DELPOL ARCHITECTURAL CASE STUDY

BARFORD ST MICHAEL · OXFORDSHIRE

Orchard House

A whole-house retrofit in which fabric, moisture, air, heat and electrical infrastructure were delivered as one coordinated construction system.

INTEGRATED RETROFIT DELIVERY BY ONE ACCOUNTABLE COMPANY

COMPLETED PROJECT · DOCUMENTED FROM THE PROJECT RECORD

CONTENTS

This case study is arranged as a cumulative argument: the building as found, the strategy that shaped the works, each technical workstream in the order it was delivered, and the completed outcome.

PRE-WORKS PHOTOGRAPH · PROJECT RECORD

The rear elevation before the works. Existing solar array and conservatory; the oil tank stood against the garage wall.

HOW TO READ THE EVIDENCE

Three kinds of evidence are kept distinct. The **project record** — DELPOL's 699-series technical briefs, specifications and drawings — establishes what was designed and specified. The **homeowners' published account** — their own record of the project — describes what was built and how they experienced it. **Current best-practice research** — Historic England, Approved Documents F and L, MCS heat-pump design guidance — is cited in endnotes (p. 29) to explain the technical reasoning, never as retrospective certification. Design targets are labelled as targets, not measured results.

The same house, working as it *always should have*

BEFORE · PRE-WORKS SURVEY — PROJECT RECORD

Uninsulated reconstituted-stone mullions, running cold. Dark staining and worn finishes at the window junctions marked a thermal bridge repeated around every mullioned opening in the house — the survey logged condensation damage at these details.

BEFORE · PRE-WORKS SURVEY — PROJECT RECORD

The pattern at every opening. Single-glazed leaded lights between cold mullions, a radiator working beneath — the opening type the project rebuilt with bespoke slim-frame double-glazed units, internally insulated surrounds, and junctions sealed and taped as one detail.

"Despite the disruption, it was undoubtedly worth the journey. We're thrilled with the results. The house now feels modern, warmer, and more welcoming than ever."

THE HOMEOWNERS · PUBLISHED PROJECT ACCOUNT

Orchard House kept its honey-coloured stone elevations, its mullioned windows and its place in the village streetscape. What changed is invisible from the pavement: a continuous, moisture-aware layer of insulation, deliberate ventilation, and electric heat in place of oil — coordinated so that each measure made the next one possible.

A whole house, treated as *one system*

Orchard House is a detached house of about 1970 in the conservation area of Barford St Michael, Oxfordshire — built in rubble stone to sit comfortably among much older neighbours, but built with the thermal expectations of its decade.

The homeowners wanted to end the house's reliance on oil and to make it warm, healthy and fit for the decades ahead. That ambition could not be met by a boiler swap: a heat pump is only as good as the envelope it serves. DELPOL therefore delivered the project as one coordinated construction programme — electrical enabling works, whole-house ventilation, replacement windows and doors, insulated stone-mullion surrounds, sloping-ceiling insulation, room-by-room internal wall insulation, and an air-source heat pump with upgraded hot-water storage — sequenced so that routes, penetrations and junctions were resolved before the fabric was closed up.

The result documented in the published account is a house that reads unchanged from the street yet behaves like a different building: insulation continuous behind wardrobes, through floor voids and into window reveals; extraction planned where moisture is made; heat delivered at temperatures the improved envelope actually needs.

This document sets out how that was done, workstream by workstream, and why the decisive factor was not any single product but the coordination of all of them by one accountable company.

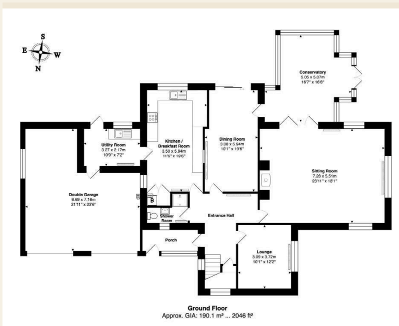
PROJECT FACTS

Building	Detached two-storey house
Built	c. 1969–70; garage and porch added c. 1997
Setting	Conservation area; not listed
Walls	Rubble-stone outer leaf, concrete-block inner leaf, irregular unfilled cavity (≈410 mm)
Envelope	≈ 208 m² heated envelope referenced in the services documentation
Heating	Oil boiler and tank removed; air-source heat pump with upgraded hot-water storage
Fabric	Internal wall insulation, skeiling insulation, insulated stone-mullion surrounds, new double-glazed windows and doors
Air	Whole-house humidity-controlled extract ventilation with planned background air
Delivery	All workstreams delivered and coordinated by DELPOL as one company
Programme	≈ six months on site as the scope expanded (published account)

No project costs are stated anywhere in this document. Performance figures quoted are design targets from the project record, not measured results; financial savings had not been measured when the homeowners' account was published.

PROJECT RECORD

From Lower Street. A 1970 house in the local stone vernacular.



PROJECT RECORD

Mapped before touched — every measure located room by room.

PROJECT RECORD

Logged opening by opening — types, surrounds and condition.

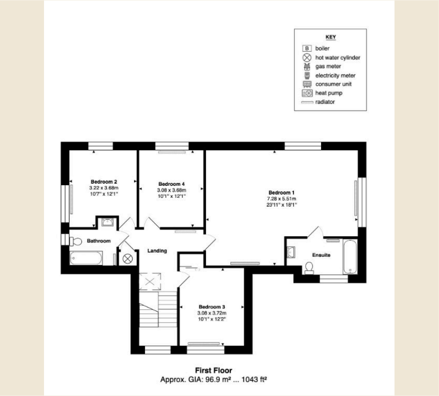
A modern house in an *older vernacular*

Orchard House was built around 1969–70 on Lower Street, within what is now the conservation area of Barford St Michael. Its architects reached for the local language: honey-coloured rubble limestone, steep stone-slate roofs and mullioned window surrounds — a late-twentieth-century plan sitting comfortably beside cottages two centuries older. A garage and porch were added around 1997.

Beneath the traditional surface, the construction is of its time: a rubble-stone outer leaf and a concrete-block inner leaf across an irregular cavity, roughly 410 mm overall — neither a true solid stone wall nor a regular modern cavity wall.[1] Ground floors are solid, of uncertain insulation; the first-floor rooms are wrapped by sloping ceilings with little behind them.

That hybrid character ruled out the two standard answers. The cavity could not be filled: too irregular for fill to be relied upon, and current guidance treats such walls as solid.[2] External insulation would have buried the stone elevations that justify the house's place in the village — the published account is plain that insulating inside was chosen to keep the external stone appearance.[3]

What remained was the harder route: insulate from within, room by room, in a way that respects how masonry manages moisture — and coordinate it with new windows, ventilation and heating so the measures reinforce rather than compromise one another.



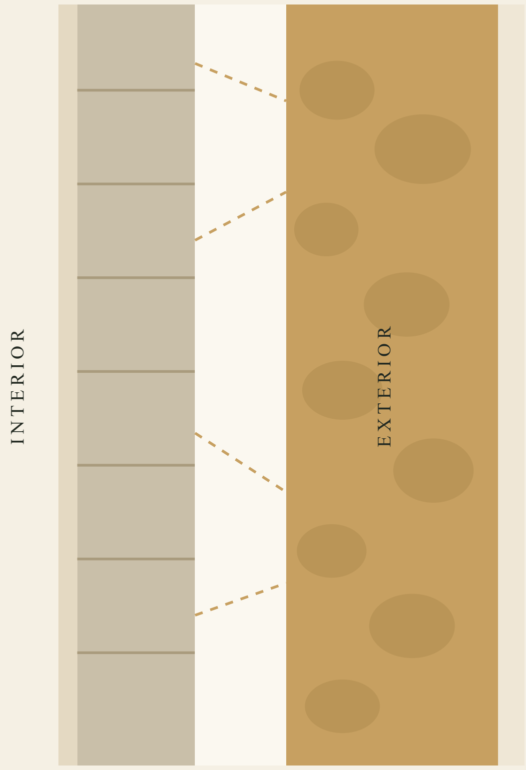
PROJECT RECORD

The first floor in plan. Bedrooms wrapped by roof slopes — the geometry that shaped the skeiling and insulation schedules.

PROJECT RECORD

Garden elevation before the works, oil tank against the garage wall.

A hybrid construction, *mapped before touched*



not to scale

- **a** Existing internal plaster
- **b** Concrete-block inner leaf
- **c** Irregular, unfilled cavity — unsuitable for cavity fill
- **d** Rubble-stone outer leaf, lime-pointed

INTERPRETIVE DIAGRAM

Drawn from the wall description in the project record (≈410 mm overall).[1] Not an approved construction detail.

Before any work was specified, the house was surveyed as a system. A whole-house plan prepared under a qualified retrofit coordinator established the thermal envelope — excluding the porch, utility room, garage and conservatory — and mapped every measure onto floor plans so that each trade could see where its work met the others.[4]

The survey recorded a heating system at the end of its life: an ageing oil-fired boiler rated at no better than about 70% efficiency, an external oil tank, and a 162-litre hot-water cylinder in the first-floor airing cupboard. Heat-distribution pipework ran through the uninsulated solid floor — the published account describes the old underfloor pipes as “literally heating the earth below”.[5] The design-stage estimate of annual heating fuel use was approximately 48,300 kWh.[6]

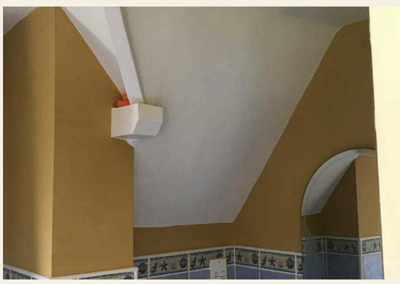
Air leakage was measured, not assumed. A pre-works pulse test recorded air changes per hour at 4 Pa ranging from 1.4 in the large sitting room to 5.6 in one of the bedrooms — a house leaky enough to lose heat, yet with no deliberate background ventilation and no trickle vents at the windows.[7]

PRE-WORKS PULSE TEST	ACH @ 4 PA
Large sitting room	1.4
Bedroom 1 (master)	3.9
Bedroom 2 (rear)	2.7
Bedroom 3 (front)	2.5
Bedroom 4 (rear)	5.6

Diagnostic measurements from the project record — a pre-works baseline, not a post-completion result.[7]

PRE-WORKS SURVEY · PROJECT RECORD

Openings logged one by one — type, condition, surrounds.



PRE-WORKS SURVEY · PROJECT RECORD

Every sloping ceiling measured for the skeiling schedule.

PRE-WORKS SURVEY · PROJECT RECORD

Every emitter recorded for the later heat-loss check.

"We didn't start this project to save money on energy bills. We did it for long-term environmental sustainability… What's more important to us is knowing that Orchard House will stand as our contribution to reducing carbon emissions. It's also now a cosy home to live in."

THE HOMEOWNERS · PUBLISHED PROJECT ACCOUNT

BEFORE · PRE-WORKS SURVEY — PROJECT RECORD

The outgoing infrastructure of oil: the ageing boiler in its kitchen cupboard, flue and expansion vessel above. The external tank and the 162-litre cylinder went with it — all removed during the works.

The brief grew from values, not payback. After encountering retrofit at a village-hall talk, the owners commissioned a whole-house plan and decided to do the work once, properly: end the dependence on oil, make the house warm and healthy, and leave it ready for a low-carbon future.[8]

That ambition set the technical bar. A heat pump cannot redeem a leaky, cold-surfaced house; the fabric had to improve first so that the new plant could run at the low temperatures where it works best. The clients also seized the disruption to renew electrics, kitchen and bathrooms — the latter two outside the core retrofit package, but planned alongside it.[9]

08 **THE STRATEGY**

One system, *one sequence*

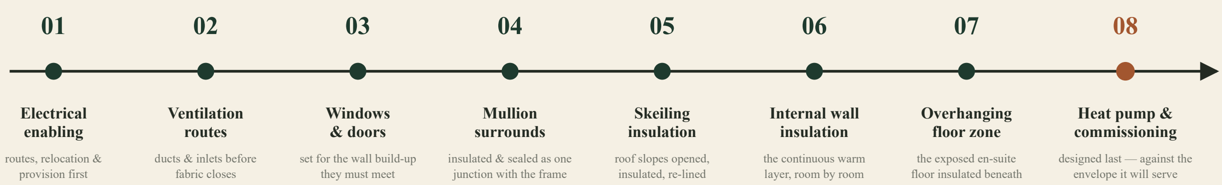
A whole-house retrofit is won or lost in the order of operations. Every measure at Orchard House either passes through a wall, changes how a wall breathes, or depends on a route that another measure would later conceal. The project record therefore fixed a sequence before it fixed any product: services first, openings next, fabric after, heat last — so that the heat pump would be designed against the building it would actually serve.[10]

The logic is defensive as much as efficient. Ventilation routes and electrical containment must exist before insulation covers their paths. Windows must be set before their reveals can be insulated and sealed. Wall insulation must be complete before room-by-room heat losses can be calculated honestly. And commissioning — of air, of heat, of power — can only happen once every interface is closed.

Sequencing also protected the household. The most disruptive phases — stripping plaster from every external wall and sloping ceiling, excavating the floor for new insulated pipework — were grouped so the family could stay elsewhere for the five most intensive months, returning for Christmas with the final month given to decorative completion.[11]

The published account records a construction period of closer to six months as the scope expanded — a figure DELPOL presents without varnish, because the honesty of that programme is part of what a prospective client should expect of a serious retrofit.[11]

THE DELIVERY SEQUENCE · AS FIXED BY THE PROJECT RECORD[10]



Services before fabric. Concealed electrical and ventilation routes must exist before insulation closes over them.

Air shapes openings. The background-ventilation decision fixed whether trickle vents went into the new windows before production.

Fabric shapes heat. The heat pump and its emitters were designed against the improved envelope, not the house as found.

Diagram prepared for this publication from the sequence table in the project record.[10] An asbestos-refurbishment decision preceded the works on site.

Why this needed *one accountable team*

Count the interfaces. The window frames meet the insulation; the insulation meets the floor voids; the ventilation ducts pass through the airtight layer; the electrical back boxes sit inside 60 mm of new build-up; the heat pump's pipework rises through a floor that had to be excavated and remade. On a conventional multi-contractor job, each of those junctions is a boundary between two companies' scopes — and boundary conditions are where retrofits fail.

At Orchard House, one company — DELPOL — carried and coordinated every workstream. That single accountability is the project's central fact: the same organisation that set the window also taped its reveal; the same organisation that ran the duct also sealed its penetration; the same organisation that excavated the floor also commissioned the heat pump whose pipework the floor now conceals.

The alternative is familiar to any architect: the window installer's seal ends where the insulator's board begins; the electrician's box punctures a layer the ventilator needed intact; the heating engineer sizes plant against an envelope someone else built. Each party is competent; the building still fails between them.

One team removes the gaps between scopes — not by doing without specialists, but by making one organisation answerable for how the specialists' work meets. The sections that follow show what that meant in practice, junction by junction.

WHERE THE WORKSTREAMS MEET · THE JUNCTIONS ONE TEAM MUST OWN

Power × fabric. Deep back boxes set for 60 mm insulation zones; supplies for heat pump and ventilation run before the walls closed.

Air × openings. Background-air strategy settled before windows went into production; every duct penetration taped and grommeted.

Heat × fabric. Emitter and pipework decisions taken against the post-retrofit envelope, not the house as found.

Insulating from within — the *rationale*

Internal wall insulation (IWI) is often treated as the option of last resort. At Orchard House it was the *considered* option. The stone elevations had to survive untouched; the cavity could not honestly be filled; and the rooms offered enough depth — between 30 and 60 mm depending on the space — to build a meaningful thermal layer without distorting the plan.[12]

The design rejected the idea of a universal board. Instead, the project record sets a room-by-room specification: wood fibre where depth allowed, thinner profiles where floor area was precious, cork with lime plaster in the wet rooms, and calcium-silicate-type boards among the compatible options.[12] The design target for the upgraded walls was a U-value around 0.3–0.4 W/m²K — a target recorded at design stage, and quoted here as a target rather than an achieved result.[13]

The philosophy matches the direction of current conservation research: choose vapour-open, capillary-active materials that let a masonry wall keep doing what it has always done — absorb, buffer and release moisture — rather than sealing it behind impermeable foam.[14]

PRE-WORKS SURVEY · PROJECT RECORD

A first-floor wall as found. Cold plaster on blockwork, a single-glazed casement, an oil-era radiator. Every external surface in rooms like this received its new layers in one continuous, room-by-room operation.

> **THE DECISION IN ONE LINE**
>
> Keep the stone outside. Rebuild the thermal performance inside — with materials the wall can breathe through, and junctions designed before they are hidden.

WHY NOT CAVITY FILL

An irregular rubble-stone cavity cannot be filled predictably; current guidance treats such walls as solid for insulation purposes.[2]

WHY NOT EXTERNAL INSULATION

The conservation-area streetscape is built of this stone. The published account records that the external appearance was to be preserved.[3]

WHY NATURAL, OPEN MATERIALS

Wood fibre, cork and lime finishes stay vapour-open and capillary-active, working with the wall's moisture behaviour rather than against it.[14]

Designing for *drying*, not just for warmth

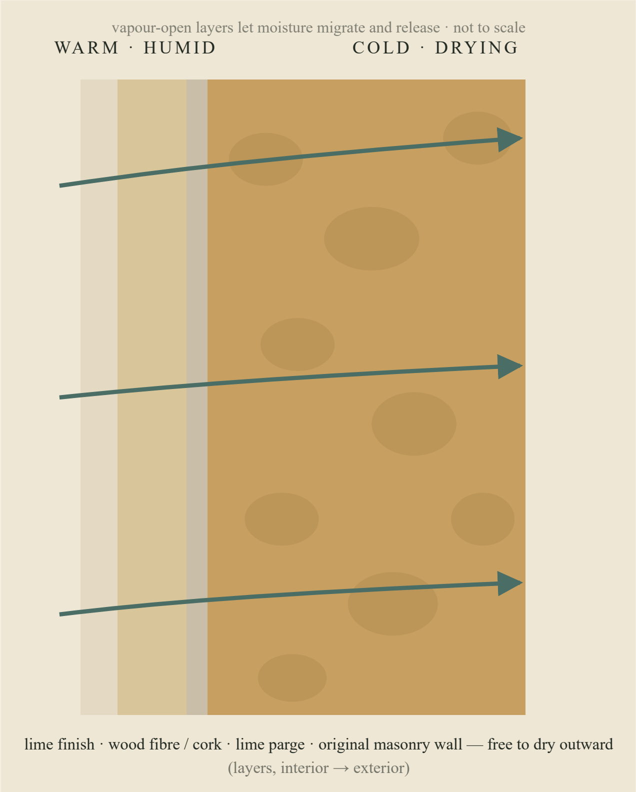
Add insulation to the inside of a masonry wall and you change its physics. The old wall becomes colder; the point where warm, moist indoor air would condense moves inward, into the new build-up. Managed carelessly, that is how retrofits grow mould inside their own walls. Managed deliberately — as here — it is a design problem with known tools.[15]

The first tool is **permeability**. The build-up at Orchard House — lime parge coat, wood fibre or cork, lime plaster, vapour-open paint with a quoted Sd of no more than about 0.1 m — lets water vapour diffuse and liquid moisture redistribute rather than trapping either.[12] Traditional masonry manages moisture by absorbing and releasing it; the new layers were chosen to keep that behaviour intact.[16]

The second tool is **air control**. Most moisture enters a wall riding on moving air, not by diffusion — so the specification required airtight tapes at service penetrations and window reveals, and a continuous plaster layer as a robust air barrier. Current research is candid that taped membranes are hard to perfect in existing buildings, and that a continuous permeable plaster is often the more durable line of defence; the Orchard House approach leaned on both.[17]

The third tool is **moderation**. Research highlighted by Historic England notes that very aggressive internal insulation raises moisture risk, and that more moderate target U-values can capture most of the benefit at lower risk. The project's 30–60 mm range — deliberately varied by room, exposure and geometry — sits squarely in that philosophy.[15]

Finally, **condition before cover**: the record required pointing, cracks and any damp or rot to be checked and addressed before insulation went on, and joist ends to be dressed with lime where they meet masonry.[12] A dry wall, well pointed, is the foundation every other layer depends on.

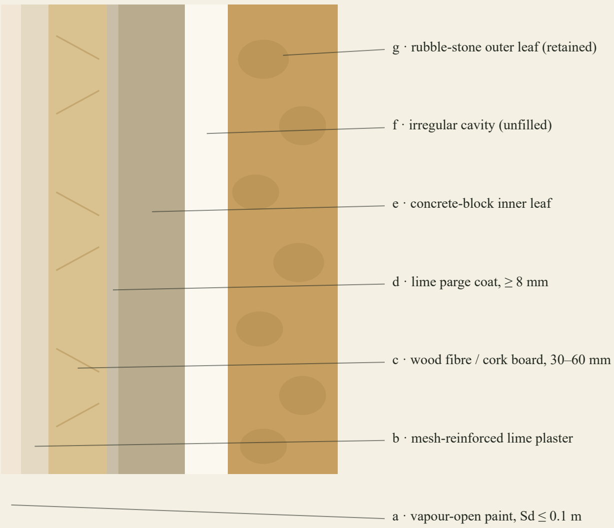


INTERPRETIVE DIAGRAM

The moisture logic of the build-up: every layer vapour-open, so the assembly can dry rather than accumulate. Based on the materials in the project record;[12] principles per current Historic England guidance.[16]

> **Honesty note.** Research into air- and vapour-control layers in traditional construction is still maturing; Historic England's own literature review calls for further evidence. This project's answer — permeable materials, continuous plaster, taped critical junctions — is presented as sound practice, not as a laboratory guarantee.[17]

The wall, *layer by layer*



INTERIOR → LEFT · BUILD-UP VARIES BY ROOM · INTERPRETIVE, NOT FOR CONSTRUCTION · PER PROJECT REC

WORKMANSHIP CHECKS RECORDED IN THE BRIEF[12]

Substrate	Damp, rot, pointing and joist condition checked and made good first
Adhesion	Full lime-adhesive bed plus mechanical fixings — no air pockets
Fixings	Structural-insulation pattresses for radiators and joinery
Edges	Airtightness tapes at reveals, perimeters and penetrations
Finish	Mesh, lime plaster coats, vapour-open decoration

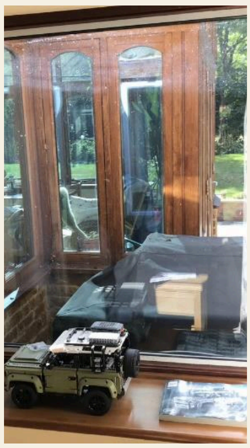
The installation followed a disciplined sequence drawn from the manufacturers' system guidance cited in the project record.[12] Existing wallpaper, gypsum and cementitious finishes were stripped back to sound masonry — impermeable layers had no place in the new assembly. The masonry was levelled with a lime parge coat of at least 8 mm and allowed to dry.

Boards were then fixed with a compatible lime adhesive *and* mechanical fixings, pressed home so no air pockets remained between wall and insulation — a void behind the board is a highway for moist air. Where radiators or joinery would later be mounted, structural insulation pattresses (Compacfoam-type) were fully adhered to the masonry first, so fixings would never bridge the new thermal layer into the cold wall.[12]

Airtightness tapes closed the vulnerable edges — service penetrations, window reveals, perimeters — before a mesh-reinforced lime plaster rebuilt the surface. Decoration used a highly vapour-open paint. Skirtings, architraves and mouldings were reinstated, with traditional profiles replicated where originals could not be re-used.[12]

PRE-WORKS SURVEY · PROJECT RECORD

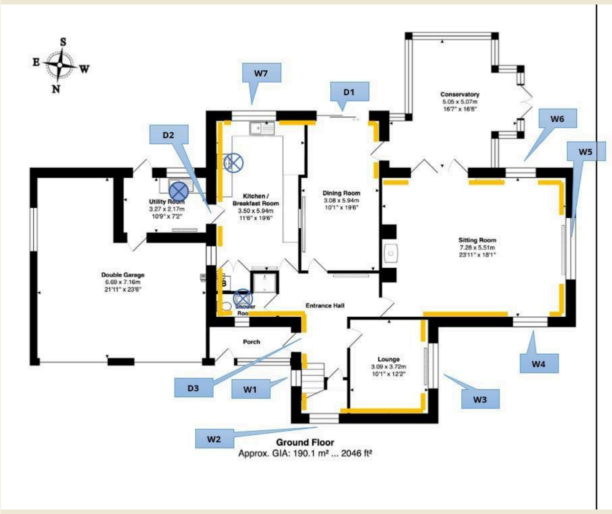
Preparation is the work. Finishes, joinery and fitted furniture came off walls like these before parge and boards — the unglamorous stage on which performance depends.



PRE-WORKS SURVEY · PROJECT RECORD

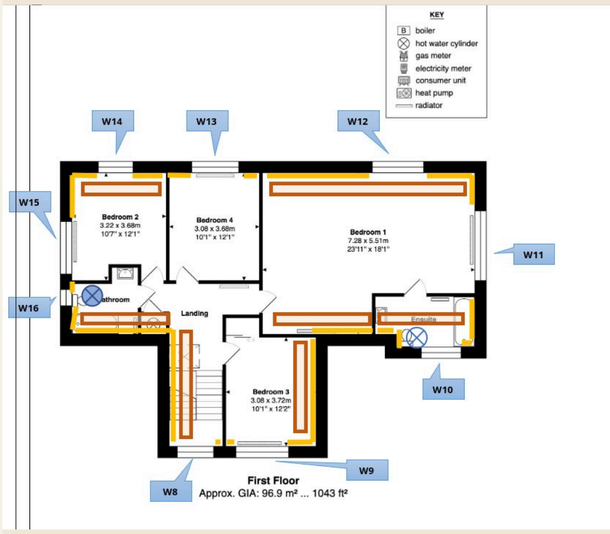
Rebuilt to the room it was. Bays, reveals and cills like these were stripped, insulated and re-plastered, with skirtings and mouldings reinstated per the record.

Room by room: *a variable section*



PROJECT RECORD · 699 TR F1

Ground floor. IWI zones (highlighted) to external walls; windows and doors referenced to the openings schedule.



PROJECT RECORD · 699 TR F1

First floor. Insulation continues behind wardrobes, into the airing cupboard and across the landing.

ROOM	ELEVATIONS	RESPONSE RECORDED IN THE BRIEF
Kitchen	E · S	IWI before new kitchen units
Dining room	S	Standard build-up
Large sitting room	S · W · N	Full-depth wood fibre
Small sitting room	W · N	40 mm profile to preserve floor area
Shower room	N · E	Cork with lime plaster finish
Stairwell & landing	N · E	Thinner profile to protect circulation width
Master bedroom	S · W · N	Continues inside wardrobes, thinner profile
Master en-suite	N	Cork and lime; overhanging floor insulated beneath
Bedrooms 2–4	various	Room-specific depths by exposure and geometry
Family bathroom	N · E	Cork with lime plaster; bath relocated
Airing cupboard	N	Thinner profile

Condensed from the room schedule in the project record.[12]

The constant is continuity. Where a partition met an external wall, insulation returned at least 400 mm along it; where the first floor's timber structure interrupted the wall, the layer continued through the floor void; where furniture stood against an external wall, the insulation went *behind* it — a wardrobe against a cold wall is a mould incubator, and the design refused to create one.[12]

Window reveals received thin insulation returns of their own, so the warm layer wraps the opening rather than stopping at its edge — the detail that separates an insulated wall from an insulated *room*.

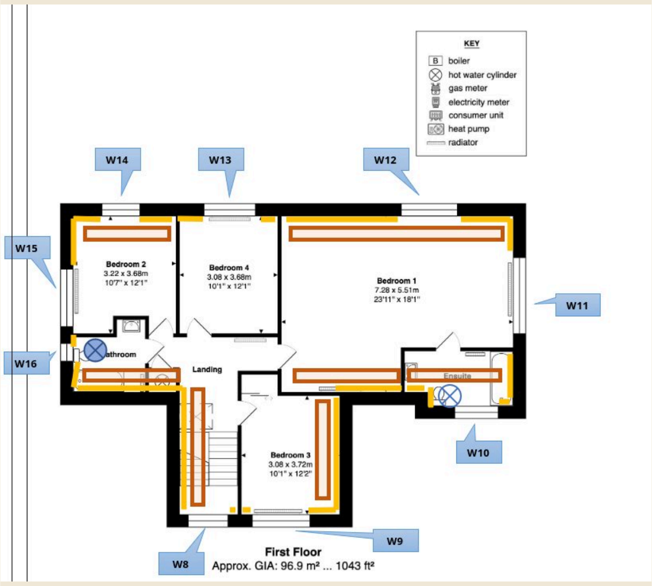
The hidden slopes above *every bedroom*

The main loft had already been topped up to about 300 mm. But a large part of the first floor is wrapped not by the loft floor but by **skeilings** — the sloping ceilings that follow the rafters — and behind those slopes the survey found little insulation at all.[18] Every bedroom, both bathrooms, the landing and the airing cupboard lost heat through a surface the owners could see every day but never suspected.

The brief measured nine separate skeiling zones, approximately 28.1 m² in total, and specified the response: remove the existing plasterboard, fit wood-fibre insulation between the rafters, add slimmer supplementary insulation below the rafters where headroom allowed, and re-line — with bathroom-rated board in the en-suite.[18] Where headroom was tight, notably at the top of the stairs, thinner build-ups were agreed rather than forcing a universal section.

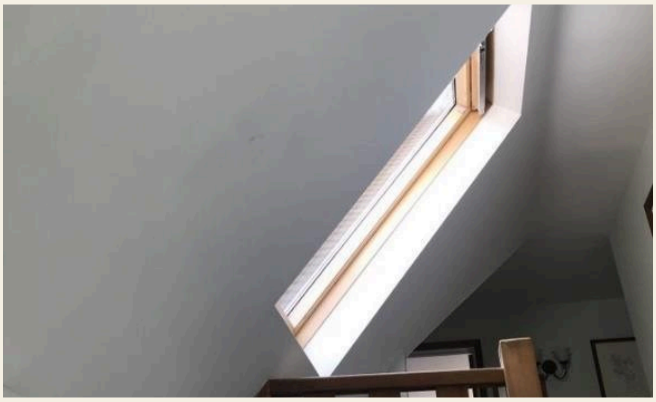
SKEILING ZONE	APPROX. AREA
Landing / stairwell	8.7 m²
Master bedroom — by door / by cupboards	2.6 + 6.5 m²
Bedroom 2 (rear) — two zones	1.8 + 1.6 m²
Bedroom 3 (front)	3.3 m²
Family bathroom	2.0 m²
En-suite bathroom · airing cupboard	0.8 + 0.8 m²
Total recorded in the brief	**28.1 m²**

Approximate dimensions from the project record; the contractor measured on site before ordering.[18]



PROJECT RECORD · 699 07

The skeiling map. Highlighted slopes across five rooms, the landing and the airing cupboard — each measured, each treated.



PRE-WORKS SURVEY · PROJECT RECORD

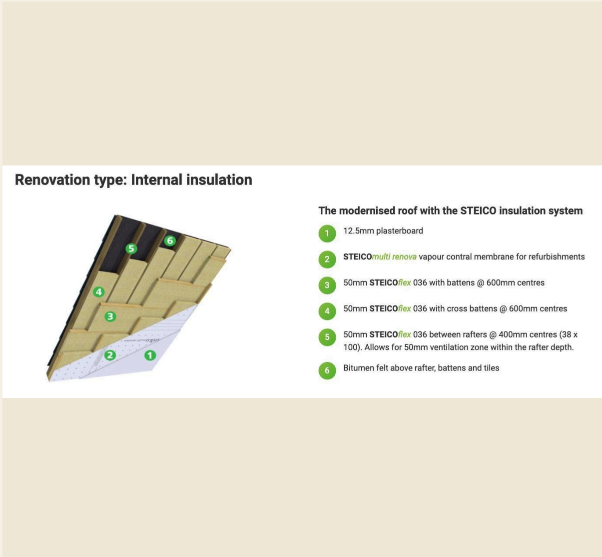
The landing slope, rooflight above the stair — one of nine zones opened and insulated.

Open, insulate, *breathe, close*

Insulating a skeiling changes the roof's microclimate: the loft and rafter zone above become colder, and with that comes a greater condensation risk. The brief therefore treated ventilation as part of the insulation detail, not an afterthought — a continuous ventilation zone had to be preserved within the rafter depth above the new insulation, and the existing loft ventilation was reviewed and supplemented if needed.[18]

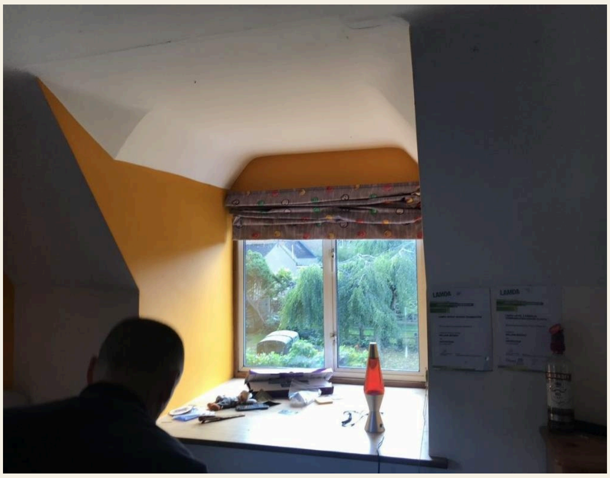
Continuity was the second discipline. The skeiling insulation had to meet the joist-level loft insulation without a gap, and meet the new wall insulation below without a thermal bridge — one unbroken warm layer from skirting to ridge line. Junctions in the vapour-control layer were sealed with airtightness tape, and boards were adhered around their full perimeter; the record explicitly rules out dot-and-dab.[18]

Only after inspection were the slopes re-lined and skimmed — work concealed is work verified first, a principle that runs through the whole project.[19]



REFERENCE ILLUSTRATION · PROJECT RECORD

The build-up principle: insulation between and below rafters, a vapour-control layer on the warm side, and — critically — a 50 mm ventilation zone preserved within the rafter depth above the insulation.[18]



PRE-WORKS SURVEY · PROJECT RECORD

A bedroom slope as surveyed. Plasterboard over rafters with little behind it — scheduled for opening up and wood fibre between the timbers.

PRE-WORKS SURVEY · PROJECT RECORD

Master bedroom and family bathroom slopes — lined, insulated and re-skimmed; bathroom-rated board used in the wet rooms.

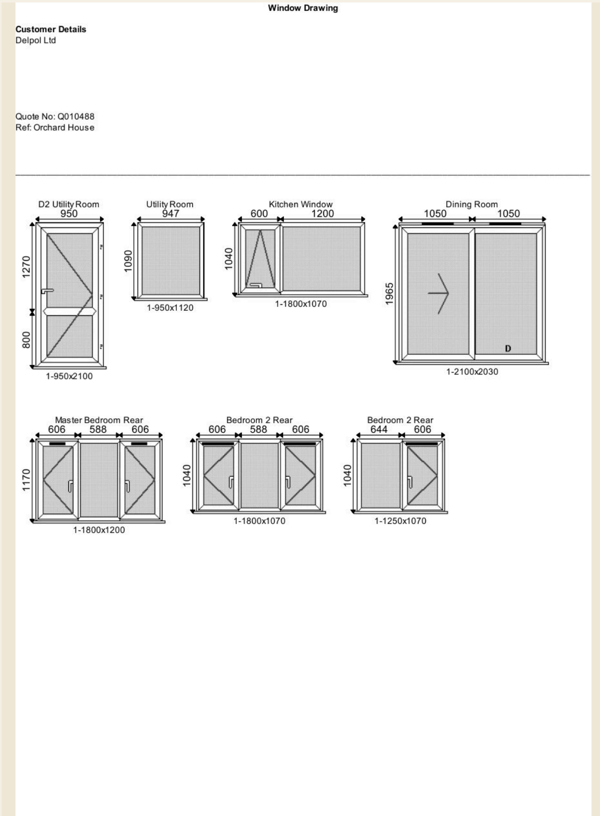
A mixed strategy for *two kinds of opening*

Orchard House has two families of openings, and the project treated them differently. The large rear and side openings — kitchen, dining patio, bedroom casements, the utility door — took high-performance PVCu units, double glazed with argon fill and warm-edge spacers: practical, robust and proportioned to broad apertures. The design target for the new windows was a whole-window U-value of roughly 1.0–1.4 W/m²K.[20]

The stone-mullioned openings at the front and sides demanded something finer. Here the frames had to read as slender as the originals within dressed-stone surrounds, so bespoke slim-frame aluminium units were specified — the Origin OW70 system is referenced in the project's supplier documentation, finished in white inside and out.[21] Because the project documents differ on the exact unit count, this study describes them simply as bespoke slim-frame units across the stone-mullion openings.

Two external-grade doors served the porch and utility — deliberately outside the thermal envelope — and seven internal doors upstairs were replaced as part of the reinstatement.[20]

Every frame was sealed to its opening with pre-compressed impregnated tape — Iso-Chemie Bloco One is named in the brief — linking weather seal, insulation and airtight layer in a single junction.[20]



PROJECT DRAWING · DELPOL WINDOW SCHEDULE

The seven large openings dimensioned for manufacture — utility door and window, kitchen, dining patio doors and three bedroom casements. The stone-mullion units were specified separately, in slim aluminium.[21]

PRE-WORKS SURVEY · PROJECT RECORD

Small sitting room, three-light mullioned opening as found.

PRE-WORKS SURVEY · PROJECT RECORD

Master bedroom, the four-light side opening as found.

PRE-WORKS SURVEY · PROJECT RECORD

Dining room, the patio doors to be replaced.

The stone-mullion junction, *remade*

The mullioned windows give the house its face. They were also its weakest thermal detail: the reconstituted-stone jambs and mullions were uninsulated, bridging straight through the wall and condensing — the published account records damp and mould at these junctions, and notes that specialist stonemasons were consulted on the solution.[5] The survey photographs show the cost plainly: staining and worn finishes tracking the stone, cold cills below the old glazing.

The answer was surgical. Damaged surrounds were repaired; the old glazing came out; new slim double-glazed units went in; and then — the step that turns a window replacement into a retrofit — the stone surrounds themselves were insulated internally with a thin, moisture-compatible layer, with calcium-silicate (Calcitherm-type) board recorded for these reveals in the published account.[5] Reveals, tapes, plaster and the room's wall insulation all meet here, so the work was done concurrently with the IWI, as one junction.[20]

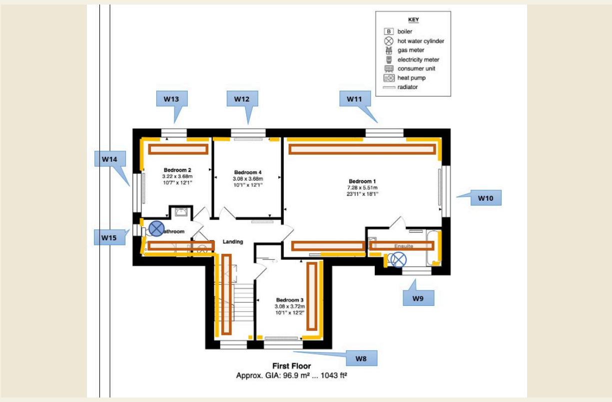
Purge and background air were part of the same decision: habitable rooms received planned background ventilation, while wet-room windows were kept free of trickle vents so that extraction — not leakage — governs their air.[22]

PRE-WORKS SURVEY · PROJECT RECORD

The junction as found. A leaded unit set directly in the reconstituted-stone surround — no insulation between stone and room, the whole depth of the jamb running cold.

PRE-WORKS SURVEY · PROJECT RECORD

The stone on the room side: mullions and reveals presented cold faces to every room — the surfaces later lined with thin moisture-compatible insulation.



PROJECT RECORD · 699 F11

Every opening in the schedule: W8–W16 across the first floor, each with its insulated-surround detail.

PRE-WORKS SURVEY · PROJECT RECORD

Deep reveals, cold surrounds: reveal faces were lined with insulation as part of the window package.

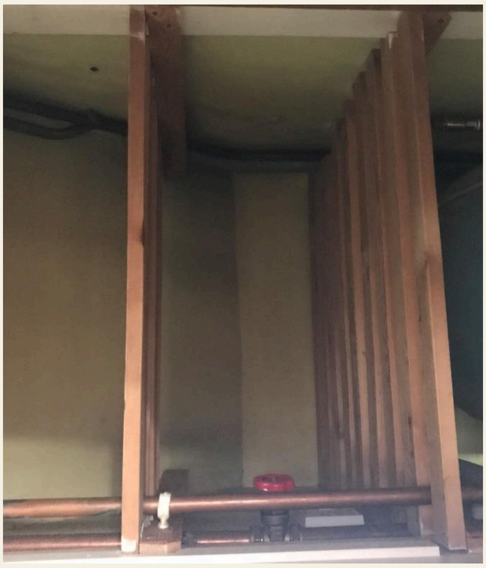
Airtightness is a *thousand small decisions*

Whole-house retrofit guidance is blunt about the priority: continuity of insulation, limitation of thermal bridges, and a deliberate air barrier — designed as junctions on drawings, built in sequence, and inspected before concealment.[19] Orchard House applied that discipline through details rather than gadgets.

At windows, impregnated tape linked frame to air barrier. At service entries, penetrations were sealed with tapes and grommets rather than mastic smears. At the floor voids, insulation passed through instead of stopping short. At the skeilings, the vapour-control layer was taped at every joint. And in the walls themselves, the continuous lime plaster acted as a robust, repairable air-control layer that no future picture hook can easily defeat.[17]

Thermal bridges were hunted one by one: stone mullions insulated on their internal faces; reveals wrapped with thin insulation; partition junctions returned 400 mm; pattresses isolating heavy fixings from the cold masonry; the exposed en-suite floor insulated from beneath so the overhang stopped behaving like a cooling fin.[12]

None of this appears in the finished rooms. That is the point — and it is why the project's photographic record of work in progress, taken at each stage for the coordinator and building control, matters as evidence rather than decoration.[23]



PRE-WORKS SURVEY · PROJECT RECORD

Concealed routes as found. Pipework and services rising through unsealed voids — every one a leak path to be sealed, and a route fixed before the fabric closed.

PROJECT RECORD · 699 TR H4

Routes designed on the drawings. Emitters, pipe runs and the hot-water store positioned on plan — penetrations planned, not improvised.[5]

PRE-WORKS SURVEY · PROJECT RECORD

The frame–masonry junction: a leak path until taped — window, reveal insulation and air barrier were specified as one detail.

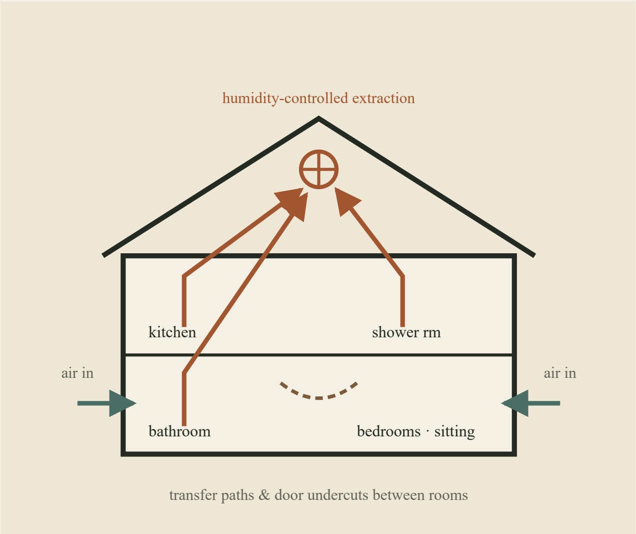
No post-completion airtightness test result is claimed in this document; the pre-works pulse-test baseline appears on page 06, and the air-control strategy is described as designed and installed, not as a measured outcome.

Once leakage stops, *ventilation must be designed*

The retrofit made the house deliberately less leaky. That is a gift to comfort and efficiency — and a responsibility: moisture and pollutants that once drifted out through gaps now need a planned exit. Current Building Regulations guidance structures this as three duties — whole-dwelling background ventilation, extraction at source in wet rooms, and purge ventilation for rapid dilution — with commissioning and occupant information as part of the work, not an appendix to it.[24]

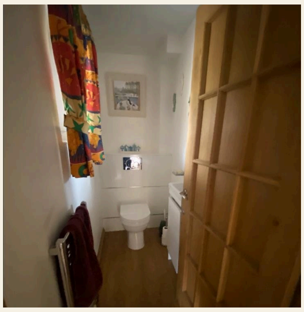
The Orchard House design answered with humidity-controlled extract ventilation across the whole house. Extraction was placed where moisture is made: the kitchen, the ground-floor shower room, both first-floor bathrooms and the utility area. Habitable rooms received planned background air — trickle vents or through-wall inlets settled before the windows went into production — and transfer paths and door undercuts let air move between the two.[22]

Wet-room windows carry no trickle vents: their air leaves through the extract terminals, under control, rather than through uncontrolled leakage. The system was planned *before* the windows and insulation precisely so that inlets, routes and terminals could be designed into the fabric rather than bored through it afterwards.[22]



INTERPRETIVE DIAGRAM

The ventilation principle: extract at source, supply by plan, connect the two with deliberate transfer paths. Drawn from the project record;[22] framework per Approved Document F.[24]



PRE-WORKS SURVEY · PROJECT RECORD

Kitchen and family bathroom — two of the five extract locations surveyed for the new system.

Air quality is an *outcome to hand over*

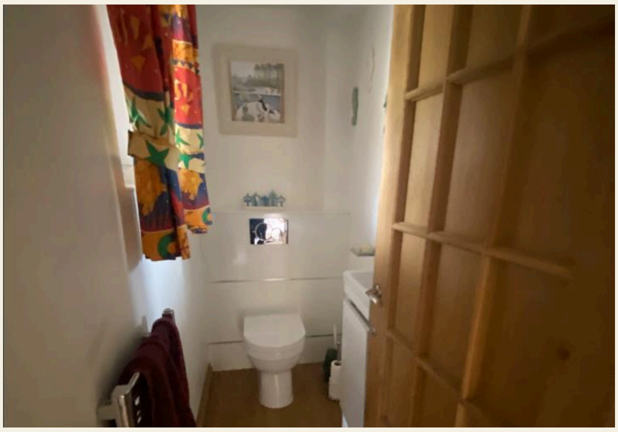
Historic England's guidance on occupants' wellbeing is unambiguous: where insulation and airtightness improve, a ventilation strategy must accompany them, because indoor humidity, particulates and contaminants otherwise accumulate.[25] The protected fabric and the protected occupant are the same problem — a wall kept dry by ventilation is also a wall that never grows the mould its occupants would breathe.

Humidity control is the operating idea. Rather than running flat-out regardless, the extraction responds to moisture, raising rates when bathrooms and the kitchen are in use and falling back to a quiet background level otherwise — exactly the demand-led behaviour regulators encourage, with fans sized so background mode does not become a noise nuisance.[24]

Commissioning closes the loop: measured airflow at each terminal, controls demonstrated, and the system explained to the people who will live with it. The brief required the client to understand how to operate what had been installed — a handover duty that turns hardware into performance.[22]

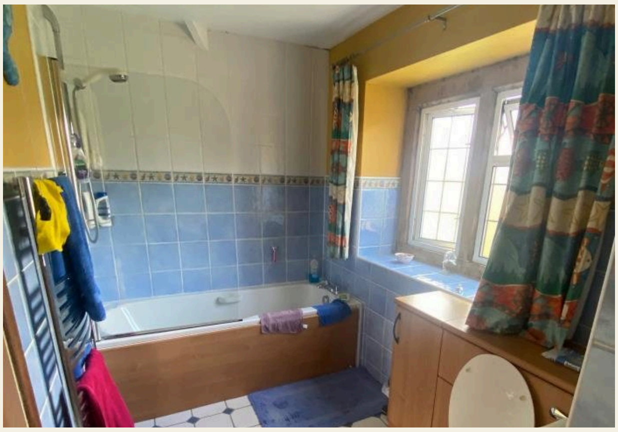
PRE-WORKS SURVEY · PROJECT RECORD

A wet room as found. No mechanical extract, no background vent — moisture managed only by leakage and an openable window. The new system put humidity-controlled extraction here instead.



PRE-WORKS SURVEY · PROJECT RECORD

The ground-floor cloakroom: among the wet spaces surveyed for the extract and transfer-path plan.



PRE-WORKS SURVEY · PROJECT RECORD

The en-suite as found — one of the wet rooms whose extraction was re-specified in the new system.

21 **HEAT**

Out with the oil, in with the *air-source heat pump*

The old system left in pieces: the Trianco oil boiler from its kitchen cupboard, the 162-litre cylinder from the airing cupboard, the external tank from its concrete piers — and, with them, the house's direct dependence on delivered fossil fuel.[26]

In their place, an air-source heat pump on a prepared base beside the east kitchen wall — the location studied in the design documents — with upgraded hot-water storage, new insulated distribution pipework, filtration, antifreeze protection and modern controls.[27]

The conservatory's wet underfloor heating — previously run from the boiler — was retained and connected into the new system, so the whole heated estate now draws from one electric source.[28]

The design and quotation record referenced a specific 17 kW unit and 300-litre cylinder at proposal stage; because completion documentation confirming the exact installed model is not part of the evidence pack, this study deliberately describes the installed plant generically — an air-source heat pump with upgraded hot-water storage.[29]

PRE-WORKS · PROJECT RECORD

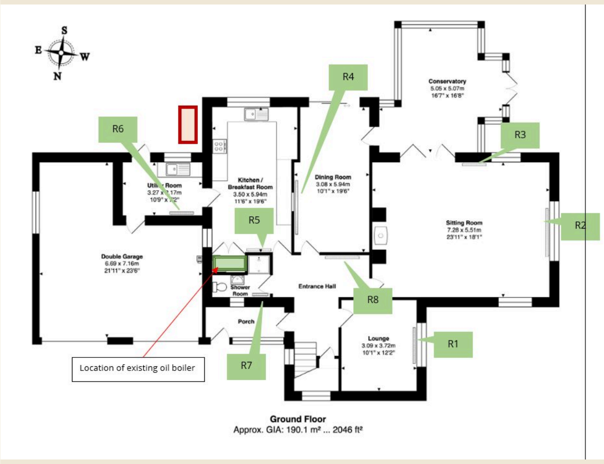
Supply readiness checked: metering and isolation surveyed for the new all-electric plant.

Heat sized for the house *it now serves*

A heat pump is not a boiler with a different badge. It delivers its efficiency at low flow temperatures, which means the whole chain — envelope, room heat losses, emitters, pipework — must be designed together. The industry design standard requires exactly that: a room-by-room heat-loss calculation for every heated and indirectly heated space, an emitter check against the selected flow temperature, and documented handover of the result.[30]

Orchard House's brief built that logic into the sequence: the heat pump was to be sized only *after* the fabric measures, against post-retrofit U-values, with existing radiators reviewed and replaced where their output would fall short at heat-pump temperatures.[31] The survey recorded sixteen emitters room by room — photographed and logged so each could be checked against the room's calculated loss rather than assumed adequate.

The consequence is a quieter kind of competence: no oversized plant cycling itself to an early grave, no room left cold because its radiator belonged to the oil era. Where rooms needed more emitter area, it was provided; where they did not, the existing radiators stayed.



PROJECT RECORD · 699 TR H4

The heating map. Every emitter logged by room, the outgoing boiler position marked, and the proposed heat-pump location fixed against the east kitchen wall.

PRE-WORKS SURVEY · PROJECT RECORD

The emitter audit: each radiator photographed, measured against the room it must warm at lower flow temperatures.

Storage, pipework and controls — *the quiet half of the system*

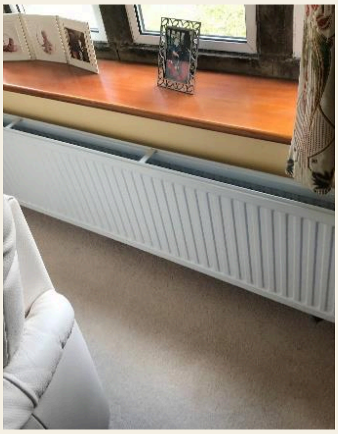
PRE-WORKS SURVEY · PROJECT RECORD

What the upgrade replaced: the 162-litre cylinder in the first-floor airing cupboard — undersized for heat-pump operation. The record specified insulated storage of roughly 300 litres, plumbed and controlled for low-temperature flow.

Hot water is where heat-pump systems most often disappoint: storage sized for a boiler's brute force cannot always serve a household from a gentler heat source. The project answered with substantially larger, well-insulated storage — the design record referenced an upgrade from 162 to approximately 300 litres — so that lower-temperature heat still means full baths and busy mornings.[27]

The hydraulic package around it was treated with the same care: filtration to protect the pump, antifreeze protection for the external circuit, flow measurement for commissioning, and controls agreed with the clients early rather than presented as a surprise at handover.[27]

Below the floors, the change was more radical. The old distribution pipework ran through the uninsulated concrete slab, warming the ground; the new insulated runs were laid in excavated channels and re-buried — invisible now in the finished floors.[5]



PRE-WORKS SURVEY · PROJECT RECORD

The emitter audit fed the hydraulics — flow temperatures, pipe sizing and the balance between rooms.

COMMISSIONED, NOT JUST CONNECTED

The brief required registration, notification and commissioning duties to be completed — including the appropriate MCS, DNO and local-authority processes — and the system handed over documented and explained.[32]

The published account confirms the completed system in daily use; no performance certificates or measured efficiencies are claimed here.

The enabling works *nobody photographs*

Retrofit runs on electricity: the heat pump, the ventilation, the controls, the future-proofing. The electrical package at Orchard House was therefore an enabling workstream in its own right, first in the sequence — not an afterthought bolted on at second fix.[33]

The consumer unit and the solar-PV controller were relocated to the garage; sections of degraded wiring were replaced; the kitchen's electrical provision was separated and reconfigured for its renewal; smoke and heat alarms, downlights, under-cabinet lighting, additional sockets and Cat6 data were installed. Dedicated supplies were run for the heat pump and the ventilation system, and the work closed with testing, earthing verification and Part P registration.[33]

The detail that tells the story is the smallest one: back boxes specified deep enough for the 60 mm insulation zones, so sockets would sit cleanly on the new wall build-up without crushing it or piercing it carelessly. That is what coordination looks like at 35 mm scale.[33]

PRE-WORKS SURVEY · PROJECT RECORD

Inherited infrastructure: the meter cabinet in the garage and the old consumer-unit arrangement — the starting point for a safer, re-planned electrical installation.

PRE-WORKS SURVEY · PROJECT RECORD

Existing generation and charging — the solar array's inverter and the EV charge point were integrated into the relocated, re-planned electrical heart of the house.

THE ENABLING SCOPE, RECORDED IN THE ELECTRICAL WORKS DOCUMENTS[33]

Relocate & protect. Consumer unit and PV controller moved to the garage; earthing and circuit testing; Part P registration.

Renew & reconfigure. Degraded wiring replaced; kitchen provision separated and rebuilt for the new layout.

Serve the retrofit. Dedicated supplies for heat pump and ventilation; deep back boxes co-ordinated with the 60 mm insulation zones.

Live well. Smoke and heat alarms, downlights and under-cabinet lighting, additional sockets and Cat6 data.

Inspect what will *become invisible*

Most of what makes this retrofit work is now sealed behind plaster. The quality system had to operate *before* closure: the project record required photographs at every stage for the retrofit coordinator and building control, with site inspections arranged at the appropriate points — a discipline current guidance recognises as the only reliable way to verify junctions that will later be concealed.[19]

DELPOL's coordination made that practical: because one team owned the interfaces, each concealed layer was photographed, checked and signed through before the next covered it — the parge before the boards, the boards before the plaster, the tapes before the reveals, the pipework before the floor was remade.

The published account is honest about the cost of doing this properly in an occupied-world home: the build took closer to six months as the scope expanded, and the family stayed elsewhere for the five most disruptive months. "You really have to go into a project like this with your eyes wide open," the homeowners advise — words DELPOL would print on every retrofit proposal if it could.[11]

The same account records that early technical issues were resolved and the project progressed to everyone's satisfaction — the realistic signature of a well-managed complex build.[11]

01

EXPOSE

METHOD · PROJECT RECORD

Stage one — expose. Finishes removed, defects visible and addressed.

02

BUILD THE LAYERS

METHOD · PROJECT RECORD

Stage two — build the layers. Insulation fitted, junctions checked before closure.

03

CLOSE & FINISH

METHOD · PROJECT RECORD

Stage three — close and finish. Verified work concealed behind new plaster.

Photographed stages. Each phase documented for coordinator and building control before the next concealed it.[23]

Inspection before concealment. Junctions, tapes and build-ups verified while still visible — the QA moment that matters.

One accountable hand. No gap between scopes in which a defect could be disowned.

Keeping a house is the *greenest specification*

The most consequential environmental decision at Orchard House was the first one: keep the building. Every tonne of stone, brick and timber already in place is embodied carbon that does not need to be spent again; the retrofit invested in performance rather than replacement. Current conservation guidance frames good retrofit exactly this way — repair and maintain first, reduce demand, then supply the remainder with low-carbon technology.[34]

The material palette followed suit: wood fibre and cork rather than plastic foam; lime rather than gypsum or cement where the wall needed to breathe; repairs in compatible materials. The oil boiler, cylinder and tank — the house's fossil-fuel apparatus — left the site entirely, replaced by electric heat that will decarbonise further as the grid does.[26]

And the conservation value is simply visible: from Lower Street, nothing has been lost. The stone, the mullions, the roofline remain — a demonstration that a conservation-area home can be made fit for this century without erasing the last one.

PROJECT RECORD

Unchanged where it matters. The stone elevations, mullioned openings and roofline all remain — the retrofit is in the performance, not the appearance.

FABRIC

Heat loss cut at source through continuous, moisture-aware insulation — the durable half of the carbon story.

ENERGY

Oil heating and its tank removed; heating and hot water now electric, on a system designed for low-temperature operation.

CHARACTER

Conservation-area fabric retained and repaired; the village streetscape reads exactly as before.

No quantified carbon saving is claimed: none was measured at publication. The environmental case rests on the documented measures — insulation, ventilation, electrified heat — and the retention of the existing building.

The completed house, *lived in*

PRE-WORKS SURVEY · PROJECT RECORD

A house, not a site. Reinstatement ran to a domestic standard — seven internal doors, joinery, skirtings and mouldings renewed or replicated as part of the record's scope.

> *"The house now feels modern, warmer, and more welcoming than ever."*

THE HOMEOWNERS · PUBLISHED PROJECT ACCOUNT

The published account measures success in lived terms: a home that is warm, modern and welcoming, its carbon burden reduced, its future secured. Financial savings had not been measured at publication, and this document does not estimate them — the owners never undertook the project to produce them.[35]

What the record does support is the quality of the change: every external wall and sloping ceiling stripped and rebuilt with insulation and lime; every window replaced or renewed within its stone surround; air managed deliberately; heat delivered by a system designed for the building it serves; new floor finishes and rebuilt fitted furniture completing the rooms.[36]

PRE-WORKS SURVEY · PROJECT RECORD

Rooms handed back to daily life — every slope and wall in rooms like this rebuilt, plastered and decorated, with the insulation invisible behind the finish.

What Orchard House *demonstrates*

If you are an architect with a technically difficult existing house — hybrid construction, conservation constraints, clients with serious environmental intent — this project is evidence that DELPOL can carry the delivery burden whole: fabric, moisture, air, heat, power and finishes, coordinated as one system and sequenced so that design intent survives contact with site reality.

If you are a homeowner contemplating a deep retrofit, it is evidence of something equally valuable: candour. Programmes stated honestly, disruption named plainly, evidence labelled for what it is, and no performance figure offered that the record cannot support.

THE CAPABILITIES THIS PROJECT EVIDENCES

- **01** Whole-house diagnosis and performance mapping before design freeze
- **02** Moisture-aware internal insulation of hybrid masonry, room by room
- **03** Conservation-sensitive window and stone-mullion renewal
- **04** Ventilation designed with the fabric, commissioned and explained
- **05** Heat-pump systems designed against the improved envelope
- **06** Electrical infrastructure replanned around the retrofit
- **07** Sequencing, photographic QA and inspection before concealment
- **08** Reinstatement, joinery and finishes to a domestic standard

One company held every interface in that list. That — more than any product named in these pages — is the capability on offer.

> “Anyone tackling a project like this needs to be fully prepared… The advice and service from the contractor helped move the project along to everyone’s satisfaction.”

THE HOMEOWNERS, ON THE DELIVERY EXPERIENCE · PUBLISHED PROJECT ACCOUNT (ABRIDGED)

Endnotes & sources

PROJECT RECORD — DELPOL 699-SERIES BRIEFS

1. 699 TR 00 *Project Overview* (24/03/2023): wall construction, conservation-area status, thermal-envelope definition.
2. Historic England, *Insulating Walls in Historic Buildings* (updated 2026): irregular and early cavities treated as solid walls.
3. The homeowners' published account: internal insulation chosen to preserve the external stone appearance.
4. TR 00: whole-house plan, retrofit coordination roles, measure maps.
5. The homeowners' published account: mullion thermal bridging and mould; stonemason consultation; Calcitherm at mullions; underfloor pipework heat loss and replacement.
6. 699 TR H4 *ASHP* (29/03/2023): ≈208 m² heated envelope; estimated annual fuel use ≈48,314 kWh (design-stage Crohm estimate); Trianco TRO 28/32 Mk2 boiler; 162 L cylinder.
7. 699 TR V1 *Ventilation* (27/03/2023): pre-works pulse-test results at 4 Pa; existing extract and background-ventilation audit.
8. The homeowners' published account: client motivation — environmental sustainability rather than payback.
9. The homeowners' published account: kitchen and bathroom renewal independent of the core retrofit package.
10. TR 00: sequence of installation table; photographic and Building Control duties.
11. The homeowners' published account: ≈ six-month construction period after scope expansion; five months away; Christmas return; disruption advice.
12. 699 TR F1 *Internal Wall Insulation* (27/03/2023): room schedule; 30–60 mm wood fibre / cork / calcium-silicate; 40 mm small sitting room; 400 mm returns; floor-void continuity; parge, pattresses, tapes, mesh and lime plaster; vapour-open paint Sd ≤ 0.1 m; preparation and reinstatement scope.
13. TR F1: design U-value targets 0.3–0.4 W/m²K — quoted as design targets.
14. Historic England, *Internal Wall Insulation* (published 29/10/2025): permeable materials, compatible finishes, thermal-continuity duties, service relocation.
15. Historic England, *Internal Wall Insulation*, citing DESNZ DEEP research: moisture risk rises with IWI; permeable systems reduce it; moderate U-value targets balance risk and benefit.
16. Historic England, *Properties of Traditional Building Construction* (updated 2025): capillarity, buffering, vapour transport and drying.
17. Historic England, *Air and Vapour Control Layers in Buildings of Traditional Construction*, Research Report 44/2024; and *Internal Wall Insulation*: AVCL difficulty in practice; continuous permeable plaster as robust air control.
18. 699 07 *Skeiling Insulation* (24/03/2023): nine zones totalling ≈28.1 m²; wood fibre between rafters; 50 mm ventilation zone; bathroom-rated board; full-perimeter adhesive; taped membrane junctions; loft-ventilation review.

PROJECT RECORD (CONTINUED) · HOMEOWNERS' ACCOUNT · GUIDANCE

19. Approved Document L, Vol. 1: Dwellings (2021 ed. inc. 2023 amendments), §§4–5: continuity of insulation, thermal bridging, airtightness, buildability and inspection; TR 00 photographic duty.
20. 699 F11 *Windows and Doors* (29/03/2023): mixed casement/mullion strategy; design whole-window U-values 1.0–1.4 W/m²K; Iso-Chemie Bloco One tape; concurrent mullion insulation and IWI; seven internal doors; two external-grade doors.
21. DELPOL supplier documentation: PVCu schedule and drawing Q010488 (seven large openings); Origin OW70 aluminium specification for the stone-mullion units (white finish). The record's mullion unit counts differ (25 vs 26 entries); no precise count is claimed.
22. TR V1: humidity-controlled whole-house extract; kitchen, shower room, two bathrooms, utility; background air by trickle or through-wall inlets settled before window production; transfer paths; no trickle vents in wet rooms; commissioning and client instruction.
23. TR 00: photographs at each stage for the retrofit coordinator and Building Control.
24. Approved Document F, Vol. 1: Dwellings (2021): whole-dwelling ventilation, extract and purge; commissioning; user information; quiet background operation.
25. Historic England, *Occupants' Wellbeing* (2024): indoor air quality, humidity and the necessity of a ventilation strategy.
26. The homeowners' published account: boiler, cylinder and tank removed; TR H4: existing oil system description.
27. Project 699 quotation (15/05/2023) and TR H4: removal scope; external siting; upgraded storage (≈300 L referenced); controls, filter, antifreeze, flow measurement, insulated pipework.
28. TR H4: conservatory wet UFH retained on the new system; envelope exclusions.
29. Project 699 quotation: Grant 17 kW unit referenced at proposal stage; installed model not confirmed in the evidence pack — hence the generic description used throughout.
30. MCS MIS 3005-D *The Heat Pump Design Standard* and MCS Heat Load Calculator guidance: room-by-room heat loss; design flow temperature; emitter checks; documentation and handover.
31. TR H4: sizing after fabric measures against post-retrofit heat loss; emitter review and replacement.
32. Project 699 record / TR H4: registration, notification and commissioning duties.
33. DELPOL electrical quotations (21/05/2023; revised 31/08/2023): consumer unit and PV controller relocation; kitchen reconfiguration; wiring renewal; alarms, lighting, sockets, Cat6; deep back boxes for 60 mm IWI; dedicated ASHP and ventilation supplies; testing and Part P registration.
34. Historic England, *Improving Energy Efficiency Through Mitigation* (updated 2026): energy-efficiency hierarchy — repair, reduce demand, then low-carbon supply.
35. The homeowners' published account: qualitative outcome; financial savings not measured at publication.
36. The homeowners' published account: completed measures list, floor finishes and rebuilt fitted furniture.

External research is cited to explain current best-practice reasoning. It does not imply that this completed project was assessed or certified against later editions. Accessed August 2026; check for revisions before relying on any citation.

One house. One plan. One accountable team — from the first survey photograph to the last coat of lime plaster.

PHOTOGRAPHY & EVIDENCE CREDITS

All photographs, floor plans, schedules and drawings reproduced in this publication are from the **DELPOL project record** — the 699-series technical briefs, survey imagery and supplier drawings — and are marked accordingly. Interpretive diagrams were prepared for this publication from the project record and are labelled as such; they are not approved construction details for any other building.

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EVIDENCE STATEMENT

No costs, savings, carbon figures, airtightness results or certifications are claimed. Design targets are identified as targets. A claim-by-claim fact-check report accompanies this publication.

TALK TO US ABOUT YOUR BUILDING

If you are planning a whole-house retrofit — or you are an architect who needs a contractor able to protect design intent through a technically difficult existing building — we would be glad to walk you through Orchard House in more detail.

CONTACT — EDITABLE BLOCK

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[website]

Insert company contact details here before distribution. No details are published in the project record, so none are invented here.

Orchard House · Barford St Michael · Oxfordshire — case study prepared from the completed project record, the homeowners' published account and current technical guidance.