noise levels, electrical energy requirement for the fans and impact on reduce heating and / or cooling demand</p> <p>knowledge on facts, principles, processes and general concepts on the two most common ducting arrangements used in residential ventilation systems (trunk-and-branch as well as octopus) and the impact these systems will</p>	<p>cognitive and practical skills required to sketch a schematic layout of the key components of a home MVHR system</p> <p>cognitive and practical skills required to install an MVHR in a home including key components such as heat exchanger, ducting, supply and exhaust registers, condensate drain and post heater</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers to ensure optimal flow rates in the spaces in which they serve and to avoid potential annoyance or irritation to occupants due to inappropriate positioning of registers</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers such that flow rates are unlikely to be adversely affected by occupants unwittingly placing furniture, storage or other</p>	<p>responsibility for suitably locating the MVHR unit considering most especially ease of access for the homeowner for the purposes of changing the filters but also positioning close to the thermal envelope thereby minimising the length of thermal bridges created by the two ducts which connect to the exterior</p> <p>responsibility for avoidance of using inappropriate ducting materials which could adversely impact on pressure losses, ease of cleaning and creation of noise and turbulence</p> <p>responsibility for full execution of the ventilation system design including provision of all specified ancillary components such as sound attenuators, filters for extract registers and fire and smoke dampers</p> <p>responsibility for completion of tasks related to ensuring that all connections are completely</p>



<p>have on the need for sound attenuators</p> <p>knowledge on facts, principles, processes and general concepts on the preferred duct types to ensure smooth air flow and avoiding sagging or kinking</p> <p>knowledge on facts, principles, processes and general concepts on the key components of a balanced ventilation system with heat recovery in drawings and buildings</p>	<p>impediments over or close to them</p> <p>cognitive and practical skills required to securely fix the routing and positions of ducts and registers so that there is minimal risk of adjustment or movement post-occupancy which would compromise their performance</p> <p>cognitive and practical skills required to carefully route ducts through the project to avoid excessive pressure losses which would result in increased fan energy use and possible risk of increased noise for occupants arising from the increased turbulence</p> <p>cognitive and practical skills required to thoroughly and completely insulate the two air ducts which connect to the exterior through the thermal envelope in order to minimise any adverse thermal bridge effect</p> <p>cognitive and practical skills required to secure a completely airtight seal of the two external air ducts at the locations where (a) they connect to the MVHR unit and (b) where they penetrate the thermal envelope</p> <p>cognitive and practical skills required to appropriately position the supply and exhaust air grilles where they exit from the conditioned space with special emphasis on avoiding short-circuiting of air flow (and resulting possible contamination)</p> <p>cognitive and practical skills required to select appropriately sized mesh coverings for external ducts openings so that they do not clog over time with small particles</p> <p>cognitive and practical skills required to measure volumetric flow rates at registers and to adjust supply and extract registers to deliver the required</p>	<p>airtight and that the two air ducts which penetrate the envelope are entirely and completely insulated with vapour tight insulation</p> <p>responsibility for completion of tasks related to ensure excellent hygiene during installation especially preventing soiling of ducts and registers through dust and debris</p> <p>responsibility for completion of tasks related to routing of condensate drain to appropriate disposal point</p> <p>responsibility for installation of correct filters in the outdoor air side and extract air side</p> <p>responsibility for hygienic protection of the filters prior to commissioning the system from risks presented by contaminants and / or moisture / humidity</p> <p>responsibility for completion of tasks related to ensuring that the duct network can be easily cleaned in the future should the need arise</p> <p>responsibility for ensuring that the homeowner knows why they should replace the MVHR filter at regular intervals and how they can replace them</p> <p>responsibility for dealing with queries and concerns from homeowners once they move in and are getting used to the MVHR system (taking the initiative to follow-up with the homeowner to make sure that everything is working well)</p>
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	volume flow rate as per the system design	
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Heating and cooling

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on what constitutes interior 'comfort' in both winter and summer with respect to temperature and relative humidity</p> <p>knowledge on facts, principles, processes and general concepts on the differences between heating and cooling 'demand' and heating and cooling 'load'</p> <p>knowledge on facts, principles, processes and general concepts on the differences in demand and load levels for heating and cooling in older (inefficient) dwellings and those of deep energy retrofit projects</p> <p>knowledge on facts, principles, processes and general concepts on heating high performance homes via the mechanical ventilation with heat recovery using a 'post-heater'</p> <p>knowledge on principles and general concepts on the difference between latent and sensible cooling</p> <p>knowledge on principles and general concepts on what constitutes 'overheating' and what passive measures can be used to reduce risk of overheating</p> <p>knowledge on facts, principles, processes and general concepts on insulation of pipework and the significant influence of this on energy consumption, especially when heating and cooling generators are located outside of the thermal envelope</p>	<p>cognitive and practical skills required to sketch a schematic layout for a heating and / or cooling system for a single family dwelling</p> <p>cognitive and practical skills required to accomplish tasks related to installation of replacement heating and cooling equipment for high performance homes</p> <p>cognitive and practical skills required to accomplish tasks related to ensuring continuity of vapour tightness of pipework where required</p>	<p>responsibility for completion of tasks related to upgrading of heating and cooling systems</p> <p>responsibility for completion of tasks related to thorough and complete insulation of pipework, including all fittings, junctions and valves as well as through-envelope penetrations</p> <p>responsibility for completion of tasks related to appropriate placement of the thermostat(s) which regulates the operation of the heating and / or cooling system.</p>



Specific topic for the craft

Knowledge	Skills	Responsibility/Autonomy
<p><i>knowledge</i> in the field of prefabricated buildings technology, appropriate techniques and processes</p> <p><i>knowledge</i> of the physical requirements and functionality of the openings</p> <p><i>advanced knowledge</i> of types of fillings and possibilities of their use</p> <p><i>advanced knowledge</i> of glazing and glazing properties (thermal resistance, light transmittance, transparency, weight, etc.)</p> <p><i>advanced knowledge</i> in the field of construction of frames (material, thermal resistance, airtight connection, etc.)</p> <p><i>knowledge</i> of waterproofing</p> <p><i>knowledge</i> of building construction, materials and wall surfaces</p> <p><i>advanced knowledge</i> of the type of anchoring and fixing prefabricated parts of structures</p> <p><i>knowledge and overview</i> of the fastening and anchoring materials, methods for their use and proper installation</p> <p><i>knowledge</i> of the behaviour of materials and their properties (e.g. hardness, elasticity, toughness, etc.)</p> <p><i>knowledge</i> of the correct joints of components and materials</p> <p><i>knowledge</i> of technical drawing and reading in construction drawings</p> <p><i>knowledge</i> of regulations and technical standards in construction</p> <p><i>knowledge</i> of occupational safety and fire protection in construction</p>	<p><i>cognitive and practical skills</i> to read in drawing documentation, understand it properly and apply it to workflow</p> <p>Manual <i>dexterity and skill</i> during the assembly</p> <p><i>skills</i> to work with measuring tools</p> <p><i>cognitive and practical skills</i> to deal with people, to communicate with customers and installers in construction</p> <p><i>cognitive and practical skills</i> of repair and modification of building structures and building components</p> <p><i>cognitive and practical skills</i> to perform control measurements and functional tests of building structures</p> <p><i>cognitive and practical skills</i> to operate construction machinery and equipment within the scope of the acquired privileges</p> <p><i>skill</i> to engage and commission automated systems associated with the openings (automatic systems, opening, etc.)</p>	<p><i>responsibility</i> for conduct during the operations</p> <p><i>responsibility</i> for work safety and fire protection in construction</p> <p><i>responsibility</i> to determine the appropriate workflow, means and methods according to design and technical documentation</p> <p><i>responsibility</i> for the functionality of the installed components (undamaged glazing, functional opening, etc.)</p> <p><i>responsible</i> for the correct orientation and positioning of prefabricated structures</p> <p><i>responsible</i> for the correct use and maintenance of tools, tools and equipment for assembly work</p>

<p><i>advanced knowledge</i> of shading structures and methods of shading</p> <p><i>knowledge</i> in automation of windows/door function</p>		
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5. Hydro-insulator (roofs and foundations)

Airtightness

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the necessity of airtightness, vapour control and windtightness in a building and the multitude of benefits they bring</p> <p>knowledge on facts, principles, processes and general concepts on the critical importance of coupling airtightness with ventilation (“<i>build tight-ventilate right</i>”)</p> <p>knowledge on facts, principles, processes and general concepts on the principle of an airtight layer (red pencil method and single airtight layer)</p> <p>knowledge on facts, principles, processes and general concepts on typical weak points in the case of airtightness, vapour control and windtightness</p> <p>knowledge on facts, principles, processes and general concepts on the difference and relationships between vapour control, airtightness and wind resistance</p> <p>knowledge on facts, principles, processes and general concepts on the role of dew point as a risk factor in determining likelihood of condensation and mould formation</p> <p>knowledge on facts, principles, processes and general concepts regarding the Importance of introducing a vapour control layer to reduce the potential for transfer of vapour from inside, through the envelope towards the exterior</p> <p>knowledge on facts, principles, processes and general concepts relating to the principle of increasing permeability of vapour</p>	<p>cognitive and practical skills required to explain the importance of airtightness, windtightness and vapour control in buildings</p> <p>cognitive and practical skills required to explain the difference between air-tightness and ‘breathability’ and distinction between ‘airtight’ yet ‘vapour open’</p> <p>cognitive and practical skills required to explain the principle of the pressurisation test method and explain the benefits of completing both positive and negative pressurisation tests</p> <p>cognitive and practical skills required to operate fans (such as ‘wincon’) to create a pressure difference between inside and outside for the purposes of pre-checking airtightness in advance of the official pressurisation tests</p> <p>cognitive and practical skills required to identify leaks in a building envelope using a variety of methods including smoke-sticks and thermography where practicable</p> <p>cognitive and practical skills required to achieve high levels of airtightness ($n_{50} \leq 1.0$ ac/hr) using a broad variety of materials and methods including specialist skills in dealing with challenging 3-D connections as well as penetrations and transition points in the envelope</p> <p>cognitive and practical skills required to identify the airtight layer and its constituent parts in drawings and buildings</p> <p>cognitive and practical skills required to seal elements such as wooden joists which penetrate</p>	<p>responsibility for formulating a logical procedure/sequence of work with reference to airtightness</p> <p>responsibility for completion of tasks related to correctly prepping surfaces for application of airtight applications (dust removal, priming, applying base layers) in order to ensure long-term maintenance of airtightness and vapour control</p> <p>responsibility for completion of tasks related to ensuring absolute continuity of the three key layers providing vapour control, airtightness and windtightness and without tears or unsealed penetrations</p> <p>responsibility for and confidence to question the application of bogus airtightness materials proposed by others which might fail in the longer term</p> <p>responsibility for and confidence to stop progress on project advancement if necessary if construction details and / or materials being proposed are regarded as being risky</p> <p>responsibility for completion of tasks related to identification of when it is best suited to carry out interim airtightness tests, based on the principle of being able to fix leaks before areas are closed up</p> <p>responsibility for completion of tasks related to preparation of construction project for arrival of airtightness tester to ensure optimal use of the tester’s time.</p> <p>responsibility for completion of tasks related to applying tapes, membranes and flexible sealants which do not compromise the</p>

<p>diffuse layers from inside to outside (“drying-out”)</p> <p>knowledge on facts, principles, processes and general concepts relating to different approaches that can be used to regulate and control air, vapour and wind movement including materials best-suited to different construction types (membranes versus plasters versus specialist sheeting)</p> <p>knowledge on facts, principles, processes and general concepts relating to the use of appropriate materials for the control of air flow and vapour movement and avoidance of materials (such as impermeable plastics) which could cause significantly adverse effects with respect to vapour trapping</p>	<p>the insulation layer into a cold exterior wall and the potential for rot over time arising from mould and condensation</p> <p>cognitive and practical skills required to explain the importance of the q50 value in large buildings</p> <p>cognitive, practical and communication skills required to bring co-workers (who might be older and ‘more experienced’) on-board regarding the importance of dealing appropriately with airtightness</p>	<p>quality of aesthetic finishes on exposed surfaces (a common example being too much tape overlapping on window frames which will not be covered later by subsequent finishes) and thus left exposed requiring subsequent removal</p>
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Mechanical Ventilation with Heat Recovery (MVHR)

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the benefits of including a controlled ventilation system in a DER</p> <p>knowledge on facts, principles, processes and general concepts on the principles of heat recovery from exhaust air and tempering of fresh air</p> <p>knowledge on facts, principles, processes and general concepts about use of MVHR’s in DER in terms of noise levels, electrical energy requirement for the fans and impact on reduce heating and / or cooling demand</p> <p>knowledge on facts, principles, processes and general concepts on the two most common ducting arrangements used in residential ventilation systems (trunk-and-branch as well as octopus) and the impact these systems will</p>	<p>cognitive and practical skills required to sketch a schematic layout of the key components of a home MVHR system</p> <p>cognitive and practical skills required to install an MVHR in a home including key components such as heat exchanger, ducting, supply and exhaust registers, condensate drain and post heater</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers to ensure optimal flow rates in the spaces in which they serve and to avoid potential annoyance or irritation to occupants due to inappropriate positioning of registers</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers such that flow rates are unlikely to be adversely affected by occupants unwittingly placing furniture, storage or other</p>	<p>responsibility for suitably locating the MVHR unit considering most especially ease of access for the homeowner for the purposes of changing the filters but also positioning close to the thermal envelope thereby minimising the length of thermal bridges created by the two ducts which connect to the exterior</p> <p>responsibility for avoidance of using inappropriate ducting materials which could adversely impact on pressure losses, ease of cleaning and creation of noise and turbulence</p> <p>responsibility for full execution of the ventilation system design including provision of all specified ancillary components such as sound attenuators, filters for extract registers and fire and smoke dampers</p> <p>responsibility for completion of tasks related to ensuring that all connections are completely</p>



<p>have on the need for sound attenuators</p> <p>knowledge on facts, principles, processes and general concepts on the preferred duct types to ensure smooth air flow and avoiding sagging or kinking</p> <p>knowledge on facts, principles, processes and general concepts on the key components of a balanced ventilation system with heat recovery in drawings and buildings</p>	<p>impediments over or close to them</p> <p>cognitive and practical skills required to securely fix the routing and positions of ducts and registers so that there is minimal risk of adjustment or movement post-occupancy which would compromise their performance</p> <p>cognitive and practical skills required to carefully route ducts through the project to avoid excessive pressure losses which would result in increased fan energy use and possible risk of increased noise for occupants arising from the increased turbulence</p> <p>cognitive and practical skills required to thoroughly and completely insulate the two air ducts which connect to the exterior through the thermal envelope in order to minimise any adverse thermal bridge effect</p> <p>cognitive and practical skills required to secure a completely airtight seal of the two external air ducts at the locations where (a) they connect to the MVHR unit and (b) where they penetrate the thermal envelope</p> <p>cognitive and practical skills required to appropriately position the supply and exhaust air grilles where they exit from the conditioned space with special emphasis on avoiding short-circuiting of air flow (and resulting possible contamination)</p> <p>cognitive and practical skills required to select appropriately sized mesh coverings for external ducts openings so that they do not clog over time with small particles</p> <p>cognitive and practical skills required to measure volumetric flow rates at registers and to adjust supply and extract registers to deliver the required</p>	<p>airtight and that the two air ducts which penetrate the envelope are entirely and completely insulated with vapour tight insulation</p> <p>responsibility for completion of tasks related to ensure excellent hygiene during installation especially preventing soiling of ducts and registers through dust and debris</p> <p>responsibility for completion of tasks related to routing of condensate drain to appropriate disposal point</p> <p>responsibility for installation of correct filters in the outdoor air side and extract air side</p> <p>responsibility for hygienic protection of the filters prior to commissioning the system from risks presented by contaminants and / or moisture / humidity</p> <p>responsibility for completion of tasks related to ensuring that the duct network can be easily cleaned in the future should the need arise</p> <p>responsibility for ensuring that the homeowner knows why they should replace the MVHR filter at regular intervals and how they can replace them</p> <p>responsibility for dealing with queries and concerns from homeowners once they move in and are getting used to the MVHR system (taking the initiative to follow-up with the homeowner to make sure that everything is working well)</p>
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	volume flow rate as per the system design	
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Heating and cooling

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on what constitutes interior 'comfort' in both winter and summer with respect to temperature and relative humidity</p> <p>knowledge on facts, principles, processes and general concepts on the differences between heating and cooling 'demand' and heating and cooling 'load'</p> <p>knowledge on facts, principles, processes and general concepts on the differences in demand and load levels for heating and cooling in older (inefficient) dwellings and those of deep energy retrofit projects</p> <p>knowledge on facts, principles, processes and general concepts on heating high performance homes via the mechanical ventilation with heat recovery using a 'post-heater'</p> <p>knowledge on principles and general concepts on the difference between latent and sensible cooling</p> <p>knowledge on principles and general concepts on what constitutes 'overheating' and what passive measures can be used to reduce risk of overheating</p> <p>knowledge on facts, principles, processes and general concepts on insulation of pipework and the significant influence of this on energy consumption, especially when heating and cooling generators are located outside of the thermal envelope</p>	<p>cognitive and practical skills required to sketch a schematic layout for a heating and / or cooling system for a single family dwelling</p> <p>cognitive and practical skills required to accomplish tasks related to installation of replacement heating and cooling equipment for high performance homes</p> <p>cognitive and practical skills required to accomplish tasks related to ensuring continuity of vapour tightness of pipework where required</p>	<p>responsibility for completion of tasks related to upgrading of heating and cooling systems</p> <p>responsibility for completion of tasks related to thorough and complete insulation of pipework, including all fittings, junctions and valves as well as through-envelope penetrations</p> <p>responsibility for completion of tasks related to appropriate placement of the thermostat(s) which regulates the operation of the heating and / or cooling system.</p>



Specific topics for the craft

Knowledge	Skills	Responsibility/Autonomy
<p>basic knowledge of requirements for physical properties and processes in roof and foundation construction</p> <p>knowledge and comprehension of building drawings and building documentation</p> <p>knowledge of regulations, technical standards in construction and standards for designing nZEB</p> <p>knowledge and comprehension of waterproofing construction details and links to other construct professions</p> <p>knowledge and comprehension of construction drawings and technical documentations, reading the detailed drawings of the waterproofing constructions</p> <p>knowledge and comprehension of the technical documentation for the manufacture, assembly, disassembly and maintenance of the formwork, scaffolding and auxiliary structures</p> <p>knowledge in assembling and repairing waterproofing construction in new buildings and renovations, including relevant work procedures</p> <p>knowledge of possible faults in waterproofing structures and methods of their removal during the assembly of waterproofing constructions</p> <p>knowledge of inspection, protection and maintenance procedures, and handover of the finished waterproofing</p> <p>knowledge of types and physical properties of waterproofing materials and the possibility of their combination with other building materials</p> <p>knowledge in processing and machining of structural elements</p>	<p>skill to apply theoretical knowledge in practical building activities</p> <p>skill to read and understand the implementation drawings related to waterproofing layer structures</p> <p>skill to read and understand building drawings and wiring drawings</p> <p>skill to appropriately use professional terminology, technical standardization documents and nZEB design standards to solve a given task</p> <p>skill to assess the quality and suitability of proposed and used materials</p> <p>skill to surveying and checking the condition of the building before the manufacture and installation of any waterproofing layers</p> <p>skill to prepare different types of underlays for waterproofing work</p> <p>skill to measure and calculate flat roof area and foundations and calculate consumption of waterproofing materials and fasteners</p> <p>skills for manual and mechanical material processing</p> <p>skills for operation of the welding equipment and tools</p> <p>skill to the correct use of mechanical tools and machinery</p> <p>skills to understand and work with technical data sheets, manuals and catalogues of manufacturers of waterproofing materials</p> <p>Manual dexterity and skill during assembly including correct material storage and manipulation</p>	<p>responsibility for conduct during the operations and for ability for working in teams</p> <p>responsibility to design work processes for the manufacture, assembly, disassembly and repair of any waterproofing layers</p> <p>responsibility for the correct position and checking parameters of the construction to the manufacture and assembly of waterproofing layers</p> <p>responsibility for proper design and assembly of construction details of waterproofing layers</p> <p>responsibility for the ability to work at heights</p> <p>responsibility for the integrity and stability of the waterproofing layer</p> <p>responsibility for work safety and fire safety</p> <p>responsibility for the correct use of mechanical tools and machinery</p> <p>responsibility for the correct use and maintenance of tools, tools and equipment for assembly work</p> <p>responsibility for the proper implementation of the green roofs</p>

<p><i>knowledge</i> of surface treatment of structural elements in contact with waterproofing layers</p> <p><i>knowledge</i> of building structures connection</p> <p><i>knowledge</i> and <i>overview</i> of types of fasteners and their use and proper assembly</p> <p><i>knowledge</i> and <i>overview</i> of types of roof and foundation constructions</p> <p><i>knowledge</i> of the principle of making openings in the roof and foundation structure</p> <p><i>knowledge</i> of occupational safety and fire protection in construction</p> <p><i>knowledge</i> of waste management and compliance with the occupational safety & health regulations when installing the waterproofing systems</p> <p><i>knowledge</i> of the implementation of the green roofs, including technologies and materials</p>	<p><i>skill</i> to perform inspection measurements and functional tests of building structures</p> <p><i>skill</i> to deal with people, communicate with customers and fitters on construction sites</p>	
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6. Electrician (low voltage)

Airtightness

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the necessity of airtightness, vapour control and windtightness in a building and the multitude of benefits they bring</p> <p>knowledge on facts, principles, processes and general concepts on the critical importance of coupling airtightness with ventilation (“<i>build tight-ventilate right</i>”)</p> <p>knowledge on facts, principles, processes and general concepts on the principle of an airtight layer (red pencil method and single airtight layer)</p> <p>knowledge on facts, principles, processes and general concepts on typical weak points in the case of airtightness, vapour control and windtightness</p> <p>knowledge on facts, principles, processes and general concepts on the difference and relationships between vapour control, airtightness and wind resistance</p> <p>knowledge on facts, principles, processes and general concepts on the role of dew point as a risk factor in determining likelihood of condensation and mould formation</p> <p>knowledge on facts, principles, processes and general concepts regarding the Importance of introducing a vapour control layer to reduce the potential for transfer of vapour from inside, through the envelope towards the exterior</p> <p>knowledge on facts, principles, processes and general concepts relating to the principle of increasing permeability of vapour</p>	<p>cognitive and practical skills required to explain the importance of airtightness, windtightness and vapour control in buildings</p> <p>cognitive and practical skills required to explain the difference between air-tightness and ‘breathability’ and distinction between ‘airtight’ yet ‘vapour open’</p> <p>cognitive and practical skills required to explain the principle of the pressurisation test method and explain the benefits of completing both positive and negative pressurisation tests</p> <p>cognitive and practical skills required to operate fans (such as ‘wincon’) to create a pressure difference between inside and outside for the purposes of pre-checking airtightness in advance of the official pressurisation tests</p> <p>cognitive and practical skills required to identify leaks in a building envelope using a variety of methods including smoke-sticks and thermography where practicable</p> <p>cognitive and practical skills required to achieve high levels of airtightness ($n_{50} \leq 1.0$ ac/hr) using a broad variety of materials and methods including specialist skills in dealing with challenging 3-D connections as well as penetrations and transition points in the envelope</p> <p>cognitive and practical skills required to identify the airtight layer and its constituent parts in drawings and buildings</p> <p>cognitive and practical skills required to seal elements such as wooden joists which penetrate</p>	<p>responsibility for formulating a logical procedure/sequence of work with reference to airtightness</p> <p>responsibility for completion of tasks related to correctly prepping surfaces for application of airtight applications (dust removal, priming, applying base layers) in order to ensure long-term maintenance of airtightness and vapour control</p> <p>responsibility for completion of tasks related to ensuring absolute continuity of the three key layers providing vapour control, airtightness and windtightness and without tears or unsealed penetrations</p> <p>responsibility for and confidence to question the application of bogus airtightness materials proposed by others which might fail in the longer term</p> <p>responsibility for and confidence to stop progress on project advancement if necessary if construction details and / or materials being proposed are regarded as being risky</p> <p>responsibility for completion of tasks related to identification of when it is best suited to carry out interim airtightness tests, based on the principle of being able to fix leaks before areas are closed up</p> <p>responsibility for completion of tasks related to preparation of construction project for arrival of airtightness tester to ensure optimal use of the tester’s time.</p> <p>responsibility for completion of tasks related to applying tapes, membranes and flexible sealants which do not compromise the</p>

<p>diffuse layers from inside to outside (“drying-out”)</p> <p>knowledge on facts, principles, processes and general concepts relating to different approaches that can be used to regulate and control air, vapour and wind movement including materials best-suited to different construction types (membranes versus plasters versus specialist sheeting)</p> <p>knowledge on facts, principles, processes and general concepts relating to the use of appropriate materials for the control of air flow and vapour movement and avoidance of materials (such as impermeable plastics) which could cause significantly adverse effects with respect to vapour trapping</p>	<p>the insulation layer into a cold exterior wall and the potential for rot over time arising from mould and condensation</p> <p>cognitive and practical skills required to explain the importance of the q50 value in large buildings</p> <p>cognitive, practical and communication skills required to bring co-workers (who might be older and ‘more experienced’) on-board regarding the importance of dealing appropriately with airtightness</p>	<p>quality of aesthetic finishes on exposed surfaces (a common example being too much tape overlapping on window frames which will not be covered later by subsequent finishes) and thus left exposed requiring subsequent removal</p>
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Mechanical Ventilation with Heat Recovery (MVHR)

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the benefits of including a controlled ventilation system in a DER</p> <p>knowledge on facts, principles, processes and general concepts on the principles of heat recovery from exhaust air and tempering of fresh air</p> <p>knowledge on facts, principles, processes and general concepts about use of MVHR’s in DER in terms of noise levels, electrical energy requirement for the fans and impact on reduce heating and / or cooling demand</p> <p>knowledge on facts, principles, processes and general concepts on the two most common ducting arrangements used in residential ventilation systems (trunk-and-branch as well as octopus) and the impact these systems will</p>	<p>cognitive and practical skills required to sketch a schematic layout of the key components of a home MVHR system</p> <p>cognitive and practical skills required to install an MVHR in a home including key components such as heat exchanger, ducting, supply and exhaust registers, condensate drain and post heater</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers to ensure optimal flow rates in the spaces in which they serve and to avoid potential annoyance or irritation to occupants due to inappropriate positioning of registers</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers such that flow rates are unlikely to be adversely affected by occupants unwittingly placing furniture, storage or other</p>	<p>responsibility for suitably locating the MVHR unit considering most especially ease of access for the homeowner for the purposes of changing the filters but also positioning close to the thermal envelope thereby minimising the length of thermal bridges created by the two ducts which connect to the exterior</p> <p>responsibility for avoidance of using inappropriate ducting materials which could adversely impact on pressure losses, ease of cleaning and creation of noise and turbulence</p> <p>responsibility for full execution of the ventilation system design including provision of all specified ancillary components such as sound attenuators, filters for extract registers and fire and smoke dampers</p> <p>responsibility for completion of tasks related to ensuring that all connections are completely</p>

<p>have on the need for sound attenuators</p> <p>knowledge on facts, principles, processes and general concepts on the preferred duct types to ensure smooth air flow and avoiding sagging or kinking</p> <p>knowledge on facts, principles, processes and general concepts on the key components of a balanced ventilation system with heat recovery in drawings and buildings</p>	<p>impediments over or close to them</p> <p>cognitive and practical skills required to securely fix the routing and positions of ducts and registers so that there is minimal risk of adjustment or movement post-occupancy which would compromise their performance</p> <p>cognitive and practical skills required to carefully route ducts through the project to avoid excessive pressure losses which would result in increased fan energy use and possible risk of increased noise for occupants arising from the increased turbulence</p> <p>cognitive and practical skills required to thoroughly and completely insulate the two air ducts which connect to the exterior through the thermal envelope in order to minimise any adverse thermal bridge effect</p> <p>cognitive and practical skills required to secure a completely airtight seal of the two external air ducts at the locations where (a) they connect to the MVHR unit and (b) where they penetrate the thermal envelope</p> <p>cognitive and practical skills required to appropriately position the supply and exhaust air grilles where they exit from the conditioned space with special emphasis on avoiding short-circuiting of air flow (and resulting possible contamination)</p> <p>cognitive and practical skills required to select appropriately sized mesh coverings for external ducts openings so that they do not clog over time with small particles</p> <p>cognitive and practical skills required to measure volumetric flow rates at registers and to adjust supply and extract registers to deliver the required</p>	<p>airtight and that the two air ducts which penetrate the envelope are entirely and completely insulated with vapour tight insulation</p> <p>responsibility for completion of tasks related to ensure excellent hygiene during installation especially preventing soiling of ducts and registers through dust and debris</p> <p>responsibility for completion of tasks related to routing of condensate drain to appropriate disposal point</p> <p>responsibility for installation of correct filters in the outdoor air side and extract air side</p> <p>responsibility for hygienic protection of the filters prior to commissioning the system from risks presented by contaminants and / or moisture / humidity</p> <p>responsibility for completion of tasks related to ensuring that the duct network can be easily cleaned in the future should the need arise</p> <p>responsibility for ensuring that the homeowner knows why they should replace the MVHR filter at regular intervals and how they can replace them</p> <p>responsibility for dealing with queries and concerns from homeowners once they move in and are getting used to the MVHR system (taking the initiative to follow-up with the homeowner to make sure that everything is working well)</p>
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	volume flow rate as per the system design	
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Domestic Hot Water

Knowledge	Skills	responsibility/Autonomy General capabilities?
<p>knowledge on facts, principles, processes and general concepts on the energy demand of DHW production in a typical family home</p> <p>knowledge on facts, principles, processes and general concepts on the most efficient means of producing DHW, whether from a boiler or furnace, heat pump technology, electric resistance, solar thermal, solar electric or hybrid of the above</p> <p>knowledge on facts, principles, processes and general concepts on the significant losses from poorly insulated DHW pipes and that up to 50% of these losses cannot be used as free ‘passive’ heat gains</p> <p>knowledge on facts, principles, processes and general concepts on clustering rooms which use DHW in an effort to keep pipe-runs short which minimises heat losses</p> <p>knowledge on facts, principles, processes and general concepts regarding impact of using low-flow showerheads in reducing DHW demand</p> <p>knowledge on facts, principles, processes and general concepts on the potential energy contribution of heat recovery from drainwater</p> <p>knowledge on facts, principles, processes and general concepts on the losses from DHW storage tanks and the importance of continuous insulation</p>	<p>cognitive and practical skills required to sketch a schematic layout for a DHW system for a single family dwelling</p> <p>cognitive and practical skills required to accomplish tasks related to installation of an efficient DHW production, storage and circulation system, including the possible linking with a heating system and / or a solar thermal collector</p> <p>cognitive and practical skills required to install a DHW time and temperature control system</p> <p>cognitive and practical skills required to accomplish tasks related to full and complete insulation of DHW pipe network and confidence and commitment required to encourage and convince others on the building site to pursue excellence in execution of insulation of pipework</p> <p>cognitive and practical skills required to retrofit low-flow showerheads to reduce DHW demand</p> <p>cognitive and practical skills required to accomplish tasks related to installation of drainwater heat recovery system</p>	<p>responsibility for completion of tasks related to full and complete insulation of the entire network of DHW pipes, including all junctions, connections, valves and awkward parts of the system that are typically left uninsulated</p> <p>responsibility for completion of tasks related to full execution of the specification for insulating DHW pipes including thermal conductivity and thickness of insulation materials used.</p> <p>responsibility for reporting anomalies in best practice in relation to efficient DHW systems</p>

<p><i>knowledge</i> on facts, principles, processes and general concepts on the significant contribution potential by solar thermal collectors towards DHW production and the challenges presented by the 'winter gap' in heating dominated climates</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on the energy consumption of DHW circulation pumps</p> <p><i>knowledge</i> on facts, principles, processes and general concepts concerning the very real health and safety risks caused by Legionella</p>		
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Heating and cooling

Knowledge	Skills	Responsibility/Autonomy
<p><i>knowledge</i> on facts, principles, processes and general concepts on what constitutes interior 'comfort' in both winter and summer with respect to temperature and relative humidity</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on the differences between heating and cooling 'demand' and heating and cooling 'load'</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on the differences in demand and load levels for heating and cooling in older (inefficient) dwellings and those of deep energy retrofit projects</p> <p><i>knowledge</i> on facts, principles, processes and general concepts on heating high performance homes via the mechanical ventilation with heat recovery using a 'post-heater'</p> <p><i>knowledge</i> on principles and general concepts on the</p>	<p><i>cognitive and practical skills</i> required to sketch a schematic layout for a heating and / or cooling system for a single family dwelling</p> <p><i>cognitive and practical skills</i> required to accomplish tasks related to installation of replacement heating and cooling equipment for high performance homes</p> <p><i>cognitive and practical skills</i> required to accomplish tasks related to ensuring continuity of vapour tightness of pipework where required</p>	<p><i>responsibility</i> for completion of tasks related to upgrading of heating and cooling systems</p> <p><i>responsibility</i> for completion of tasks related to thorough and complete insulation of pipework, including all fittings, junctions and valves as well as through-envelope penetrations</p> <p><i>responsibility</i> for completion of tasks related to appropriate placement of the thermostat(s) which regulates the operation of the heating and / or cooling system.</p>

<p>difference between latent and sensible cooling</p> <p>knowledge on principles and general concepts on what constitutes 'overheating' and what passive measures can be used to reduce risk of overheating</p> <p>knowledge on facts, principles, processes and general concepts on insulation of pipework and the significant influence of this on energy consumption, especially when heating and cooling generators are located outside of the thermal envelope</p>		
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Specific topics for the craft

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts of occupational health and safety principles</p> <p>knowledge on facts, principles, processes and general concepts on principles of electrical safety</p> <p>knowledge on methods of displaying electrical components and electronic devices</p> <p>knowledge on facts, principles, processes and general concepts of solutions of electric and electronic circuits</p> <p>knowledge on facts, principles, processes and general concepts of designing of small and low voltage wiring in residential building</p> <p>knowledge on facts, principles, processes and general concepts of measuring and evaluation and knowledge of basic measuring devices</p> <p>knowledge on facts, principles, processes and general concepts of automation technology</p>	<p>cognitive and practical skills required to comply with requirements and conditions of OHS regulations in electrical engineering.</p> <p>cognitive and practical skills required to use the technical drawings, catalogues of parts, electronic schemes, work manuals and instructions</p> <p>cognitive and practical skills required to use, with regard to technical, economic and environmental requirements, proper technological procedures, tools, equipment for dismantling, assembling and connecting electronic devices</p> <p>cognitive and practical skills required to diagnose the operability and functionality of the systems with measuring technology</p> <p>cognitive and practical skills required to attend and operate automated systems</p> <p>cognitive and practical skills required to test and operate electrical machines, devices and equipment</p>	<p>responsibility for quality of their work</p> <p>autonomy and determination in solving the tasks and problems and analyse them</p> <p>responsibility for precise and professional communication and work in team</p> <p>responsibility for working disciplined and deliver the tasks as specified</p> <p>responsibility for and confidence to stop progress on project advancement if necessary if installation details and / or materials being proposed are regarded as being risky</p> <p>responsibility for proper functionality of solar electric or hybrid collectors installations</p> <p>responsibility for proper functionality of the preparation for the e-cars</p>



<p><i>knowledge</i> on facts, principles, processes and general concepts of pneumatic systems</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of sensory technology</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of functions and design of system of automated control devices</p> <p><i>knowledge</i> on facts, principles, processes and general concepts related to use of computer technology in the management process itself</p> <p><i>knowledge</i> on facts, principles, processes and general concepts related to definition of PLC in terms of function, usage and layout of parts</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of intelligent technology</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of intelligent house</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of intelligent devices in houses and buildings</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of “dead working” , “live working” and “working in the vicinity of live parts” and securing the dead working environment</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of security measures at live work, dead work and work in vicinity of live parts</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of bus system (sensors, PC-link, switching unit, dimming blinds unit, actuators)</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of components of radio systems</p>	<p><i>cognitive and practical skills</i> required to work with standards, electrical tables and catalogues</p> <p><i>cognitive and practical skills</i> required to make electrical lighting of premises</p> <p><i>cognitive and practical skills</i> required to make basic measures on the assembly, repairs and maintenance of electronic devices</p> <p><i>cognitive and practical skills</i> required to carry out basic work and measures on the assembly, repair, diagnosis and maintenance of technical devices of automatic control</p> <p><i>cognitive and practical skills</i> required to design control circuits</p> <p><i>cognitive and practical skills</i> required to design and realize basic digital circuits</p> <p><i>cognitive and practical skills</i> required to build a control program for simple functions using a PLC</p> <p><i>cognitive and practical skills</i> required to select the necessary work equipment, tools, types of materials used for the installation of intelligent installation of bus and radio systems</p> <p><i>cognitive and practical skills</i> required to know general installation procedures for intelligent installation systems in different environments, their basic differences in the installation of intelligent installation of bus and radio systems</p> <p><i>cognitive and practical skills</i> required to take measures to ensure safety during the dead working, live working and working in vicinity of live parts</p> <p><i>cognitive and practical skills</i> required to know the procedure for securing the dead working environment</p>	
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<p>(sensors, actuators, switching units)</p> <p><i>knowledge</i> on facts, principles, processes and general concepts of demand response issues</p> <p><i>knowledge</i> functionality of solar electric or hybrid collectors</p> <p><i>knowledge</i> of functionality of the preparation for the e-cars</p>	<p><i>cognitive and practical skills</i> required to add the control system to 230V grid without voltage</p> <p><i>cognitive and practical skills</i> required to install and connect bus and radio frequency systems with sensors and actuators as specified, make a check of the wiring without voltage</p> <p><i>cognitive and practical skills</i> required to set the parameters of control components of bus and radio systems in accordance to their functions and documentation</p>	
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7. Chimney sweeper (Installation)

The full name of the profession is Chimney sweeper – Installation of chimneys and chimney liners.

Airtightness

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the necessity of airtightness, vapour control and windtightness in a building and the multitude of benefits they bring</p> <p>knowledge on facts, principles, processes and general concepts on the critical importance of coupling airtightness with ventilation (“<i>build tight-ventilate right</i>”)</p> <p>knowledge on facts, principles, processes and general concepts on the principle of an airtight layer (red pencil method and single airtight layer)</p> <p>knowledge on facts, principles, processes and general concepts on typical weak points in the case of airtightness, vapour control and windtightness</p> <p>knowledge on facts, principles, processes and general concepts on the difference and relationships between vapour control, airtightness and wind resistance</p> <p>knowledge on facts, principles, processes and general concepts on the role of dew point as a risk factor in determining likelihood of condensation and mould formation</p> <p>knowledge on facts, principles, processes and general concepts regarding the Importance of introducing a vapour control layer to reduce the potential for transfer of vapour from inside, through the envelope towards the exterior</p> <p>knowledge on facts, principles, processes and general concepts</p>	<p>cognitive and practical skills required to explain the importance of airtightness, windtightness and vapour control in buildings</p> <p>cognitive and practical skills required to explain the difference between air-tightness and ‘breathability’ and distinction between ‘airtight’ yet ‘vapour open’</p> <p>cognitive and practical skills required to explain the principle of the pressurisation test method and explain the benefits of completing both positive and negative pressurisation tests</p> <p>cognitive and practical skills required to operate fans (such as ‘wincon’) to create a pressure difference between inside and outside for the purposes of pre-checking airtightness in advance of the official pressurisation tests</p> <p>cognitive and practical skills required to identify leaks in a building envelope using a variety of methods including smoke-sticks and thermography where practicable</p> <p>cognitive and practical skills required to achieve high levels of airtightness ($n_{50} \leq 1.0$ ac/hr) using a broad variety of materials and methods including specialist skills in dealing with challenging 3-D connections as well as penetrations and transition points in the envelope</p> <p>cognitive and practical skills required to identify the airtight layer and its constituent parts in drawings and buildings</p>	<p>responsibility for formulating a logical procedure/sequence of work with reference to airtightness</p> <p>responsibility for completion of tasks related to correctly prepping surfaces for application of airtight applications (dust removal, priming, applying base layers) in order to ensure long-term maintenance of airtightness and vapour control</p> <p>responsibility for completion of tasks related to ensuring absolute continuity of the three key layers providing vapour control, airtightness and windtightness and without tears or unsealed penetrations</p> <p>responsibility for and confidence to question the application of bogus airtightness materials proposed by others which might fail in the longer term</p> <p>responsibility for and confidence to stop progress on project advancement if necessary if construction details and / or materials being proposed are regarded as being risky</p> <p>responsibility for completion of tasks related to identification of when it is best suited to carry out interim airtightness tests, based on the principle of being able to fix leaks before areas are closed up</p> <p>responsibility for completion of tasks related to preparation of construction project for arrival of airtightness tester to ensure optimal use of the tester’s time.</p> <p>responsibility for completion of tasks related to applying tapes,</p>

<p>relating to the principle of increasing permeability of vapour diffuse layers from inside to outside (“drying-out”)</p> <p>knowledge on facts, principles, processes and general concepts relating to different approaches that can be used to regulate and control air, vapour and wind movement including materials best-suited to different construction types (membranes versus plasters versus specialist sheeting)</p> <p>knowledge on facts, principles, processes and general concepts relating to the use of appropriate materials for the control of air flow and vapour movement and avoidance of materials (such as impermeable plastics) which could cause significantly adverse effects with respect to vapour trapping</p>	<p>cognitive and practical skills required to seal elements such as wooden joists which penetrate the insulation layer into a cold exterior wall and the potential for rot over time arising from mould and condensation</p> <p>cognitive and practical skills required to explain the importance of the q50 value in large buildings</p> <p>cognitive, practical and communication skills required to bring co-workers (who might be older and ‘more experienced’) on-board regarding the importance of dealing appropriately with airtightness</p>	<p>membranes and flexible sealants which do not compromise the quality of aesthetic finishes on exposed surfaces (a common example being too much tape overlapping on window frames which will not be covered later by subsequent finishes) and thus left exposed requiring subsequent removal</p>
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Mechanical Ventilation with Heat Recovery (MVHR)

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the benefits of including a controlled ventilation system in a DER</p> <p>knowledge on facts, principles, processes and general concepts on the principles of heat recovery from exhaust air and tempering of fresh air</p> <p>knowledge on facts, principles, processes and general concepts about use of MVHR’s in DER in terms of noise levels, electrical energy requirement for the fans and impact on reduce heating and / or cooling demand</p> <p>knowledge on facts, principles, processes and general concepts on the two most common ducting arrangements used in residential ventilation systems (trunk-and-branch as well as octopus) and the impact these systems will</p>	<p>cognitive and practical skills required to sketch a schematic layout of the key components of a home MVHR system</p> <p>cognitive and practical skills required to install an MVHR in a home including key components such as heat exchanger, ducting, supply and exhaust registers, condensate drain and post heater</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers to ensure optimal flow rates in the spaces in which they serve and to avoid potential annoyance or irritation to occupants due to inappropriate positioning of registers</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers such that flow rates are unlikely to be adversely affected by</p>	<p>responsibility for suitably locating the MVHR unit considering most especially ease of access for the homeowner for the purposes of changing the filters but also positioning close to the thermal envelope thereby minimising the length of thermal bridges created by the two ducts which connect to the exterior</p> <p>responsibility for avoidance of using inappropriate ducting materials which could adversely impact on pressure losses, ease of cleaning and creation of noise and turbulence</p> <p>responsibility for full execution of the ventilation system design including provision of all specified ancillary components such as sound attenuators, filters for extract registers and fire and smoke dampers</p>



<p>have on the need for sound attenuators</p> <p>knowledge on facts, principles, processes and general concepts on the preferred duct types to ensure smooth air flow and avoiding sagging or kinking</p> <p>knowledge on facts, principles, processes and general concepts on the key components of a balanced ventilation system with heat recovery in drawings and buildings</p>	<p>occupants unwittingly placing furniture, storage or other impediments over or close to them</p> <p>cognitive and practical skills required to securely fix the routing and positions of ducts and registers so that there is minimal risk of adjustment or movement post-occupancy which would compromise their performance</p> <p>cognitive and practical skills required to carefully route ducts through the project to avoid excessive pressure losses which would result in increased fan energy use and possible risk of increased noise for occupants arising from the increased turbulence</p> <p>cognitive and practical skills required to thoroughly and completely insulate the two air ducts which connect to the exterior through the thermal envelope in order to minimise any adverse thermal bridge effect</p> <p>cognitive and practical skills required to secure a completely airtight seal of the two external air ducts at the locations where (a) they connect to the MVHR unit and (b) where they penetrate the thermal envelope</p> <p>cognitive and practical skills required to appropriately position the supply and exhaust air grilles where they exit from the conditioned space with special emphasis on avoiding short-circuiting of air flow (and resulting possible contamination)</p> <p>cognitive and practical skills required to select appropriately sized mesh coverings for external ducts openings so that they do not clog over time with small particles</p> <p>cognitive and practical skills required to measure volumetric flow rates at registers and to adjust supply and extract</p>	<p>responsibility for completion of tasks related to ensuring that all connections are completely airtight and that the two air ducts which penetrate the envelope are entirely and completely insulated with vapour tight insulation</p> <p>responsibility for completion of tasks related to ensure excellent hygiene during installation especially preventing soiling of ducts and registers through dust and debris</p> <p>responsibility for completion of tasks related to routing of condensate drain to appropriate disposal point</p> <p>responsibility for installation of correct filters in the outdoor air side and extract air side</p> <p>responsibility for hygienic protection of the filters prior to commissioning the system from risks presented by contaminants and / or moisture / humidity</p> <p>responsibility for completion of tasks related to ensuring that the duct network can be easily cleaned in the future should the need arise</p> <p>responsibility for ensuring that the homeowner knows why they should replace the MVHR filter at regular intervals and how they can replace them</p> <p>responsibility for dealing with queries and concerns from homeowners once they move in and are getting used to the MVHR system (taking the initiative to follow-up with the homeowner to make sure that everything is working well)</p>
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	registers to deliver the required volume flow rate as per the system design	
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Heating and cooling

Knowledge	Skills	responsibility/Autonomy General capabilities?
<ul style="list-style-type: none"> - knowledge on facts, principles, processes and general concepts on what constitutes interior ‘comfort’ in both winter and summer with respect to temperature and relative humidity - knowledge on facts, principles, processes and general concepts on the differences between heating and cooling ‘demand’ and heating and cooling ‘load’ - knowledge on facts, principles, processes and general concepts on the differences in demand and load levels for heating and cooling in older (inefficient) dwellings and those of deep energy retrofit projects - knowledge on facts, principles, processes and general concepts on heating high performance homes via the mechanical ventilation with heat recovery using a ‘post-heater’ - knowledge on principles and general concepts on the difference between latent and sensible cooling - knowledge on principles and general concepts on what constitutes ‘overheating’ and what passive measures can be used to reduce risk of overheating - knowledge on facts, principles, processes and general concepts on insulation of pipework and the significant influence of this on energy consumption, especially when 	<ul style="list-style-type: none"> - cognitive and practical skills required to sketch a schematic layout for a heating and / or cooling system for a single family dwelling - cognitive and practical skills required to accomplish tasks related to installation of replacement heating and cooling equipment for high performance homes - cognitive and practical skills required to accomplish tasks related to ensuring continuity of vapour tightness of pipework where required 	<ul style="list-style-type: none"> - responsibility for completion of tasks related to upgrading of heating and cooling systems - responsibility for completion of tasks related to thorough and complete insulation of pipework, including all fittings, junctions and valves as well as through-envelope penetrations - responsibility for completion of tasks related to appropriate placement of the thermostat(s) which regulates the operation of the heating and / or cooling system.

<p>heating and cooling generators are located outside of the thermal envelope</p>		
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Specific topics for the craft

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge reading of projects documentation. Reading the documentation in all layers of chimney</p> <p>knowledge Describe kinds of chimney sweeping services according to national standards written by Chamber of Chimney sweepers</p> <p>knowledge of standards and prescriptions, service and connection to other appliances</p> <p>knowledge adjust device for measure and chose the right locations of the sampling flue-gas</p> <p>knowledge expertize project documentation of chimney and fuel-gas tracks in all necessary criteria of fire defence and Safety rules</p> <p>knowledge of reconstruction of all the layer of the chimney including insoles (lining)</p>	<p>cognitive and practical skills required to explain the by words and practically explain documentation. Condition of Being a chimney inspector is 5 years in praxis as a chimney sweeper.</p> <p>cognitive and practical skills prove orientation in standards, prescriptions and rules connected to burn trails and connected appliances or devices at least of two kinds of fuel</p> <p>cognitive and practical skills control the chimney cleaning trails, smoke trails and appliances for firm fuel</p> <p>cognitive and practical skills cleaning vents at multiple floor building from sweeping throat</p> <p>cognitive and practical skills cleaning chimney at multiple floor building at whole burn trail appliances according to request</p> <p>cognitive, practical and communication skills prepare boiler room and appliances for measuring, find out all obligatory facts and finally measure the substances of the fuel-gas.</p> <p>cognitive, practical and communication skills Make conditions to assembly all necessary parts of the chimney and correctly set up the assembly , be careful of safety distance and flammable materials , find and define places for safety fixing points</p>	<p>responsibility for formulating a logical procedure/sequence of work including safety attitude</p> <p>responsibility for completion of tasks related to correctly prepping burn trails for application</p> <p>responsibility for completion of tasks related to ensuring absolute continuity of the three key layers providing all layer of chimney</p> <p>responsibility for completion of tasks related to identification of all possible control mechanisms. Prepare documentations of measuring fuelgas and evaluate the effectivity of burning fuelgas</p> <p>responsibility assembly chimney according to requested documentations and rules made by Chamber of Chimney builders . Assembly the fuel tracks according to criteria of safeness and fire defence. Assembly smoke tracks for appliances according to the request of safety and fire defence in focus on appliances producer advice</p>

	<p><i>cognitive, practical and communication skills</i> prepare appropriate conditions of insole , find out the real condition of the chimney, evaluate risks caused by installation and replace them, minimize the risk. Install chimney insole according the request and project documentation, according to producers' advice and according to the Technical routine, approved by Chamber of chimney builders. Repair the chimney, fill up bricks gaps, fill gaps in insole, or repair all the leaking – Particular steps must be approved by Technical routine established by Chamber of Chimney builders.</p>	
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8. Chimney sweeper (Inspection)

The full name of the profession is Chimney sweeper – Inspection technician of flue ways.

Airtightness

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the necessity of airtightness, vapour control and windtightness in a building and the multitude of benefits they bring</p> <p>knowledge on facts, principles, processes and general concepts on the critical importance of coupling airtightness with ventilation (“<i>build tight-ventilate right</i>”)</p> <p>knowledge on facts, principles, processes and general concepts on the principle of an airtight layer (red pencil method and single airtight layer)</p> <p>knowledge on facts, principles, processes and general concepts on typical weak points in the case of airtightness, vapour control and windtightness</p> <p>knowledge on facts, principles, processes and general concepts on the difference and relationships between vapour control, airtightness and wind resistance</p> <p>knowledge on facts, principles, processes and general concepts on the role of dew point as a risk factor in determining likelihood of condensation and mould formation</p> <p>knowledge on facts, principles, processes and general concepts regarding the Importance of introducing a vapour control layer to reduce the potential for transfer of vapour from inside, through the envelope towards the exterior</p> <p>knowledge on facts, principles, processes and general concepts</p>	<p>cognitive and practical skills required to explain the importance of airtightness, windtightness and vapour control in buildings</p> <p>cognitive and practical skills required to explain the difference between air-tightness and ‘breathability’ and distinction between ‘airtight’ yet ‘vapour open’</p> <p>cognitive and practical skills required to explain the principle of the pressurisation test method and explain the benefits of completing both positive and negative pressurisation tests</p> <p>cognitive and practical skills required to operate fans (such as ‘wincon’) to create a pressure difference between inside and outside for the purposes of pre-checking airtightness in advance of the official pressurisation tests</p> <p>cognitive and practical skills required to identify leaks in a building envelope using a variety of methods including smoke-sticks and thermography where practicable</p> <p>cognitive and practical skills required to achieve high levels of airtightness ($n_{50} \leq 1.0$ ac/hr) using a broad variety of materials and methods including specialist skills in dealing with challenging 3-D connections as well as penetrations and transition points in the envelope</p> <p>cognitive and practical skills required to identify the airtight layer and its constituent parts in drawings and buildings</p>	<p>responsibility for formulating a logical procedure/sequence of work with reference to airtightness</p> <p>responsibility for completion of tasks related to correctly prepping surfaces for application of airtight applications (dust removal, priming, applying base layers) in order to ensure long-term maintenance of airtightness and vapour control</p> <p>responsibility for completion of tasks related to ensuring absolute continuity of the three key layers providing vapour control, airtightness and windtightness and without tears or unsealed penetrations</p> <p>responsibility for and confidence to question the application of bogus airtightness materials proposed by others which might fail in the longer term</p> <p>responsibility for and confidence to stop progress on project advancement if necessary if construction details and / or materials being proposed are regarded as being risky</p> <p>responsibility for completion of tasks related to identification of when it is best suited to carry out interim airtightness tests, based on the principle of being able to fix leaks before areas are closed up</p> <p>responsibility for completion of tasks related to preparation of construction project for arrival of airtightness tester to ensure optimal use of the tester’s time.</p> <p>responsibility for completion of tasks related to applying tapes,</p>

<p>relating to the principle of increasing permeability of vapour diffuse layers from inside to outside (“drying-out”)</p> <p>knowledge on facts, principles, processes and general concepts relating to different approaches that can be used to regulate and control air, vapour and wind movement including materials best-suited to different construction types (membranes versus plasters versus specialist sheeting)</p> <p>knowledge on facts, principles, processes and general concepts relating to the use of appropriate materials for the control of air flow and vapour movement and avoidance of materials (such as impermeable plastics) which could cause significantly adverse effects with respect to vapour trapping</p>	<p>cognitive and practical skills required to seal elements such as wooden joists which penetrate the insulation layer into a cold exterior wall and the potential for rot over time arising from mould and condensation</p> <p>cognitive and practical skills required to explain the importance of the q50 value in large buildings</p> <p>cognitive, practical and communication skills required to bring co-workers (who might be older and ‘more experienced’) on-board regarding the importance of dealing appropriately with airtightness</p>	<p>membranes and flexible sealants which do not compromise the quality of aesthetic finishes on exposed surfaces (a common example being too much tape overlapping on window frames which will not be covered later by subsequent finishes) and thus left exposed requiring subsequent removal</p>
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Mechanical Ventilation with Heat Recovery (MVHR)

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on the benefits of including a controlled ventilation system in a DER</p> <p>knowledge on facts, principles, processes and general concepts on the principles of heat recovery from exhaust air and tempering of fresh air</p> <p>knowledge on facts, principles, processes and general concepts about use of MVHR’s in DER in terms of noise levels, electrical energy requirement for the fans and impact on reduce heating and / or cooling demand</p> <p>knowledge on facts, principles, processes and general concepts on the two most common ducting arrangements used in residential ventilation systems (trunk-and-branch as well as octopus) and the impact these systems will</p>	<p>cognitive and practical skills required to sketch a schematic layout of the key components of a home MVHR system</p> <p>cognitive and practical skills required to install an MVHR in a home including key components such as heat exchanger, ducting, supply and exhaust registers, condensate drain and post heater</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers to ensure optimal flow rates in the spaces in which they serve and to avoid potential annoyance or irritation to occupants due to inappropriate positioning of registers</p> <p>cognitive and practical skills required to optimise the position of supply and extract registers such that flow rates are unlikely to be adversely affected by</p>	<p>responsibility for suitably locating the MVHR unit considering most especially ease of access for the homeowner for the purposes of changing the filters but also positioning close to the thermal envelope thereby minimising the length of thermal bridges created by the two ducts which connect to the exterior</p> <p>responsibility for avoidance of using inappropriate ducting materials which could adversely impact on pressure losses, ease of cleaning and creation of noise and turbulence</p> <p>responsibility for full execution of the ventilation system design including provision of all specified ancillary components such as sound attenuators, filters for extract registers and fire and smoke dampers</p>



<p>have on the need for sound attenuators</p> <p>knowledge on facts, principles, processes and general concepts on the preferred duct types to ensure smooth air flow and avoiding sagging or kinking</p> <p>knowledge on facts, principles, processes and general concepts on the key components of a balanced ventilation system with heat recovery in drawings and buildings</p>	<p>occupants unwittingly placing furniture, storage or other impediments over or close to them</p> <p>cognitive and practical skills required to securely fix the routing and positions of ducts and registers so that there is minimal risk of adjustment or movement post-occupancy which would compromise their performance</p> <p>cognitive and practical skills required to carefully route ducts through the project to avoid excessive pressure losses which would result in increased fan energy use and possible risk of increased noise for occupants arising from the increased turbulence</p> <p>cognitive and practical skills required to thoroughly and completely insulate the two air ducts which connect to the exterior through the thermal envelope in order to minimise any adverse thermal bridge effect</p> <p>cognitive and practical skills required to secure a completely airtight seal of the two external air ducts at the locations where (a) they connect to the MVHR unit and (b) where they penetrate the thermal envelope</p> <p>cognitive and practical skills required to appropriately position the supply and exhaust air grilles where they exit from the conditioned space with special emphasis on avoiding short-circuiting of air flow (and resulting possible contamination)</p> <p>cognitive and practical skills required to select appropriately sized mesh coverings for external ducts openings so that they do not clog over time with small particles</p> <p>cognitive and practical skills required to measure volumetric flow rates at registers and to adjust supply and extract</p>	<p>responsibility for completion of tasks related to ensuring that all connections are completely airtight and that the two air ducts which penetrate the envelope are entirely and completely insulated with vapour tight insulation</p> <p>responsibility for completion of tasks related to ensure excellent hygiene during installation especially preventing soiling of ducts and registers through dust and debris</p> <p>responsibility for completion of tasks related to routing of condensate drain to appropriate disposal point</p> <p>responsibility for installation of correct filters in the outdoor air side and extract air side</p> <p>responsibility for hygienic protection of the filters prior to commissioning the system from risks presented by contaminants and / or moisture / humidity</p> <p>responsibility for completion of tasks related to ensuring that the duct network can be easily cleaned in the future should the need arise</p> <p>responsibility for ensuring that the homeowner knows why they should replace the MVHR filter at regular intervals and how they can replace them</p> <p>responsibility for dealing with queries and concerns from homeowners once they move in and are getting used to the MVHR system (taking the initiative to follow-up with the homeowner to make sure that everything is working well)</p>
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	registers to deliver the required volume flow rate as per the system design	
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Heating and cooling

Knowledge	Skills	Responsibility/Autonomy
<p>knowledge on facts, principles, processes and general concepts on what constitutes interior 'comfort' in both winter and summer with respect to temperature and relative humidity</p> <p>knowledge on facts, principles, processes and general concepts on the differences between heating and cooling 'demand' and heating and cooling 'load'</p> <p>knowledge on facts, principles, processes and general concepts on the differences in demand and load levels for heating and cooling in older (inefficient) dwellings and those of deep energy retrofit projects</p> <p>knowledge on facts, principles, processes and general concepts on heating high performance homes via the mechanical ventilation with heat recovery using a 'post-heater'</p> <p>knowledge on principles and general concepts on the difference between latent and sensible cooling</p> <p>knowledge on principles and general concepts on what constitutes 'overheating' and what passive measures can be used to reduce risk of overheating</p> <p>knowledge on facts, principles, processes and general concepts on insulation of pipework and the significant influence of this on energy consumption, especially when heating and cooling generators are located outside of the thermal envelope</p>	<p>cognitive and practical skills required to sketch a schematic layout for a heating and / or cooling system for a single family dwelling</p> <p>cognitive and practical skills required to accomplish tasks related to installation of replacement heating and cooling equipment for high performance homes</p> <p>cognitive and practical skills required to accomplish tasks related to ensuring continuity of vapour tightness of pipework where required</p>	<p>responsibility for completion of tasks related to upgrading of heating and cooling systems</p> <p>responsibility for completion of tasks related to thorough and complete insulation of pipework, including all fittings, junctions and valves as well as through-envelope penetrations</p> <p>responsibility for completion of tasks related to appropriate placement of the thermostat(s) which regulates the operation of the heating and / or cooling system.</p>



Specific topics for the craft

Knowledge	Skills	Responsibility/Autonomy
<p><i>knowledge</i> reading of projects documentation, reading of chimney ventilation including vents (breathers)</p> <p>Reading the documentation in all layers of chimney</p> <p><i>knowledge</i> Advanced orientation in standards, prescriptions and rules connected to burn trails and connected appliances or devices</p> <p><i>knowledge</i> of standards and prescriptions, service and connection to other appliances</p>	<p><i>cognitive and practical skills</i> required to explain the by words and practically explain documentation. Condition of Being a chimney inspector is 5 years in praxis as a chimney sweeper.</p> <p><i>cognitive and practical skills</i> of expertize the accuracy of the burn (fire) trail according to standards. Expertize connection to controlling points of burn trails</p> <p><i>cognitive and practical skills</i> design the burn trails for device 25kW including mathematical miscount of the size, diameter of the burn trail</p> <p><i>cognitive and practical skills</i> miscount the size of cross section of the chimney breath) vent) according to the request</p> <p><i>cognitive and practical skills</i> control the correct function of devices, smoke tracks, according to request for all kinds of the fuel</p> <p><i>cognitive, practical and communication skills</i> make accurate smoke and pressure test according to the task – practical performance with description of particular steps. Control of gas proof and over pressure of the chimney according to request – practical performance with description of particular steps.</p>	<p><i>responsibility</i> for formulating a logical procedure/sequence of work</p> <p><i>responsibility</i> for completion of tasks related to correctly prepping burn trails for application</p> <p><i>responsibility</i> for completion of tasks related to ensuring absolute continuity of the three key layers providing all layer of chimney</p> <p><i>responsibility</i> for completion of tasks related to identification of all possible control mechanisms, pressure test and other obligatory tasks.</p> <p><i>responsibility</i> for completion of tasks related to applying final revision, find out all obligatory factors for revision and properly fill the Inspectional report.</p>

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