AHU REFURBISHMENT DECODED

A Complete Guide to Decision, Upgrade Strategy and Delivery

MANSFIELD POLLARD
AIR MANAGEMENT EXPERTS

table of **CONTENTS**

Section 1 - Refurbish vs Replace: Decision Criteria and Risk

When does ahu refurbishment make more sense than replacement?

AHU refurbishment makes more sense than replacement when you need a step-change in performance, efficiency, or reliability, but the existing unit still gives you a sound structural and spatial starting point. In practice, the decision is rarely driven by a single factor. It is usually a combination of energy cost, carbon targets, plantroom constraints, downtime risk, and the practical reality of replacing a large piece of equipment inside a live building.

Refurbishment is typically the right option when:

The casing and base structure remain serviceable:
If the AHU's core construction is stable, refurbishment can address the parts that drive performance and energy use without the disruption of full replacement.

Access and replacement logistics are a problem:
Many sites cannot remove a complete AHU due to plantroom layout, restricted routes, or lifting limitations. Refurbishment allows targeted intervention with fewer building works and less programme risk.

Downtime has to be controlled:
Where ventilation is critical to operations, the question becomes how to improve performance without an extended shutdown. Refurbishment can be planned in phases, with changeovers structured around operational windows.

Energy efficiency is the driver, not capacity increase:
If the duty is broadly correct but the unit is inefficient, refurbishment focuses investment on the parts that make the biggest difference. Fan upgrades are often central, along with controls, filtration strategy, and airflow integrity improvements.

Decarbonisation is a requirement.
Refurbishment can support operational carbon reduction by reducing electrical consumption, and it can support embodied carbon reduction by retaining major structural elements rather than scrapping and replacing the entire unit.

Replacement is usually the better option when the AHU is fundamentally unsuitable for the duty, when the casing condition is beyond economic repair, or when the scope of required change is so extensive that the project becomes a "new unit in all but name". When that is the case, replacement can be the cleanest route to compliance and performance, particularly if the building's ventilation strategy is changing.

The most useful way to frame the decision is this. Refurbishment is a controlled upgrade programme. Replacement is a system reset. If your objectives can be met with a controlled upgrade, refurbishment is often quicker to deliver, easier to validate on a live site, and more efficient in both cost and carbon terms.

What drives most ahu refurbishment projects in practice: cost, carbon, compliance, or risk?

Most AHU refurbishment projects start because something has become operationally expensive to tolerate. That is usually one of three issues. The unit costs too much to run. The unit is increasingly unreliable. The unit is no longer delivering the performance the building requires.

In real estates, decision-making, drivers tend to stack together rather than compete.

Cost and operational savings:
Energy consumption is often the first measurable trigger. Older fan and motor arrangements, poor control stability, and deteriorated airflow integrity can push running costs up year on year. Refurbishment becomes attractive because it targets the components that drive electrical consumption and control stability without the capital and enabling works required for a full replacement.

Decarbonisation and sustainability:
Many organisations now treat refurbishment as a decarbonisation lever. The operational carbon case comes from reduced electrical consumption once efficiency upgrades are made and properly controlled. The embodied carbon case comes from retaining major structural elements rather than discarding a whole unit and manufacturing a replacement. This combination is a practical reason refurbishment appears in decarbonisation programmes.

Compliance and performance risk:
In environments where ventilation expectations are explicit, refurbishment can be driven by compliance exposure as much as cost. Any variance from expected / regulated performance can create risk: Poor airflow delivery, unstable temperature control, excessive noise, and maintenance access shortcomings all become sources of complaints and operational disruption. Refurbishment is selected when those risks can be removed through a defined scope and evidence-based acceptance.

Programme and site constraints:
The final driver is often physical reality. Many sites cannot remove and replace a complete AHU without structural works, craneage, or extended shutdowns. Where access, lifting, and downtime are constrained, refurbishment is often the only viable route to improve performance within the limits of the building.

The consistent theme across all of these drivers is that refurbishment only creates value if it is scoped to outcomes and verified properly. An unvalidated upgrade can reduce energy use on paper while leaving the underlying performance risks unchanged.

Refurbish or replace: what is the fastest way to make a justifiable decision?

The fastest justifiable decision is made using a structured viability framework supported by a condition survey. The reason is simple. Refurbishment decisions fail when they are based on assumptions, and replacement decisions fail when they are based on habit rather than constraint.

A verifiable decision can normally be reached quickly if you answer five practical questions and treat the answers as engineering criteria, not opinions.

1) Is the casing structurally recoverable?
If the casing and base structure are fundamentally sound, refurbishment can be engineered around them. If corrosion, distortion, or widespread panel degradation makes the casing unreliable, you are no longer refurbishing. You are attempting to rebuild a unit inside a compromised shell.

2) Can the unit be made to meet the required duty and control stability?
If airflow delivery, pressure development, temperature control, and filtration strategy can be achieved with upgrades and corrections, refurbishment remains viable. If the duty has changed materially or the performance requirement has moved beyond what the unit footprint and arrangement can deliver, replacement is often the more controlled route.

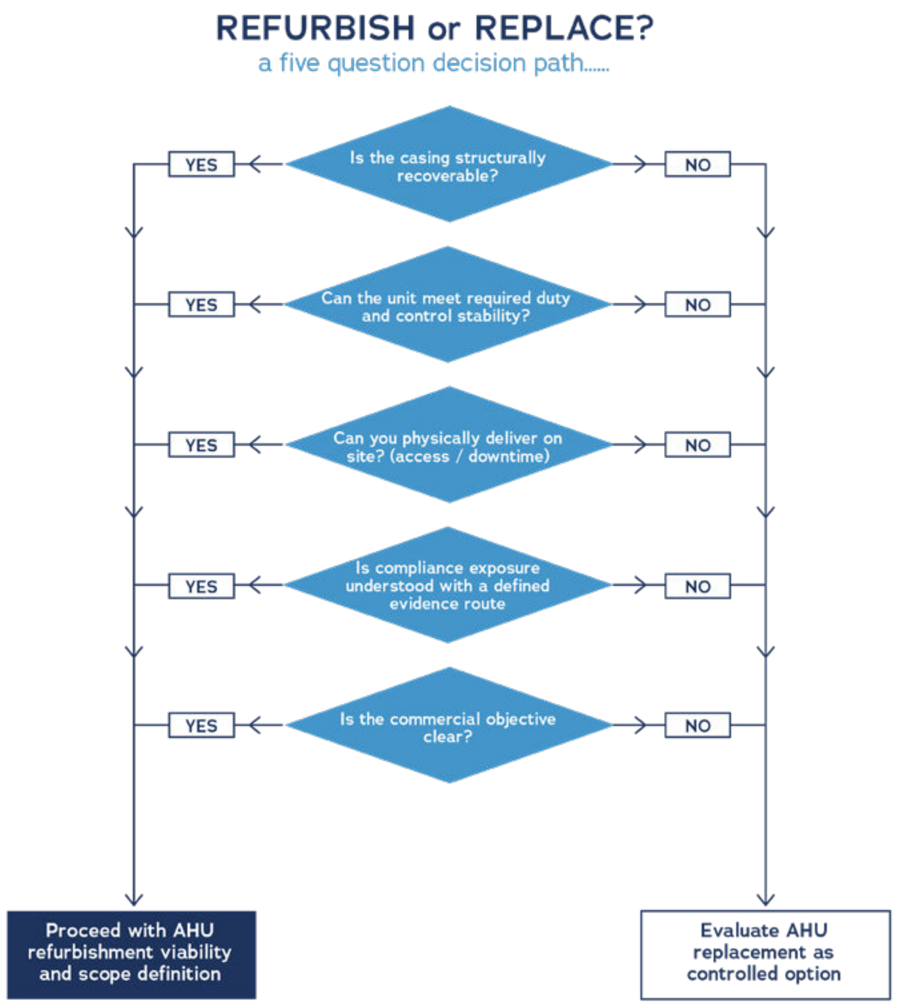
3) Can you physically deliver the project on this site?
Access constraints and downtime limits frequently decide the route. Many buildings make full replacement impractical without structural works or extended shutdowns. In those cases, refurbishment becomes the deliverable option, but only if the intervention can be engineered safely and methodically.

4) What is the compliance exposure, and how will evidence be produced?
A refurbishment that cannot be validated is not a refurbishment programme. It is a gamble. If

performance, leakage, and commissioning evidence can be defined and produced, refurbishment is justifiable. If the project is likely to end with “it seems better”, replacement may be the only way to reset performance and compliance with confidence.

5) What is the commercial objective?
Sometimes the objective is to defer capital cost while improving efficiency and reliability. Sometimes it is to extend service life. Sometimes it is to align an asset with a decarbonisation plan. If you are clear on the objective, you can scope the minimum intervention that meets it. If you are not, the project typically grows, delays, and underdelivers.

The fastest route is therefore not a guess. It is a short survey-led decision process that converts unknowns into a scope and an acceptance plan.



Section 2: Viability and Constraints: When Refurbishment Doesn’t Stack Up

What factors determine whether an ahu is viable to refurbish?

Viability is determined by whether the unit can be made fit for purpose, safely maintained, and validated against defined outcomes. That requires more than a judgement on age. It requires a view on condition, arrangement, and constraints.

The most reliable viability assessment considers the unit under six headings:

1 - Structural condition and casing integrity:
The casing is the platform for everything else. If panels, frame, and base structure can be recovered, leakage and bypass pathways can be addressed, and access points can be made safe and serviceable, refurbishment remains credible. If casing condition is beyond economic repair, the project becomes high risk because you cannot build long-term performance on unstable structure.

2 - Performance capability versus current and future duty:
A unit can be viable even if it is currently underperforming, but it must be capable of meeting the duty after intervention. That means airflow and pressure capability, stable temperature control, and an arrangement that supports the required indoor air quality (IAQ) outcomes, including the filtration approach where relevant. If the building duty has increased significantly, or if the unit footprint and internal arrangement cannot support the required performance, viability reduces quickly..

3 - Fan technology and upgrade feasibility:
Fan upgrade feasibility is often central because fans dominate electrical consumption and control stability. The question is not simply “can we replace the fan”. It is whether an upgraded arrangement can be integrated within the available space, installed through the available routes, and maintained safely over the long term and whether it will deliver a measurable efficiency improvement in terms of fan energy and duty delivery, not just a change of components.

4 - Controls and integration constraints:
Some sites have BMS limitations, legacy control strategies, or operational practices that affect what can be achieved. A unit can be refurbished mechanically but still underperform if the control and commissioning approach does not match how the building actually operates.

5 - Access, safety, and maintainability:
Refurbishment should remove maintenance risk, not inherit it. If access cannot be made safe, filter changes remain difficult, or critical components are still unserviceable, the refurbished unit may look improved but remain operationally compromised.

6 - Evidence and acceptance:
A viable refurbishment is one where acceptance evidence is achievable. If the project can define what will be tested, how it will be tested, and what “pass” looks like, it becomes viable in a way that buyers, contractors, and consultants can support

What are the red flags that mean refurbishment is not the right option?

Refurbishment is not the right option when it cannot produce a durable, verifiable improvement. The most common red flags fall into four categories: structural condition, duty mismatch, deliverability, and evidence risk.

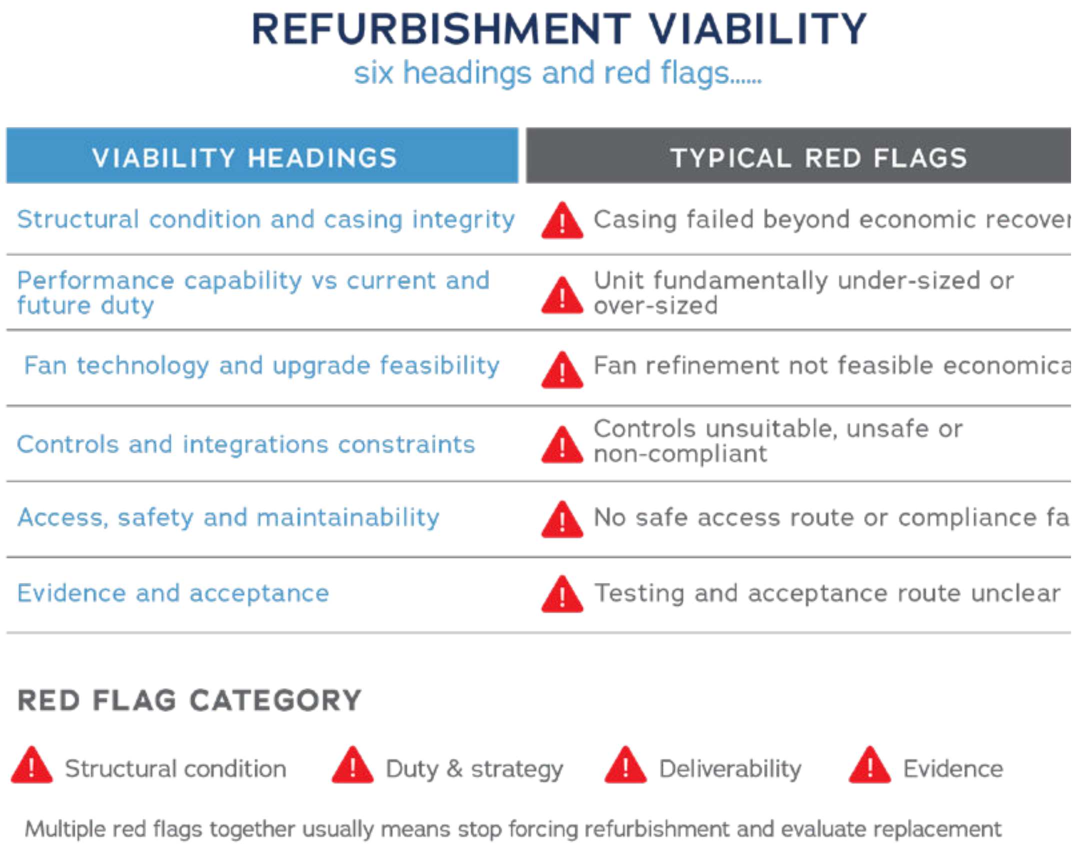
Structural red flags:
If the casing and base structure are beyond economic recovery, refurbishment becomes a short-term patch. Severe corrosion, distorted frames, degraded panel systems, and widespread leakage pathways that cannot be recovered are warning signs. In these cases, you are trying to build performance on a failing platform.

Duty and strategy red flags:
If the unit is fundamentally wrong for the duty, refurbishment often becomes forced. This can happen when the ventilation strategy has changed, when airflow requirements have increased

materially, or when the unit's footprint and internal arrangement cannot support the required filtration and coil strategy. A refurbishment cannot compensate for a unit that is the wrong shape, the wrong size, or the wrong arrangement for the system.

Deliverability red flags:
If access restrictions prevent safe intervention and you cannot engineer a buildable methodology, refurbishment becomes high risk. Where a project requires extensive dismantling, invasive building works, or unsafe handling just to reach the components, replacement may be the safer and more predictable route.

Evidence red flags:
Any approach that cannot define acceptance testing and handover evidence should be treated as a red flag. If the project has no route to proving airflow delivery, control stability, and performance improvement, the buyer is left managing the risk after handover. Refurbishment should reduce risk, not transfer it.
If multiple red flags appear together, the correct outcome is usually to stop trying to force refurbishment and instead evaluate replacement as the controlled option.



REFURBISHMENT VIABILITY

six headings and red flags......

VIABILITY HEADINGS	TYPICAL RED FLAGS
Structural condition and casing integrity	⚠ Casing failed beyond economic recover
Performance capability vs current and future duty	⚠ Unit fundamentally under-sized or over-sized
Fan technology and upgrade feasibility	⚠ Fan refinement not feasible economica
Controls and integrations constraints	⚠ Controls unsuitable, unsafe or non-compliant
Access, safety and maintainability	⚠ No safe access route or compliance fa
Evidence and acceptance	⚠ Testing and acceptance route unclear

RED FLAG CATEGORY

⚠ Structural condition ⚠ Duty & strategy ⚠ Deliverability ⚠ Evidence

Multiple red flags together usually means stop forcing refurbishment and evaluate replacement

How do access constraints and plantroom limitations change the refurbishment strategy?

Access constraints change the project from a straightforward component upgrade into an engineered intervention. The scope, methodology, programme, and even the choice of upgrade solution can be dictated by what can physically be moved through the building, what can be handled safely in the plantroom, and what can be installed without dismantling the building around the unit.

A refurbishment strategy that works on paper can fail on site if access is treated as an afterthought. The practical impacts usually fall into six areas:

1) What can be removed and replaced, and in what form:
If large components cannot be removed intact, the strategy shifts towards modular replacement, sectional installation, and solutions that can be introduced through constrained routes. This is one reason fan wall arrangements can be attractive in refurbishment. They allow multiple smaller components to be installed and serviced without relying on a single large lift.

2) Whether the casing can remain in situ:
Where the casing cannot be removed and replaced, the strategy often becomes "retain structure, upgrade internals". In that scenario, casing recovery, sealing integrity, access improvements, and internal airflow management become central. You are improving the unit within the physical envelope you have. Where access constraints drive casing replacement, the scope can move towards a "new unit" outcome, and ErP/Ecodesign conformance requirements may then apply, so compliance must be assessed and designed into the solution from the outset.

3) How downtime is planned:
Constrained sites are often live sites. Access constraints frequently correlate with limited shutdown windows, because the unit is in a difficult location for a reason. A practical strategy will therefore define how work is phased, which activities can be completed with partial operation, and what temporary measures are required if sections need to be taken offline.

4) Safety and handling methodology:
If the only way to remove a component is unsafe, then it is not an option. The strategy must be built around safe handling and realistic lifting. This often pushes decisions towards smaller modular components, revised access doors, or changes in internal layout to make routine maintenance possible after refurbishment.

5) Programme risk and sequencing:
Access constraints increase programme sensitivity. If a key component cannot be delivered through the route as assumed, the programme stops. A robust strategy includes route confirmation, measured constraints, and an installation methodology that is planned before manufacture and procurement are finalised.

6) Long-term maintainability:
A refurbishment that improves performance but leaves maintenance access difficult is a future failure condition. Plantroom constraints should therefore drive design decisions that make filter changes, beltless fan access, coil access, and inspection achievable within the real space available.

7) Existing services and ductwork route restrictions:
Even when access to the plantroom is workable, the unit's surrounding services and existing ductwork can still dictate what is possible. Fixed duct connection positions, rigid duct routes, limited straight lengths, and congested service corridors can prevent changes to unit geometry, section lengths, access door locations, and internal arrangement.

These constraints often mean the refurbishment design must be engineered around existing interfaces, using compatible connection strategies and buildable installation sequencing. If ductwork and services restrictions are not assessed early, the project can end up with a technically sound upgrade that cannot be installed, cannot be connected, or creates avoidable programme and cost risk

The practical takeaway is simple. Access and plantroom limitations are not project "detail". They are primary design inputs. A refurbishment strategy is only credible if it is designed around the route, the space, the downtime, and safe maintenance after handover.

How do you handle refurbishment when there is no safe route to remove a complete unit?

You treat it as a constrained-site engineering problem, not a procurement problem. The objective is to deliver the required performance improvement through an intervention that is buildable, safe, and verifiable within the building's limits.

A practical approach usually includes the following steps:

Confirm the constraints, then design to them:
Before scope is finalised, the access route needs to be measured and confirmed. That includes doors, corridors, turns, stair access where relevant, lifting constraints, and the working space around the unit. Once that is known, refurbishment can be designed so components are sized and configured for the route.

Choose upgrade solutions that match install reality:
Where a large single fan cannot be removed or installed safely, the design may move to a fan wall or multiple smaller fans. Where a single large coil is impractical, the approach may be to retain and remediate, or replace using sectional methods if feasible. Controls upgrades often remain straightforward, but panel location and cable routes still need to be planned.

Retain the casing where it is viable, but do not ignore casing integrity:
Retaining the casing avoids major building works, but only works if the casing can be recovered. That means addressing corrosion, repairing panels, improving seals, and controlling bypass paths that undermine filtration and duty. If casing leakage and bypass are left unresolved, the upgrade can still underdeliver because air quality outcomes are compromised and the system is no longer behaving as designed..

Engineer the method statement as part of the design:
On constrained sites, the method statement is not written after the design. It is part of the design. The refurbishment plan should make it clear how components will be removed, how the site will be protected, what temporary measures are needed, and how downtime is controlled.

Protect the outcome with acceptance evidence:
Constrained-site refurbishments can be perceived as "best effort" unless the acceptance plan is explicit. A verification-led approach defines what will be tested and what evidence will be provided to demonstrate performance, control stability, and airflow delivery after the work.

When there is no safe route to remove a complete unit, refurbishment becomes a precision exercise. It can deliver excellent outcomes, but only when install methodology, access design, and acceptance evidence are treated as core requirements, not add-ons.

Section 3 – Surveys and Baselines: The evidence you need before you design

What should a proper ahu condition survey include?

A proper AHU condition survey is a structured assessment that exists to answer three practical questions. What is the unit's current condition. What is realistically recoverable. What scope and evidence plan will remove risk.

A survey that only describes what is visible is not enough. It needs to capture the information that drives viability, scope, and acceptance.

Unit identification and operating context:
The survey should confirm unit location, duty, operating schedule, and any constraints that affect downtime and access. It should also capture known complaints and failure patterns, because these often point to the underlying issues that the refurbishment must remove.

Casing condition and integrity:
This includes condition of panels and frame, corrosion state, condition of doors and seals, and any evidence of bypass air and leakage. The objective is to establish whether the casing can be recovered and whether sealing integrity can be improved to a measurable level.

Fan system and drive arrangement:
The survey should identify fan type, drive arrangement, motor condition, control approach, vibration history where relevant, and practical constraints around replacement. If fan upgrades are being considered, the survey should establish whether the route and internal space support a modern arrangement.

Filtration and airflow management:
Filter frames, bypass risk, access for replacement, and evidence of poor fitment or uncontrolled leakage around filters should be captured. Filtration strategy is often central to performance, hygiene, and pressure drop.

Coils, drainage, and hygiene-critical features:
Coil condition, fouling risk, corrosion, and drainage arrangements matter because they affect duty, control stability, and long-term reliability. Where hygiene expectations apply, the survey should identify features that could prevent compliant maintenance and cleaning.

Controls and integration constraints:
The survey should note the existing control strategy, BMS interface, sensor condition, and any operational practices that affect performance. Many performance issues are control and commissioning issues as much as mechanical issues.

Access, maintainability, and safety:
This is not a “nice to have”. If the unit cannot be maintained safely, it will underperform again. The survey should document safe access, clearances, lifting constraints, and the practical process required for routine maintenance tasks.

A good survey ends with a conclusion that links condition and constraints to a recommended scope and a route to verification.

If budget is limited, what delivers the most decision value?

If you cannot fund a full survey scope, prioritise the items that determine viability and protect the outcome with evidence. Start with casing integrity and sealing, because leakage and bypass can undermine duty, energy performance, and filtration effectiveness regardless of what components you upgrade. Next, assess the fan system and the pressure environment it operates in, including practical feasibility of replacement, because this is usually the dominant driver of electrical consumption and control stability.

Then confirm the condition of filtration frames and bypass risk, because poor fitment and uncontrolled leakage create performance losses that cannot be corrected with fan upgrades alone. Finally, verify controls, sensing, and access constraints, because many “performance” issues are actually control and commissioning failures, and a unit that cannot be maintained safely will drift again after handover.

A limited-budget survey is only valuable if it ends with a clear conclusion that links findings to a recommended scope and a route to verification.

Which components should you always assess, even if the refurbishment looks simple?

Even a “simple” refurbishment can fail if the hidden constraints are not assessed. That is because AHUs do not underperform for one reason. They underperform as a system. A fan upgrade may improve efficiency, but it will not correct bypass air. A control upgrade may stabilise setpoints, but it will not remove pressure losses created by poor filtration fitment. A cosmetic casing repair may improve appearance, but it will not recover leakage class if seals and frames are not addressed.

A thorough assessment therefore reviews the components and interfaces that most commonly undermine performance, efficiency, and maintainability.

Casing integrity and sealing pathways:
Assess corrosion, panel condition, frame condition, door fitment, access door seals, and any visible bypass paths between sections. Any uncontrolled leakage or bypass changes the relationship between fan energy and delivered airflow, and it can undermine filtration effectiveness. If the casing is being retained, it must be recoverable to a standard that supports the performance outcomes you intend to claim.

Fan arrangement, motor technology, and control method:
Identify the fan arrangement, drive type, motor type, current control approach, and any vibration history. Establish whether a modern arrangement can be integrated within the existing footprint and installed through the available routes. Where fan upgrades are being considered, assess the pressure environment the fan will actually work in, because that is what determines whether the efficiency claim will hold in service.

Filtration frames, bypass risk, and maintenance reality:
Filters are often treated as consumables and ignored in refurbishment planning. That is a mistake. Poor frames, bypass air around filters, and poor access for replacement create both performance and operational problems. Assess frame condition, fitment, access for change, and whether the filtration strategy remains appropriate for the building’s current use.

Coils, drainage, and water management:
Coil condition and fouling affect duty, stability, and energy. Drainage arrangements affect hygiene, corrosion risk, and long-term reliability. If drainage is poor, the unit will degrade quickly even after refurbishment. Assess coil condition, condensate management, and whether remedial work is required to prevent repeat issues.

Controls, sensing, and BMS integration constraints:
If the building’s control environment is constrained, upgrades must be designed to work within it. Assess the existing control philosophy, sensor condition and placement, BMS interface requirements, and any known instability or override behaviours. Many “inefficiency” complaints are really control and commissioning problems.

Access, safety, and maintainability:
This is not secondary. If access to filters, fans, coils, and inspection points remains poor,

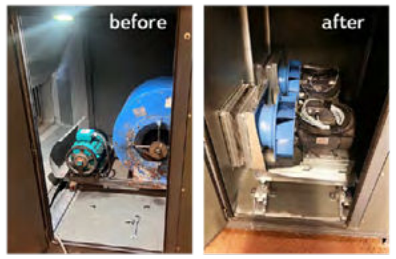
the refurbished unit will drift and underperform again. Assess door locations, safe working clearances, lifting points where needed, and whether routine maintenance tasks can be carried out without unsafe practices.

The practical rule is this. If you do not assess the components that govern airflow integrity, pressure environment, and maintainability, you cannot claim a refurbishment outcome with confidence.

BULKHEAD

FILTER FRAMES

FAN SECTION



What site information should you gather before you ask for a refurbishment proposal?

If you want an accurate proposal, you need to provide the information that removes guesswork. Refurbishment proposals become vague when the supplier has to assume duty, access, downtime, and the condition of the unit. That is where risk enters the project.

A practical pre-proposal information pack should cover five areas:

1) Duty and operating pattern
Provide the required airflow, pressure, temperature control requirements, and operating schedule. If the building has seasonal or variable occupancy patterns, include that, because it affects both control strategy and the business case for upgrades.

2) Site constraints and access route
Document where the unit is located, how it is accessed, any door and corridor constraints, lifting constraints, and whether craneage is possible. Photographs and measured dimensions are often more useful than assumptions or outdated drawings.

3) Downtime and phasing constraints
State clearly how long the system can be offline and whether temporary ventilation is required. Where the site is live and ventilation is critical, phasing often becomes the dominant project driver.

4) Existing control environment
Provide the BMS context, any preferred control standards, and any limitations that might affect integration. If you know the current control issues, include them, because they often determine whether a refurbishment will remove the pain points that triggered the project.

5) Performance expectations and acceptance approach
If the project requires evidence, state it. If the project is being driven by compliance expectations, state them. The best proposals are built around outcomes that can be tested and signed off, not around a list of parts.

If you do not have all of this information, a condition survey is usually the fastest route to gather it properly and turn the project into a defined scope with a defined acceptance plan.

Section 4 - Refurbishment Strategy: Levels of Intervention, Priorities and Expected Outcomes

What does “ahu refurbishment” mean in practice, and what are the main levels of intervention?

In practice, AHU refurbishment means improving the unit’s performance, efficiency, and reliability by upgrading and correcting the elements that govern real-world operation, while retaining the parts of the asset that are structurally sound and commercially sensible to keep.

The term “refurbishment” can describe very different levels of intervention. Clarity matters, because outcomes depend on what you actually do.

Level 1: Targeted upgrades:
This is where one or two high-impact changes are made, typically to address a known pain point. Fan upgrades and control upgrades are common at this level. Targeted upgrades can make sense when the casing is in good condition and performance issues are primarily driven by outdated fan technology or control instability.

The risk at this level is assuming the rest of the unit will support the upgrade. If leakage, bypass air, poor filter fitment, or high pressure losses remain, the upgraded component may not deliver the expected benefit.

Level 2: Performance recovery refurbishment:
This level is designed to recover the unit as a system. It typically includes component upgrades, but also includes casing integrity work, sealing improvements, filtration arrangement correction, internal airflow management, and access improvements. The objective is to deliver measurable improvement and reduce operational risk.

This is often the level required when units have drifted over time, when maintenance burden has increased, or when efficiency gains are a driver but cannot be realised without fixing the fundamentals of airflow integrity and control.

Level 3: Deep refurbishment or major rebuild within the existing footprint:
This is used where the asset must be retained due to access constraints or programme realities, but significant change is needed. It can include major internal reconfiguration, comprehensive component replacement, major casing repair, and engineering of redundancy or resilience where required.

At this level, the project must be approached with the same discipline as a new unit in terms of specification and evidence. If the intervention is deep, acceptance criteria and testing become central to making the outcome acceptable at handover.

The right level of intervention is determined by the drivers. If the driver is energy and carbon, you still need to fix airflow integrity to realise savings. If the driver is reliability and complaints, you need to address the root causes, not just the symptoms. In every case, refurbishment only has meaning if it is scoped to outcomes and validated properly.

How do you prioritise upgrades when budget is limited?

When budget is limited, prioritisation must be driven by outcomes, not preference. The objective is to spend where you change the unit's operating cost, reliability, and risk profile most meaningfully, while avoiding partial upgrades that leave the root cause untouched.

A practical prioritisation approach is to work through three layers:

Layer 1: Remove the dominant energy and reliability drivers:
Fan and control upgrades are often the highest-value changes because they influence electrical consumption, control stability, and ongoing maintenance. If the existing arrangement is belt-driven, unstable, or difficult to maintain, modernising it can change both energy and reliability quickly. However, that change only creates value if the fan operates in a controlled pressure environment and the unit's airflow integrity supports the intended duty.

Layer 2: Fix airflow integrity so the upgrades deliver what they should:
Leakage, bypass air, poor filter fitment, and unnecessary pressure losses undermine efficiency. If those issues are present and you ignore them, you may install efficient components that operate inefficiently in service. A limited budget is often better spent combining a key component upgrade with targeted airflow integrity fixes than spending the whole budget on the component alone.

Layer 3: Reduce maintenance burden and operational risk:
Once the energy and airflow fundamentals are addressed, prioritise improvements that prevent future drift. That includes access improvements that allow filters to be changed correctly, sealing improvements that remain effective, control strategies that avoid hunting behaviour, and any remedial work that reduces repeat failure patterns.

The right question to ask is not "what can we afford to change". It is "what must change for the project to achieve a measurable improvement". If budget limits mean the project cannot achieve a measurable improvement, it is better to re-scope the objective than to deliver a refurbishment that creates expectation but not outcome.

Which upgrades typically deliver the biggest gains in energy efficiency and control?

The biggest gains are usually delivered by upgrades that reduce fan energy, stabilise control, and remove the real-world losses that force systems to run harder than they should. In refurbishment, that typically means fan technology, control strategy, and the pressure and leakage environment the fan is operating against.

A useful way to look at "biggest gains" is to separate upgrades into three categories: energy drivers, control drivers, and loss reducers.

Energy drivers: fan system upgrades:
Fans are a major electrical load. Upgrading fan technology can materially reduce electrical consumption, but the scale of gain depends on how inefficient the existing system is. If the existing arrangement is belt-driven, poorly selected for the operating point, or operating with significant system losses, the opportunity is larger. If the existing arrangement is already modern and operating close to a sensible point, the gain will be smaller and more dependent on loss reduction elsewhere.

Fan upgrades are also where refurbishment can solve access constraints. Where a single large fan is not feasible, multiple smaller fans can be introduced in a configuration that supports installability and maintenance. The energy benefit then needs to be assessed in the context of how the fans will be controlled and how the duty will be shared.

Control drivers: controls and instrumentation upgrades:
Control upgrades deliver value because they reduce waste created by instability. Poor controls lead to hunting, overrides, conservative setpoints, and inconsistent airflow delivery. A controls upgrade should improve stability, match fan output to demand, and support monitoring so that drift is visible rather than hidden.

The highest value control upgrades are those that align with real operating patterns. A design that assumes constant occupancy or constant load will not deliver the same savings as a design that responds to demand and runs only as hard as needed.

Loss reducers: sealing integrity, filtration arrangement, pressure drop management:
Loss reducers determine whether the energy and control upgrades translate into delivered savings. Leakage and bypass air can drive fan energy up and undermine filtration. Excessive pressure drop across filters, coils, and poorly arranged internal sections forces fans to work harder. If loss reducers are ignored, the upgraded unit may look modern but perform like an old unit.

The practical conclusion is that the biggest gains do not usually come from one component alone. They come from a fan and control upgrade delivered alongside targeted fixes that reduce losses and stabilise operation.

How does ahu refurbishment support decarbonisation targets?

Refurbishment supports decarbonisation in two distinct ways: operational carbon and embodied carbon:

Operational carbon:
Operational carbon reduction comes from lowering the electrical energy required to move and condition air. In refurbishment, that typically means upgrading fan technology and controls, then addressing the real-world issues that stop efficiency gains being realised, such as leakage, bypass air, unstable control, and unnecessary pressure losses through the unit. If you change a fan but leave the airflow problems in place, the headline improvement is rarely achieved.

A refurbishment that is designed around measured duty and real operating conditions can reduce energy consumption because it improves the relationship between airflow delivered and electrical energy used. It also improves control stability, which matters because poorly controlled systems tend to waste energy through hunting behaviour, manual overrides, or conservative setpoints introduced to keep the building stable.

Embodied carbon:
Embodied carbon reduction comes from retaining major structural elements. In many cases, the casing, base frame, and general unit footprint can be retained while the performance-defining components are upgraded. That avoids the carbon and waste impact of scrapping a whole unit and replacing it with new materials and transport.

The point customers often miss is that decarbonisation in refurbishment is not delivered by one component. It is delivered by a package. Fans, controls, sealing integrity, filtration arrangement, and maintenance access all affect whether the refurbished unit can run efficiently over the long term. Done properly, refurbishment can be a decarbonisation route that is both practical and deliverable on constrained, live sites.

How do you assess embodied carbon benefits when refurbishing rather than replacing?

Embodied carbon benefit is created when you avoid making, transporting, and disposing of a complete new unit. In refurbishment, the practical mechanism is straightforward. You retain the casing and base structure where they are serviceable, and you replace or upgrade the components that govern performance, energy use, and compliance.

A useful way to assess embodied carbon in customer decision-making is to treat it as part of an overall lifecycle value case.

Start with what you are retaining:
The key question is whether the structural elements you plan to keep will remain reliable and maintainable after refurbishment. Retaining a casing with irrecoverable corrosion or structural weakness undermines both carbon and financial outcomes because it brings forward the next intervention.

Then consider what you are changing:
Embodied carbon benefit is strongest when the refurbishment changes the energy profile of the unit meaningfully, because that creates operational carbon benefit as well. That is why fan and controls upgrades often sit at the centre of refurbishment business cases.

Finally, account for the programme reality:
Replacement can bring embodied carbon and operational carbon benefits, but it can also trigger enabling works, extended shutdowns, and more waste. Where access and downtime constraints are severe, refurbishment is often the more deliverable route to carbon improvement within the real limits of the building.

The practical outcome customers want is a refurbishment that genuinely extends service life and reduces energy consumption. If those two outcomes are achieved, the embodied carbon argument becomes a credible part of the decision, not a marketing line.

What operational savings can AHU refurbishment deliver, and what determines the result?

Operational savings vary because buildings vary. The question that matters is not “what is the typical saving”, but “what drives savings on this unit, on this duty, in this operating pattern”.

Savings are typically governed by four factors:

1) How inefficient the existing fan system is:
Older belt-driven systems, worn components, and poor control arrangements can add avoidable electrical load. If the existing arrangement is materially inefficient, an upgraded fan solution and control package can change the operating cost profile quickly. Where the existing arrangement is already reasonably modern, savings may still exist, but the magnitude will be smaller and more dependent on airflow integrity and controls.

2) How well the unit controls to demand:
Control stability is a savings multiplier. A system that responds accurately to demand, maintains setpoints reliably, and integrates properly with the BMS avoids waste associated with manual overrides and conservative operation. Controls upgrades often create operational savings because they reduce the need to “run hard just in case”.

3) Airflow integrity through the casing and sections:
Leakage and bypass air reduce effective performance. They can force fans to work harder to achieve delivered airflow and can undermine filtration performance. Addressing sealing integrity, filter frames, and bypass paths is not cosmetic. It is often a prerequisite for realising the savings expected from component upgrades.

4) Pressure losses across the unit:
Poor internal arrangement, clogged or mismatched filtration, and legacy components can increase pressure drop. That drives fan energy. Refurbishment creates savings when it reduces unnecessary resistance while still meeting the filtration and performance requirements of the building.

A good refurbishment proposal should describe the route to savings and the risks to savings. If the proposal only lists new components, it is not yet a savings plan. Customers should expect a clear explanation of what will change, why it will change running cost, and how the outcome will be validated.

How do you make sure efficiency gains do not create new operational problems?

Efficiency upgrades can create operational problems when they are implemented without considering system behaviour, maintainability, and acceptance evidence. The aim is not to install efficient components. The aim is to create a unit that operates efficiently, reliably, and predictably over time.

There are five practical risk areas to manage.

1) Control instability introduced by new components:
Upgraded fans and controls can expose poor tuning, poor sensor placement, or poor control philosophy. If the control strategy is not aligned to the real system behaviour, the unit can hunt, overshoot, and frustrate operators. The prevention is to specify control intent clearly and to require commissioning evidence that demonstrates stable operation.

2) Increased pressure drop and higher fan energy:
Efficiency projects sometimes introduce filtration upgrades or internal changes that increase pressure drop. If pressure environment is not managed, fan energy can rise, and the perceived savings can disappear. The prevention is to treat pressure drop as a design input and to verify the operating point after refurbishment.

3) Noise and vibration effects:
Changes to fan systems and airflow paths can change noise and vibration behaviour. If the project is in a noise-sensitive environment, acoustic outcomes should be considered as part of the scope. The prevention is to assess risk early and to specify acceptance where required.

4) Maintenance burden that prevents the unit staying efficient:
If access remains poor, filters are changed incorrectly, coils foul, and seals deteriorate, the unit will drift back to inefficient operation. The prevention is to include access and maintainability improvements as part of the refurbishment outcome, not as optional extras.

5) Lack of acceptance evidence:
If the project cannot prove delivered airflow, stable control, and intended operating behaviour,

you cannot know whether efficiency gains have been achieved. The prevention is to define what will be tested, what documentation will be provided, and what constitutes acceptance.

Efficiency upgrades work when they are delivered as a system package with proper controls, corrected airflow integrity, maintainability, and evidence-led handover. That is what stops a refurbishment becoming a short-term improvement followed by long-term drift.

How does EcoDesign influence refurbishment choices and expected outcomes?

Ecodesign influences refurbishment because it shapes what “acceptable efficiency” looks like for key components and, increasingly, what clients expect in the performance narrative of a project.

In refurbishment, the influence is most visible in fan and motor selection, control approach, and the overall expectation that energy performance improvements should be measurable rather than implied. The influence is practical, not abstract.

It pushes projects towards demonstrable efficiency improvements:
Where organisations have decarbonisation or cost targets, Ecodesign-aligned thinking reinforces the requirement to select efficient fan solutions, to avoid avoidable losses, and to implement controls that prevent waste. Even where a regulation is not directly applied to a specific refurbishment scope, it influences what clients and consultants consider “credible” in a modern upgrade.

It strengthens the business case requirement:
Refurbishment decisions increasingly require a clear explanation of why an upgrade reduces energy. Ecodesign helps shape that explanation by keeping the focus on efficient components operating correctly within a well-controlled system. This is why fan upgrades and control upgrades often sit at the centre of refurbishment proposals, supported by corrections that reduce pressure losses and leakage.

It increases the importance of verification:
If the project is justified on efficiency, the handover must include evidence that the refurbished unit operates as intended. That does not mean every project needs the same level of testing. It does mean the acceptance plan should be aligned to the claims made in the business case.

The practical conclusion is that Ecodesign influences refurbishment by raising the bar for credibility. If you claim efficiency, you need a defined scope, a coherent control strategy, and a route to verifying the outcome.

Section 5 - Refurbishment Upgrades: System Design Choices That Drive Outcomes

What are EC fans, and why are they a common refurbishment upgrade?

EC fans use electronically commutated motors with integrated speed control. In refurbishment, they are commonly selected because they provide a controllable, high-efficiency route to modernising airflow delivery, and because they can be deployed in configurations that suit constrained sites.

To understand why EC fans appear in so many refurbishment projects, it helps to look at what they change in practice:

They change how airflow is controlled:
EC fans typically provide fine control of speed and can support stable control strategies when correctly integrated. That matters in refurbishment because many existing systems suffer from unstable operation, conservative setpoints, and poor matching between fan output and actual demand.

They reduce maintenance burden compared with older arrangements:
Where the existing unit uses belt drives or older motor arrangements, maintenance burden is often part of the reason performance drifts. Modern direct-drive arrangements reduce the number of wear components and can make routine maintenance more predictable. Maintenance benefit is not automatic, but it is a common reason EC fans are selected.

They enable buildable solutions on constrained sites:
In refurbishment, feasibility is often decided by what can be installed. EC plug fans can be used in fan wall or fan array arrangements, allowing multiple smaller units to be installed through constrained routes and serviced more easily once in place. This can avoid invasive casing modification and heavy handling that may not be viable in the plantroom.

They only deliver their potential if the unit is corrected around them:
An EC fan upgrade will not deliver the expected result if the unit has uncontrolled leakage, bypass air, unstable controls, or unnecessary pressure losses. The fan will simply work harder against losses, and the system will still drift. The value comes when the fan upgrade is delivered as part of an outcomes-led refurbishment package.

When is a fan wall or fan array the right choice in a refurbishment?

A fan wall or fan array is the right choice when it solves a real constraint or delivers a real operational advantage that a single fan solution cannot provide. In refurbishment, those constraints are often access, resilience, controllability, and maintainability.

The decision is typically driven by five practical considerations:

1) Access and installability:
If a single large fan cannot be removed or installed safely, multiple smaller fans may be the only practical route. A fan wall arrangement can be designed so fans can be brought through constrained routes, installed in sequence, and serviced without dismantling the unit or the building.

2) Maintenance access and operational continuity:
Multiple fans can support maintenance without a complete shutdown if the system is designed with appropriate redundancy and control strategy. That matters where ventilation is critical and downtime is constrained.

3) Resilience and redundancy requirements:
In some environments, resilience is not optional. A fan array can provide redundancy, but only if the design includes the control logic and acceptance criteria that prove the unit can maintain duty under fan failure conditions. This needs to be considered in specification, not added as a post-hoc assumption.

4) Control stability across variable demand:
Fan arrays can provide stable control across a wide operating range if correctly designed and commissioned. This is particularly relevant where the building load varies and the system needs to respond without hunting behaviour or poor airflow stability.

5) The pressure environment and internal arrangement of the AHU:
A fan array does not fix a poor pressure environment. If the unit has high losses, poor internal arrangement, or uncontrolled leakage, the fan array will still work against those losses. The array should be part of a broader refurbishment scope that corrects airflow integrity and pressure drop.

The practical test for “right choice” is this. If the fan wall solves access constraints, improves maintainability, supports resilience where needed, and can be validated against defined performance evidence, it is a strong refurbishment solution. If it is being selected only because it sounds modern, it is not yet a design decision.

What do controls upgrades achieve in a refurbishment, and what should you specify?

Controls upgrades achieve value when they make the AHU operate in a stable, predictable way under real operating conditions. Many refurbishment projects focus on mechanical upgrades, then discover that the unit still wastes energy or drifts in performance because the control philosophy is outdated, poorly implemented, or mismatched to how the building is actually used.

A controls upgrade should therefore be specified as an outcomes package, not as a replacement of hardware alone.

Improved stability and repeatable performance:
Stable control matters because unstable systems create waste. They hunt, overshoot, and get overridden by operators trying to keep the building comfortable. A refurbishment controls upgrade should aim to make airflow and temperature control predictable, so the system operates to demand rather than to fear of complaints.

Better energy performance through demand-led operation:
Savings are achieved when the fan system and conditioning elements run only as hard as needed. Controls upgrades support this by enabling appropriate setpoint strategy, scheduling, and proper modulation. The best outcomes come when the control strategy is aligned to occupancy pattern and the building’s real load profile.

Improved visibility and maintainability:
A refurbished AHU should be easier to run and easier to maintain. Controls upgrades can improve fault reporting, trending, and clarity of operation. This reduces the risk that performance drifts unnoticed until complaints and failures force intervention again.

What to specify:
A practical specification should state the intent and the interface expectations. That usually includes:

- the required control philosophy for airflow and temperature control, including any critical interlocks and safeties
- the BMS integration requirements, including points list, trending expectations, and alarm strategy
- the required sensor set, sensor placement intent, and calibration or commissioning expectations
- the acceptance evidence expected at handover, so the control intent is verified rather than assumed

If the control scope is vague, it becomes an area where performance gaps appear. A refurbishment that changes fans and then leaves control stability to chance rarely delivers the intended energy and performance outcomes.

How do filtration changes affect energy use, air quality, and system resilience?

Filtration changes affect energy use because filters create pressure drop, and pressure drop drives fan energy. They affect air quality because filtration efficiency and fitment determine what is removed from the air. They affect resilience because filtration strategy influences how often filters block, how predictable maintenance becomes, and how the unit behaves under varying conditions.

A refurbishment should treat filtration as part of a system design, not as a consumable detail.

Energy use and pressure drop:
A higher performing filter can increase resistance if the selection and installation are not managed. That does not mean better filtration is “bad for energy”. It means the filter strategy must be designed so pressure drop is controlled and predictable. That includes correct filter selection, correct filter bank design, correct face velocities, and a frame arrangement that prevents bypass and makes replacement reliable.
If filtration changes are made without addressing bypass air and fitment, you can end up with higher fan energy without the air quality benefit you expected.

Air quality and bypass risk:
The biggest practical issue in filtration is bypass. A high-grade filter does not deliver high-grade outcomes if air can flow around it. Refurbishment should therefore assess filter frames, sealing, and access. If filters are difficult to access, they are more likely to be installed poorly or changed late, which undermines both performance and hygiene.

Resilience and maintenance reality:
Resilience in filtration is about predictable operation. If filters are selected in a way that blocks quickly, or if they are difficult to replace, the system becomes unstable. Pressure control changes, fan energy rises, and maintenance workload increases. A good refurbishment considers the site environment, loading conditions, and realistic maintenance intervals, then selects a filtration strategy that supports stable operation.

Refurbishment is the right time to correct filtration “inheritance issues”. Poor frame condition, bypass pathways, and unsafe access are all problems that cause repeat drift in performance. If they are not corrected, other upgrades often underdeliver.

What can you do about thermal performance losses, casing leakage, and uncontrolled bypass air?

Thermal losses, casing leakage, and bypass air are the quiet reasons refurbishment projects underperform. They rarely appear as headline failures, but they undermine energy performance, airflow delivery, and air quality. If you want refurbishment to deliver measurable outcomes, these issues must be treated as core scope items, not cosmetic work.

A practical refurbishment approach addresses three things: structure, sealing, and interfaces.

Structure and condition recovery:
If panels, frames, and joints are degraded, the casing cannot maintain integrity. Refurbishment scope should include repair or replacement of degraded elements where recovery is possible, and correction of localised failure points that create persistent leakage. If corrosion and panel degradation are extensive and irrecoverable, that becomes a viability issue, not a repair detail.

Seals, doors, and access points:
Doors and access panels are common leakage sources because they are used repeatedly and often suffer from poor fitment or worn seals. Refurbishment should therefore include proper door refurbishment, seal replacement where needed, and adjustment to ensure access points close correctly and consistently. This also has a safety and maintainability benefit, because properly functioning access points reduce operator workarounds.

Interfaces that create bypass air:
Bypass air is often created at filter frames, section joints, and internal dividers. Correcting bypass requires assessment of the fit and sealing at these interfaces, and correction of the internal arrangement so air is forced through the intended paths rather than around them.

Thermal performance also matters. Poor casing performance can increase heat losses and reduce control stability. If the building's energy objectives are a driver for refurbishment, casing integrity and thermal performance should be treated as part of the energy package, not as an afterthought.

This is where survey quality matters. Leakage and bypass pathways are often only clear when you look at the unit as a system and understand how air is actually moving through it.

How do coil and heat exchanger improvements fit into a refurbishment business case?

Coil and heat exchanger improvements fit into the business case when they remove persistent performance limitations, stabilise control, and reduce the operational cost associated with poor heat transfer.

Coils are sometimes ignored in refurbishment because fans and controls deliver obvious energy narratives. That can be a mistake. A system that cannot exchange heat properly will often operate inefficiently and unpredictably.

Coils influence three things: duty, stability, and running cost:

Duty and capacity:
If coils are fouled, corroded, or degraded, the AHU cannot deliver the intended heating or cooling. That can create comfort complaints, process instability, and operational workarounds. A refurbishment should assess whether coil condition is limiting duty, and whether remediation, replacement, or cleaning is required as part of making the unit fit for purpose.
Control stability and energy waste:
Poor coil performance often leads to control instability. The system compensates by pushing airflow harder, adjusting setpoints, or extending run times. That wastes energy. If a refurbishment is intended to improve efficiency, coil condition must be assessed, because poor heat transfer forces the rest of the system to work harder.

Water management and long-term reliability:
Coil and condensate management also affects corrosion risk and long-term reliability. Drainage issues can accelerate degradation and create repeat problems. Refurbishment is an opportunity to correct coil and drainage issues so the unit remains stable after handover.

The business case question should therefore be: does coil condition materially affect duty and stability, and will remediation prevent waste and complaints. If the answer is yes, coil work becomes a value item. If the answer is no, coil work may be unnecessary. The decision should be driven by evidence from the survey, not by assumptions.

Section 6 - Specification and Procurement: Controlling Scope, Compliance and Comparability

What should be included in a refurbishment scope to avoid performance gaps?

A refurbishment scope avoids performance gaps when it is written as an outcomes document rather than a shopping list. A parts list can be delivered without improving performance. An outcomes-led scope defines what must be achieved, what must be upgraded to achieve it, and what evidence will be provided to confirm it.

A clear scope typically includes six elements:

1) The performance intent, stated clearly:
This includes airflow and pressure requirements, control stability expectations, and any specific operational objectives such as energy reduction, noise reduction, improved maintainability, or improved filtration performance. If performance intent is vague, the project drifts and value engineering becomes easier to justify.

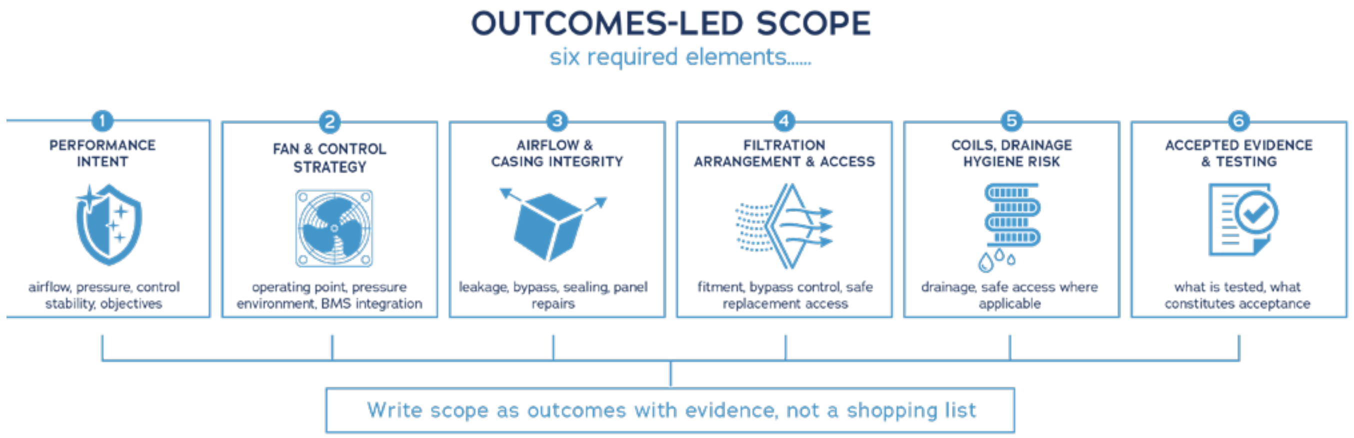
2) Fan strategy and control strategy:
The scope should state what will change and why, including fan arrangement, redundancy expectations where relevant, and the control approach including BMS integration requirements. If fans are upgraded, the scope should also address the operating point and pressure environment the fan will work in, because this often determines the real savings and stability achieved.

3) Airflow integrity and casing integrity:
If casing leakage, bypass air, and sealing problems are not addressed where they exist, performance and efficiency outcomes are undermined. A well-defined scope includes recovery of casing integrity, repair of panels where required, and correction of bypass paths that affect filtration and duty.

4) Filtration arrangement and access:
Filter fitment, bypass control, and safe access for replacement matter both for performance and for ongoing operation. A scope that upgrades performance but leaves filters difficult to change will often fail in service.

5) Coils, drainage, and associated hygiene risk where applicable:
If coils are fouled or degraded, or if drainage is poor, duty and stability suffer. Where hygiene expectations apply, this element becomes a compliance issue as well as a performance issue.

6) Acceptance evidence and testing requirements:
This is the most common omission. Without defined acceptance evidence, refurbishment becomes subjective. A clear scope specifies what will be tested, what documentation will be provided, and what constitutes acceptance at handover.
If you want to avoid performance gaps, write the scope as a route to outcomes with evidence, then design the work package around that route.



What are the most common causes of refurbishment scope creep, and how do you prevent them?

Scope creep happens when unknowns are allowed to remain unknown. In refurbishment, unknowns typically sit in condition, access, duty, and acceptance expectations. If those are not resolved early, they surface mid-project as changes, delays, and arguments about what was "assumed".

The most common causes and the practical prevention measures are as follows:

Cause 1: Condition is not surveyed properly
If corrosion, leakage, bypass paths, coil condition, or fan condition are not fully understood, the scope will evolve reactively. Prevention is a structured condition survey that produces an engineering conclusion and a recommended scope, not a generic inspection note.

Cause 2: Access constraints are discovered late
If routes, lifting, and working space are assumed, you often discover late that components do not fit or cannot be handled safely. Prevention is measured route confirmation and an installation methodology developed alongside the design.

Cause 3: The required outcome is not defined
When the project does not define performance outcomes, the scope becomes a negotiation. One party assumes improvement is "obvious", another party delivers the minimum. Prevention is to state the outcomes clearly and link them to acceptance evidence.

Cause 4: Acceptance evidence is treated as optional
If testing and documentation are not included in the scope, they are either omitted or become variations. Prevention is to define acceptance evidence as part of the scope from the outset, with clear responsibilities for delivery and sign-off.

Cause 5: The project is trying to achieve too many objectives without prioritisation
Refurbishments often start as an efficiency project and then acquire reliability, compliance, access, and performance objectives. That can be valid, but it must be managed. Prevention is to prioritise objectives early and structure the scope accordingly, rather than adding major changes late.

The discipline that prevents scope creep is simple. Survey properly, design to constraints, define outcomes, and specify evidence. If those four steps are in place, scope creep reduces sharply and the project becomes predictable.

Which standards and requirements matter most in ahu refurbishment projects?

The standards and requirements that matter most are the ones that affect mechanical performance, energy performance, and the evidence a client can rely on at handover. In refurbishment, the risk is often not that a standard "applies" in theory. The risk is that a project is specified and delivered without a clear performance baseline, without measurable acceptance criteria, and without evidence that the refurbished unit behaves as intended.

A practical way to think about standards in refurbishment is to group them into three categories:

1 - Mechanical performance classification and casing integrity:
Where a refurbishment is intended to recover mechanical performance, casing integrity and leakage behaviour are central. Mechanical performance classification standards provide a structured way to define what "good" looks like and to avoid subjective acceptance. If you want to claim a meaningful improvement, the specification needs to state which performance aspects must be met and what evidence is expected.

2 - Energy performance and efficiency expectations:
Energy expectations are rarely met through components alone. They depend on fan efficiency, control strategy, and system losses. Standards and regulations that shape fan performance and system efficiency therefore matter because they influence selection, compliance, and the credibility of the energy case.

3 - Sector and client requirements:
In some sectors, ventilation requirements are defined by guidance and specification practice that effectively becomes an acceptance threshold. In these environments, refurbishment scope and evidence must be aligned to those expectations, because the client's risk exposure is not theoretical. It is operational, reputational, and sometimes regulatory.

The key point is that standards only protect the customer if they are written into scope and acceptance. A refurbishment that references standards but does not define how compliance and performance will be evidenced still leaves the customer carrying risk after handover.

How do BS EN 1886 requirements affect refurbishment acceptance and evidence?

BS EN 1886 matters in refurbishment because it gives you a recognised way to define what "better" means for casing performance, instead of relying on subjective judgement at handover. In practical terms, it helps you translate casing integrity into clear expectations around attributes such as leakage behaviour and structural performance, and it provides a common language that all parties can procure against. Refurbishment projects often fail at handover because the customer expects a better unit and the supplier delivers new components.

BS EN 1886 avoids that mismatch when it is used to set measurable acceptance criteria. If the scope includes casing recovery and sealing, the specification should state what improvement is being targeted and what evidence will demonstrate it, for example leakage-related verification that shows the refurbished unit has improved integrity compared with the baseline condition. Without that step, BS EN 1886 becomes a reference rather than a mechanism for acceptance.

It influences what you can credibly claim:
If you want to claim improved casing performance, leakage control, or structural integrity, you need a framework for what those claims mean and how they are evidenced. BS EN 1886 gives a structured set of mechanical performance classifications. In refurbishment, that allows you to set expectations and avoid vague statements.

It changes how you write acceptance into the project:
A refurbishment scope that includes BS EN 1886 intent should translate into acceptance criteria. That means defining the mechanical performance attributes that matter for the project, defining what evidence will be provided, and defining what constitutes acceptance. Without that translation, BS EN 1886 becomes a reference rather than a requirement.

It supports procurement clarity:
Where multiple parties are involved, BS EN 1886-based language can help remove ambiguity. It allows consultants and contractors to compare proposals more fairly, and it helps the client understand what they are buying. This matters in refurbishment because proposals can otherwise look similar while delivering very different outcomes.

The practical approach is to use BS EN 1886 as a tool for clarity. Define which performance attributes are relevant to the refurbishment, align the scope to those attributes, and build the evidence plan around them. That is how the standard affects acceptance in reality.

How should you specify ahu refurbishment to avoid value engineering and ambiguity?

You avoid value engineering and ambiguity by specifying refurbishment as outcomes with evidence, then tying the scope to those outcomes. In refurbishment, ambiguity is not an administrative issue. It is the mechanism by which projects underdeliver, because the supplier can meet a vague specification while missing the intent.

A robust specification approach usually includes five elements:

1) Define the objective and the performance intent:
State the objectives clearly. For example: reduce energy consumption, improve reliability, restore airflow delivery, improve maintainability, or align the unit to sector expectations. Then state the performance intent in measurable terms where possible, including airflow duty, control stability expectations, and any constraints that shape delivery.

2) Define the upgrade strategy, not just the components:
If fan upgrades are required, specify the intent, the control approach, and any resilience requirement. If casing integrity is a known issue, specify recovery and sealing intent. If filtration performance is critical, specify frame and bypass control requirements, not only filter grades.

3) Embed acceptance evidence in the specification:
This is the most important step. State what evidence will be provided to demonstrate the refurbished unit meets the required outcomes. Evidence might include performance testing outcomes, commissioning records, and sign-off documentation. If evidence is not specified, it becomes optional, and optional evidence usually becomes absent evidence.

4) Define handover documentation expectations:
Refurbishment is high risk when knowledge is not transferred. Specify what documentation the client will receive, including operating and maintenance information, any updated drawings where relevant, commissioning data, and details of what was changed and why.

5) Define exclusions explicitly:
Ambiguity often hides in exclusions. If the project does not include coil replacement, casing repair, or access improvements, state that clearly so the client can make an informed decision. If the project includes those elements only if required, state how "required" will be determined and how changes will be managed.

The goal is to make the refurbishment package comparable and auditable. When the specification is outcomes-led and evidence-led, value engineering becomes harder because the end result still has to be proven.

What should you provide to get an accurate, quick refurbishment proposal?

If you want a proposal that is accurate and quick, provide the information that removes uncertainty around duty, constraints, and acceptance. Most slow and vague proposals are slow and vague because the supplier has to fill gaps with assumptions.

A practical "proposal pack" includes five elements:

1) Duty and operating context:
Provide required airflow and pressure, temperature control expectations, operating schedule, and any known operational issues. If the unit serves critical spaces, state that early, because it affects methodology and evidence expectations.

2) Site constraints and access:
Provide unit location, access route constraints, lifting limitations, plantroom working space, and

any restrictions that affect delivery and installation. Photographs and measured dimensions are particularly useful.

3) Downtime and phasing constraints:
State what downtime is acceptable, whether temporary ventilation is required, and whether works must be scheduled around operational windows.

4) Control and integration environment:
Provide BMS context, required interfaces, and any control standards or site preferences that affect how upgrades can be integrated.

5) Acceptance expectations:
State what evidence will be required to sign off the project. If the project is justified on energy and decarbonisation outcomes, state how you expect those outcomes to be evidenced. If compliance requirements apply, state them.

If you cannot provide this information quickly, the fastest way to gather it properly is a structured condition survey. That converts unknowns into a defined scope and an evidence plan, which in turn makes pricing and programme far more reliable.

What should you request in submittals and technical queries for a refurbishment project?

Submittals and technical queries should exist to protect the client from assumptions. In refurbishment, assumptions are the primary source of performance gaps. A good submittal pack allows you to confirm that the proposed solution is compatible with the site constraints, the duty, and the acceptance expectations.

A practical submittal request typically covers the following:

Proposed scope mapped to objectives:
Request a clear mapping between project objectives and proposed works. If the objective is energy reduction, the submittal should explain which changes drive energy reduction and how the outcome will be demonstrated.

Methodology and buildability:
Request the installation methodology, including access route assumptions, lifting and handling method, phasing plan, and downtime requirements. This is where many refurbishment projects fail, because a technically sound proposal becomes unbuildable on the real site.

Fan and control strategy detail:
Request fan selection rationale, operating point assumptions, control philosophy, and BMS integration approach. If resilience is required, request how resilience will be achieved and evidenced.

Airflow integrity and filtration strategy:
Request details of how leakage and bypass will be addressed where relevant, and how filtration frames and fitment will be handled to avoid bypass air.

Acceptance testing and evidence plan:
Request the acceptance plan. What will be tested, how it will be tested, what documentation will be provided, and what constitutes a pass. If the supplier cannot provide a clear answer here, the project is carrying forward performance risk.

The goal of submittals is not paperwork volume. It is decision quality. The right submittal pack reduces variation risk, reduces site delays, and protects the client at handover.

What are the most common reasons ahu refurbishment projects fail, and how do you avoid them?

Refurbishment projects fail when they do not remove the underlying performance risks that triggered the project, or when they create new risks through poor methodology, poor specification, or lack of evidence. Failure is rarely dramatic at the moment of handover. More often it appears as ongoing complaints, missed energy targets, unstable operation, premature component issues, or a client who is unsure whether the refurbishment delivered what it promised.

The most common failure modes are predictable:

Failure mode 1: The project is scoped as parts, not outcomes
A list of new components does not guarantee performance improvement. Avoidance is to define outcomes and acceptance evidence from the outset, then scope the work as the route to achieving those outcomes.

Failure mode 2: Access and installability are assumed
Projects fail when components cannot be installed as assumed, or when the safe handling method is not viable. Avoidance is measured route confirmation and a method statement developed alongside the design.

Failure mode 3: Airflow integrity problems are inherited
Upgraded fans cannot deliver expected efficiency if leakage and bypass remain. Filtration performance cannot be assured if bypass air persists. Avoidance is to assess and correct casing integrity, sealing, and bypass pathways as part of scope where required.

Failure mode 4: Controls and commissioning are treated as secondary
Performance drift often has a controls root cause. If the control strategy is not aligned to operating reality, the system hunts, wastes energy, and becomes difficult to run. Avoidance is a controls intent specification and a commissioning plan with evidence of stable operation.

Failure mode 5: Acceptance evidence is not defined
If the project cannot demonstrate delivered airflow, stable control, and intended operating behaviour, the client is left with uncertainty and risk. Avoidance is to specify testing and handover documentation requirements, then deliver them as a contractual output.

Failure mode 6: Maintainability is not improved
If access remains poor, filters are changed late or badly, coils foul, and seals degrade. The refurbished unit drifts back towards poor performance. Avoidance is to treat access and maintainability as performance requirements, not optional extras.

Avoiding failure is not complicated, but it does require discipline.
- Survey properly.
- Design to constraints.
- Specify outcomes with evidence.
- Deliver with a method that protects the building.
- Validate the result at handover.

Section 7 - Delivery, Performance Validation and Handover: Commissioning Evidence and Documentation

How do you plan refurbishment around occupied buildings and restricted downtime?

Planning refurbishment around an occupied building is a risk management exercise first, and a manufacturing exercise second. The site does not care that the upgrade solution is elegant if the building cannot operate safely during the works. The planning therefore has to start with operational constraints, then design the refurbishment scope and methodology around those constraints.

A robust approach usually follows six steps:

1) Define what "downtime" really means on this site:
Downtime is not always a single shutdown window. It can be partial operation, reduced airflow, out-of-hours access, or a sequence of short shutdowns across several weeks. The plan needs to define what is acceptable in operational terms, not simply what is desirable from a project perspective.

2) Identify critical ventilation dependencies:
Occupied buildings often have spaces that cannot tolerate reduced ventilation without operational impact. In some sites, ventilation is linked to process, hygiene, or safety. The plan must identify critical areas and determine whether temporary ventilation, phased changeover, or controlled reduction is required.

3) Separate work into "offline-only" and "possible-while-operational"
Some activities require full shutdown. Others can be carried out with the system in partial operation or in planned windows. The refurbishment plan should identify which tasks sit in each category. That allows the programme to be built around realistic operational windows.

4) Design the installation methodology, not just the upgrade:
On constrained live sites, the method statement is part of the design. The plan must cover access route, lifting and handling, protection of building fabric, waste removal, and safe working arrangements. If the method is not engineered early, downtime tends to increase late.

5) Align controls, commissioning, and acceptance to the operational reality:
Occupied sites often cannot tolerate a long commissioning period. The plan should define how controls will be introduced, how the system will be stabilised quickly, and what evidence will be provided at handover. Acceptance should be designed around practical verification, not around assumptions.

6) Build the communication plan into the programme:
In occupied buildings, stakeholders need clarity on what will happen and when. A refurbishment that creates unexpected shutdowns or unstable building conditions loses confidence fast. The plan should define what will change, when it will change, and what contingencies exist if the plan needs adjustment.

The practical outcome customers want is a refurbishment programme that improves performance without creating a building operations problem. That only happens when downtime and occupancy constraints are treated as primary design inputs.

When does phased refurbishment make sense, and how should it be structured?

Phased refurbishment makes sense when the building cannot tolerate a single extended shutdown, or where the unit condition and site constraints mean the project is better delivered as a controlled sequence rather than one intervention. It is also relevant where multiple units serve critical areas and the project can be sequenced to preserve resilience.

A phased approach is only effective when it is designed with clear objectives for each phase and with a route to maintaining stable operation throughout.

When phasing is the right approach:
Phasing is usually appropriate when:
- Ventilation is critical and the system cannot be taken offline for long periods
- Access constraints mean work needs to be staged to manage handling and safe working
- The refurbishment includes multiple scope elements that can be separated logically, such as controls first, then fan upgrade, then casing and filtration integrity work
- You need to maintain partial operation and avoid destabilising the building

How to structure a phased refurbishment:
A robust phasing plan normally includes:
- Phase objectives: what the phase will achieve and what it will not attempt to achieve
- Operational constraints per phase: the allowable downtime, partial operation assumptions, and any temporary measures required
- Methodology per phase: what needs to be removed, how it will be handled, and what protection is required
- Commissioning and stabilisation plan per phase: how the building will be returned to stable operation at the end of each phase
- Acceptance evidence per phase: what will be tested and documented to confirm the phase outcome

The risk in phasing is that it can create "half-finished" operation if the phases are not defined properly. The mitigation is to design each phase so it delivers a stable intermediate state and so the final phase confirms the overall performance outcome with clear evidence.

How do you maintain ventilation during works when the system cannot be offline?

Maintaining ventilation during works is a planning problem that must be solved before the refurbishment scope is finalised. If the building cannot tolerate downtime, the project must define how ventilation is maintained, what temporary measures are required, and how the building is protected during changeover.

There are several approaches, and the correct choice depends on the site's criticality, physical constraints, and the refurbishment scope.

Temporary ventilation provision:
Where critical spaces require continuous ventilation, temporary systems can be used to maintain airflow during shutdown windows. The plan must define the required airflow, filtration needs, and distribution method, as well as safe installation and removal. Temporary ventilation should not be treated as a generic solution. It has to be designed to the site's needs.

Phased changeover and partial operation:
If the system can tolerate reduced airflow for defined periods, the refurbishment can be phased

so that parts of the unit or system remain operational while work is carried out on other parts. This requires careful sequencing and clear control strategy, because unstable partial operation can create more operational disruption than a planned shutdown.

Redundancy management where multiple units exist:
In some buildings, ventilation resilience exists through multiple units or multiple serving strategies. In those cases, works can be scheduled to preserve ventilation by sequencing shutdowns and ensuring alternative provision is available. This requires a clear understanding of which spaces are served by which assets and how the building will behave under reduced capacity.

Communication and operational controls:
Where ventilation is maintained through temporary or partial measures, operational controls must be agreed. That includes occupancy constraints, space use restrictions, and monitoring during the works. Maintaining ventilation is not only about airflow. It is about maintaining operational safety and confidence.

A refurbishment that plans ventilation maintenance early protects programme and protects the building. A refurbishment that discovers it late tends to create emergency measures, increased cost, and unnecessary disruption.

What does a robust quality plan look like for an ahu refurbishment?

A robust quality plan exists to protect the client from two risks: work that is not delivered as intended, and work that is delivered but cannot be evidenced. In refurbishment, quality is not only about workmanship. It is about ensuring the refurbished unit behaves as a system and can be accepted with confidence.

A practical quality plan usually includes the following elements.

Defined scope, defined outcomes, defined responsibilities:
Quality starts with clarity. The plan should map the project objectives to scope items, define responsibilities across parties, and define how change will be managed if condition issues are discovered during the works.

Manufacturing and installation controls:
Where components are being manufactured or modified, the plan should define inspection points and sign-offs. On site, it should define installation controls that protect the building and protect the refurbishment outcome, including protection of seals, correct fitment of frames, correct installation of fans and controls, and correct reinstatement of access points.

Hold points and witness points:
A quality plan benefits from hold points where work cannot proceed until a check is completed and signed off. Examples include casing repairs before resealing, filtration frame installation before filter fitment, fan installation before controls commissioning, and functional checks before returning the unit to service.

Commissioning and performance verification:
Commissioning should be structured, with clear intent and acceptance evidence. The plan should define what will be tested and documented, and how stable operation will be demonstrated. If the refurbishment includes efficiency and performance claims, verification is the mechanism that makes those claims credible.

Handover documentation and long-term maintainability:
A quality plan should define what the client receives at handover, including what was changed, how it was commissioned, and what maintenance approach is required to protect the refurbished performance. If the client cannot maintain the unit safely and correctly, quality will drift.

A quality plan is therefore not a generic template. It is a practical control system that makes refurbishment predictable, auditable, and verifiable.

How do you prove a refurbished ahu will meet performance, not just appear upgraded?

You prove performance by defining, before work starts, what “performance” means on this project, then producing evidence at handover that the refurbished unit meets that definition.

Refurbishment projects often fail on proof because improvement is assumed rather than measured. The casing looks better, components are new, and the building feels “more stable” for a short period. That is not proof. Proof is a combination of clear acceptance criteria and documented verification.

A verifiable proof approach has four parts.

1) Define the performance outcomes in measurable terms:
At minimum, this means defining the required airflow and pressure, the control stability expectations, and any critical performance constraints such as filtration performance or noise limits where relevant. If the business case includes energy reduction, the performance definition should also state how energy improvement will be assessed, even if it is by proxy measures such as fan power at duty or improved system pressure profile.

2) Translate outcomes into acceptance evidence:
The key is to decide what evidence will demonstrate each outcome. For example:

- delivered airflow and pressure can be supported by commissioning records and system testing
- casing integrity improvements can be supported by leakage-related evidence where relevant to project objectives
- control stability can be supported by functional testing, trend data over an agreed period, and defined sign-off criteria
- filtration performance can be supported by fitment verification, bypass control measures, and maintenance access verification

The level of testing should match the risk. A critical environment needs more evidence than a low-risk application. The point is that the project should define the evidence up front, not negotiate it after work is complete.

3) Prove build quality where it matters to performance:
Some of the biggest performance losses are created by details. Poor sealing, bypass pathways, poor filter frame fitment, and poorly reinstated access panels can undermine the whole refurbishment. Proof therefore includes inspection and sign-off of critical installation details, not only final performance readings.

4) Provide documentation that allows future performance to be maintained:
A refurbishment is only proven if performance can be sustained. Handover should therefore include what was changed, why it was changed, how the unit was commissioned, and what maintenance requirements protect the refurbished outcome. Without that, the unit will drift, and the proof becomes temporary.

The practical conclusion is that “proof” is not a single test. It is an evidence chain. The chain starts in specification and ends at handover with documentation that makes performance auditable.

What performance testing should be completed after refurbishment, and what is “good” evidence?

Performance testing after refurbishment should be selected to match the project’s objectives and risk profile. The mistake is to assume that “testing” is a generic box to tick. Good evidence is evidence that directly supports the outcomes the client is paying for, and that can be used to sign off the project without ambiguity.

A practical approach is to think in terms of three testing layers: component verification, system performance verification, and operational verification.

Component verification:
Component verification confirms that what was specified is what was delivered and installed correctly. This includes:

- fan arrangement and control method installed as designed
- correct sensor provision and placement for control stability
- filtration frames and access arrangements installed correctly
- casing repairs and sealing work completed as intended

This layer is often verified through inspection records and hold-point sign-offs, not through complex testing, but it is critical because errors here create downstream performance issues.

System performance verification:
System verification focuses on the delivered airflow and the unit’s ability to meet duty at the required operating conditions. Evidence typically includes:

- airflow and pressure commissioning results
- functional verification that the unit can achieve and maintain setpoints under expected loads
- verification that control sequences operate correctly, including safeties and interlocks

If resilience is part of the design, evidence should include demonstration that the unit can maintain duty under defined failure conditions, where feasible and appropriate.

Operational verification:
Operational verification demonstrates that the unit runs stably once handed back to the building. Evidence can include:

- trend data showing stable operation over an agreed period
- confirmation that the unit responds predictably to demand changes
- confirmation that maintenance tasks can be carried out safely and correctly

What counts as “good evidence” is evidence that is defined in advance, provided in a usable format, and linked clearly to acceptance criteria. If the evidence cannot be used to make a clear sign-off decision, it is not good evidence.

What is the difference between factory testing, site testing, and commissioning evidence?

The difference is where risk sits and what each activity can prove:

Factory testing:
Factory testing is carried out in controlled conditions. Its value is that it can verify performance attributes that are difficult to assess reliably on site, and it can confirm that the unit has been assembled and configured as designed before it becomes difficult to access. Factory testing is most useful when the refurbishment involves significant rebuild work, where acceptance evidence needs to be robust, or where project criticality justifies the additional control.

Factory testing does not prove site performance in isolation. Site conditions, ductwork, installation quality, and controls integration still affect final performance.

Site testing:
Site testing confirms performance in the installed environment. It can verify airflow delivery, pressure behaviour, and functional operation within the building’s real constraints. Site testing is essential when the acceptance question is “does this installed system meet the building requirement”.

Site testing also exposes installation-related issues that factory testing cannot, such as ductwork constraints, external pressure environment, and integration with BMS.

Commissioning evidence
Commissioning evidence is the recorded process of making the system operate as intended. It includes functional testing, sequence validation, setpoint checks, trend evidence where required, and sign-off documentation. Commissioning evidence is what allows the client to accept that the system is not only capable of performance, but operating correctly and stably.

A refurbishment project is strongest when these three are treated as complementary. Factory testing controls build risk. Site testing verifies installed performance. Commissioning evidence confirms stable operation and provides the documentation trail for future maintenance and auditing.

What documentation should you expect at handover, and what is often missing?

You should expect documentation that allows you to operate, maintain, and audit the refurbished unit. Handover is where many refurbishment projects lose value because information is incomplete, scattered, or not aligned to what was actually changed.

A practical handover pack should include the following:

Scope confirmation and as-built clarity:
The client should receive a clear record of what was done, what components were upgraded, what casing and sealing work was completed, and what changes were made to internal arrangement where relevant. If drawings are updated, they should reflect what is installed, not what was originally assumed.

Controls and commissioning information:
Controls documentation should include sequence descriptions, points lists, and confirmation of BMS integration expectations. Commissioning evidence should include functional test results, setpoint verification, and any trend evidence agreed for acceptance. If the building will be maintained by a third party, this information is essential to prevent future drift.

Testing and verification evidence:
If performance testing was specified, the results should be included in a usable format, with clear reference to acceptance criteria. Where inspection hold points were part of the quality plan, sign-off records should be included because they prove critical details such as filter fitment and sealing were completed correctly.

Operating and maintenance requirements:
The client should receive guidance on maintenance tasks that protect refurbished performance. This includes filter change requirements, access and safety notes, and any specific instructions related to fan arrays, controls tuning, or monitoring.

What is often missing:
The most common omissions are evidence and clarity. Evidence is missing when testing and commissioning data is not provided or is incomplete. Clarity is missing when documentation does not show what was actually changed, leaving the client unable to audit the refurbishment outcome later.

A refurbishment handover should allow a new engineer to understand the unit quickly and to maintain the refurbished performance without guesswork.

USEFUL EXTERNAL LINKS:

CIBSE KS12: Refurbishment for improved energy efficiency (overview)
https://www.cibse.org/knowledge-research/knowledge-portal/ks12-refurbishment-for-improved-energy-efficiency-an-overview/
CIBSE Commissioning Code A: Air distribution systems (2024) (PDF page)
https://www.cibse.org/knowledge-research/knowledge-portal/cca-commissioning-code-a-air-distribution-systems-2024-pdf/
BSRIA BG 49/2024: Commissioning Air Systems
https://www.bsria.com/uk/product/rqJzen/commissioning_air_systems_bg_492024_a15d25e1/
BSI: BS EN 1886:2025 (publication reference)
https://knowledge.bsigroup.com/products/ventilation-for-buildings-air-handling-units-mechanical-performance-2

FURTHER INFORMATION:

Decarbonisation webpage
https://www.mansfieldpollard.co.uk/decarbonisation/
AHU refurbishment webpage
https://www.mansfieldpollard.co.uk/products/air-handling/ahu-refurbishment/
AHU refurbishment brochure (PDF)
https://www.mansfieldpollard.co.uk/wp-content/uploads/2022/07/Mansfield-Pollard-AHU-Refurbishment-Brochure.pdf
Bio Sciences AHU refurbishment (case study)
https://www.mansfieldpollard.co.uk/case-studies/bio-science-technology-laboratory-business-park-ahu-refurbishment/
Hospital AHU refurbishment (HTM 03-01) (case study)
https://www.mansfieldpollard.co.uk/case-studies/hospital-air-handling-refurbishment-htm-03-01/
Morrisons refurbishment (food processing) (case study)
https://www.mansfieldpollard.co.uk/case-studies/ahu-refurbishment-food-processing/
Tesco Estate decarbonisation programme (case study)
https://www.mansfieldpollard.co.uk/case-studies/national-hvac-decarbonisation/
NHS Estate HVAC decarbonisation (case study)
https://www.mansfieldpollard.co.uk/case-studies/nhs-hvac-decarbonisation/
AHU Decarbonisation: The Complete Guide (PDF)
https://www.mansfieldpollard.co.uk/wp-content/uploads/2025/09/AHU-Decarbonisation-The-Complete-Guide-v2.pdf
White Paper: Decarbonising Business Estates through Air Handling (PDF)
https://www.mansfieldpollard.co.uk/wp-content/uploads/2025/09/Decarbonising-Business-Estates-through-Air-Handling-v2.pdf
White Paper: From Gas to Grid (PDF)
https://www.mansfieldpollard.co.uk/wp-content/uploads/2025/09/From-Gas-to-Grid-v2.pdf
AHU Rental Units- UK Wide Plant Hire (case study)
https://www.mansfieldpollard.co.uk/case-studies/ahu-rental_units/
All case studies
https://www.mansfieldpollard.co.uk/case-studies/

AHU REFURBISHMENT
DECODED

www.mansfieldpollard.co.uk
salesteam@mansfieldpollard.co.uk

MANSFIELD POLLARD
AIR MANAGEMENT EXPERTS