Section-Level Configuration as the Unit of Selection: Engineering Architecture for Air Handling Unit Design and Costing

Architecture, Computational Methods, and Field Evidence from MileSoft AHU Selection Software

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Abstract

An air handling unit is not a catalogue item. It is an ordered assembly of sections — mixing box, filters, coils, fan, attenuator, plenum — whose aerodynamic, thermal, acoustic and commercial behaviour is a property of the assembly rather than of any component in it. Selection tools that treat the unit as a model number to be looked up therefore mis-state the one quantity the customer will measure on site: the pressure the fan must actually develop against the sections placed in front of it.

This paper presents the architecture and computational methods of MileSoft AHU Selection Software, in which the unit of selection is the section rather than the unit. A guided five-step workflow — project information, unit configuration, section design, bill of materials and costing, reports — assembles the unit from a governed catalogue of section types, each carrying its own engineering dialogue and its own certified component data. Pressure drop accumulates along the air path as sections are placed; the coil is rated at the air state it will actually see; and the same engine that performed the selection emits the bill of materials, so the price and the physics cannot diverge.

We state the pressure-accumulation and coil-duty methods, the specific-fan-power reporting that follows from them, and the cost roll-up from section to unit to project. We anchor the work in the casing and component regimes of EN 1886 and EN 13053, the filter classification of ISO 16890 and ASHRAE 52.2, and the fan rating methods of ISO 5801 and ANSI/AMCA 210.

Reported outcomes from the product's published record include a 60-70% reduction in selection-cycle time with zero audit findings in the first quarter, a 40% reduction in manufacturing lead time, and adoption by 50+ HVAC manufacturers. A four-module deployment at an HVAC OEM, in which this module was one of four, reported a 70% selection-cycle reduction and 12% proposal-to-order uplift; that result is not attributed to this module alone. We close with a capability reference framework for AHU selection tooling.

Keywords: AHU selection software; Air handling unit design; Section-by-section configuration; EN 1886 casing classification; EN 13053; ISO 16890 filter classes; Specific fan power; Pressure drop accumulation; SAP-coded bill of materials; 2D CAD export DXF DWG; EUROVENT certified performance; HVAC tender submittal

1 Introduction

Air handling unit selection is usually described as a sizing problem, and that description is what makes it go wrong. Sizing implies a lookup: state the duty, find the model. But an AHU is built as an ordered assembly of sections, and the properties a customer eventually measures — the pressure the fan develops, the state of the air leaving the coil, the sound at the neck — belong to the assembly rather than to any component chosen from a table.

The practical consequence is a specific and repeatable error. An engineer sizes the coil from a catalogue at a reference air state, sizes the fan against an estimated external static pressure, and adds an allowance for the filters. The unit is quoted. On site the filters load, the actual entering air differs from the reference, and the fan runs at a duty nobody computed. The unit does not fail; it simply does not do what the submittal said.

This paper describes a tool built on the opposite premise: that the section is the unit of selection, and the unit's behaviour is derived from the sections placed in it. The design consequence is that pressure drop accumulates as the engineer builds, the coil is rated at the state it will actually see, and the price is emitted by the engine that did the physics.

1.1 What a spreadsheet cannot hold

The incumbent tool is a spreadsheet, and its failure is not arithmetic. A typical AHU selection touches five inter-dependent calculations: coil performance in sensible and latent terms, fan curve fit, motor sizing, filter pressure drop, and acoustic level at the neck and casing. Each is tractable alone. What a spreadsheet cannot hold is the dependency between them — change the coil rows and the pressure drop moves, which moves the fan duty, which moves the motor and the sound.

Nor can it hold provenance. A selection sheet that lives on a sales engineer's laptop, using a coil curve from 2019 that no one has audited in eighteen months, will produce an internally consistent answer that no longer corresponds to the components the factory will build with. The question an auditor asks is not whether the arithmetic is right; it is whether the curve can be traced. The blunt test is whether that trace takes under a minute.

> Version drift across regional offices is the same failure in a different costume: several answers, each defensible in isolation, none reconcilable with the others.

1.2 Contributions

1. A section-level configuration model in which pressure drop accumulates along the air path, so fan duty is derived rather than assumed.
2. A costing method that emits the bill of materials from the same engine that produced the performance, per decker and per tag, with SAP part codes.
3. A drawing and submittal path in which the schematic the engineer builds is the artefact exported to 2D CAD, removing the redraw step.
4. An eight-dimension capability reference framework for evaluating AHU selection tooling by demonstration.

2 Background and Related Work

Three regimes govern what an AHU selection must be able to state: the casing and component standards, the filter classification standards, and the fan rating standards. A fourth — ecodesign — converts several of them into a compliance obligation.

2.1 Casing and component rating

EN 1886 specifies laboratory test methods, requirements and classifications for the casings of non-residential air handling units — mechanical strength, air leakage, thermal transmittance and thermal bridging. It is a casing standard: it says nothing about what the unit does thermally, only about the box.

EN 13053 covers the other half: requirements, classification and testing for the rating and performance of the unit as a whole and of its components and sections. It applies both in the laboratory and in situ, and to mass-produced and tailor-made units alike — which matters here, because an engineered-to-order AHU is by definition not a catalogue model.

Read together, the two standards describe exactly the architecture this tool implements: a classified casing enclosing rated sections. A selection tool that models the unit as an indivisible model number cannot express that structure, and therefore cannot state a section-level claim an auditor can check.

2.2 Filter classification and the pressure band

ISO 16890 has been the international classification basis for general-ventilation air filters since December 2016, and the mandatory basis since 30 June 2018, superseding EN 779. Its innovation is to express efficiency against the ambient particulate fractions — PM1, PM2.5 and PM10 — rather than against a single synthetic test particle, with classes ISO ePM1, ISO ePM2.5, ISO ePM10 and ISO Coarse assigned where a filter separates at least half of the corresponding range across a 0.3 to 10 micrometre spectrum.

Where a project is specified in North American terms, ANSI/ASHRAE 52.2 supplies the MERV reporting system over the same particle-size range. A selection tool serving both markets must hold both, because a filter section specified as ISO ePM1 70% and one specified as MERV 14 are not interchangeable statements.

For unit design the classification matters less than what accompanies it: each filter carries an initial and a final pressure drop. The section is not a single number but a band, and the fan must be selected against the loaded end of it. Sizing to the clean value is the most common way a unit that passed at the factory fails to hold airflow in service.

2.3 Fan rating and ecodesign

ISO 5801 specifies procedures for determining fan performance using standardized airways, with rules for converting results across changes in speed, gas and — for model tests — size. ANSI/AMCA 210, published jointly as ANSI/ASHRAE 51, establishes uniform laboratory methods for certified aerodynamic performance rating in terms of airflow rate, pressure developed, power, density, rotational speed and efficiency.

Commission Regulation (EU) No 1253/2014 turns these ratings into an obligation for units placed on the European market, setting ecodesign requirements for ventilation units and distinguishing residential from non-residential units. The regulation is why specific fan power is a design constraint rather than a reporting nicety, and why a tool that cannot compute it at selection time cannot demonstrate compliance.

2.4 Failure modes of catalogue-driven selection

- Reference-state coil rating. The coil is rated at a catalogue air state rather than the state the preceding sections actually deliver, so the sensible and latent split are both wrong.
- Clean-filter fan sizing. The fan is selected against initial filter pressure drop, so the unit loses airflow as the filters load through their service interval.
- Assumed external static. External static pressure is entered as a number rather than derived from the sections placed, so the internal contribution is double-counted or omitted.
- Detached costing. The bill of materials is built in a separate sheet from the selection, so a late coil change updates the price or the performance but rarely both.
- Redrawn general arrangement. The schematic is rebuilt by hand in a CAD package, introducing a second description of the unit that can disagree with the first.

> All five follow from treating the unit as a catalogue entry. None is fixed by a better catalogue.

3 System Overview

The tool is organised as a guided five-step workflow over a governed section catalogue. The steps are project information, unit configuration, section design, bill of materials and costing, and reports and submission. Each step narrows what the next may do, so an infeasible unit cannot be reached by accident.

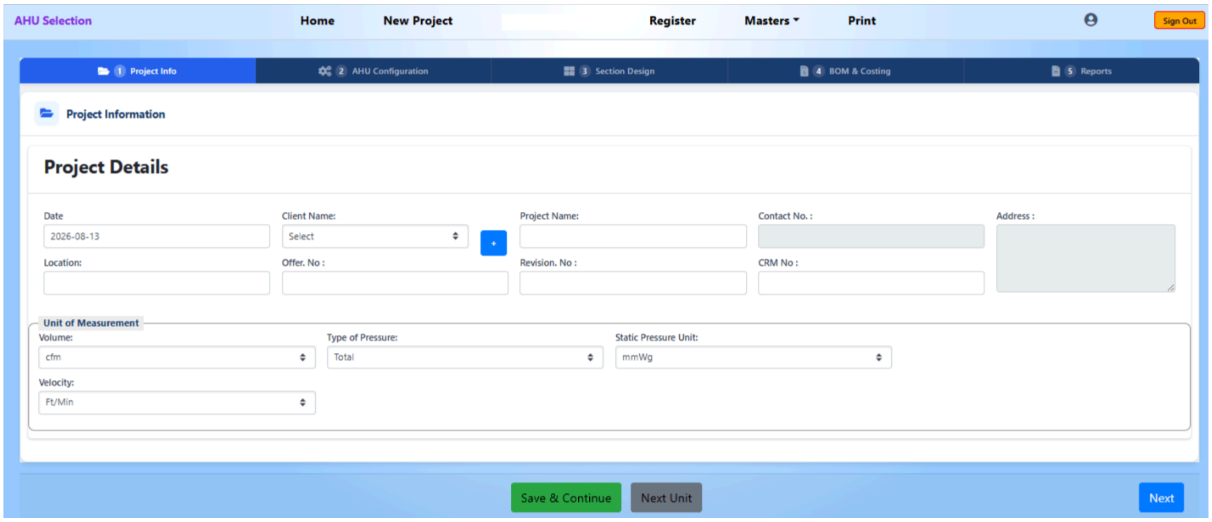

Figure 1. Step 1, project information. Client, project, offer and CRM details are captured together with the project's units of measurement — airflow, static pressure and air velocity — so every subsequent section dialogue works in the units the project is specified in rather than converting at the boundary.

3.1 Unit configuration

Configuration fixes the properties that belong to the unit rather than to any section: certification regime, unit category, air balance across fresh, return and supply, panel build-up, damper face velocities and unit orientation. These are the parameters that constrain what sections may subsequently be placed and in what order.

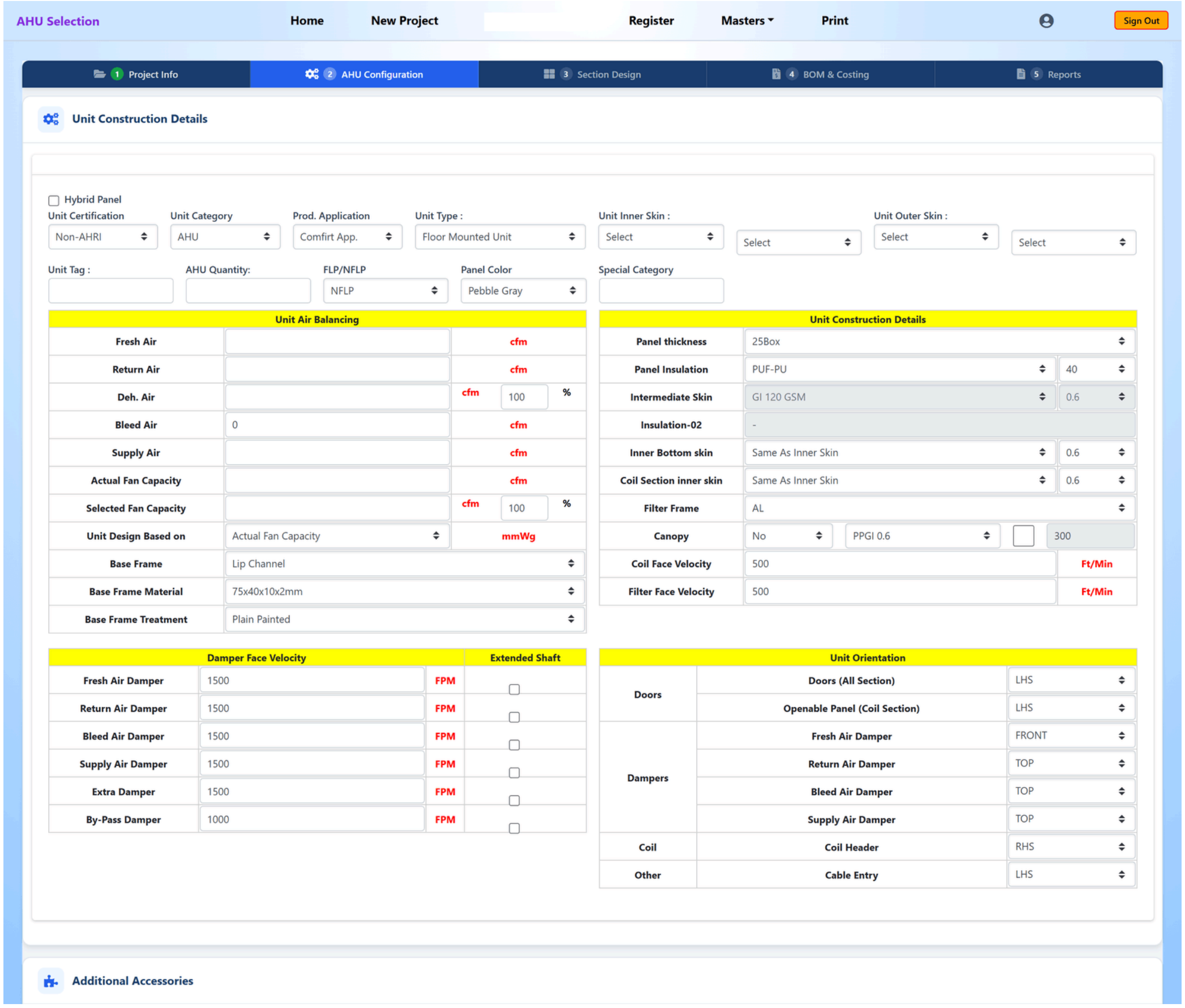

Figure 2. Step 2, unit configuration. Certification regime, air balance, panel build-up and damper face velocities are set once at unit level. Panel build-up is where the EN 1886 casing classification is expressed, and it is fixed before sections are placed because it constrains their depth and weight.

Fixing the air balance here rather than per section is a deliberate ordering choice. Fresh, return and supply flows are conservation constraints on the whole unit; allowing them to be edited inside a section dialogue would permit an assembly whose mass flows do not close.

3.2 Section design

Section design is the core of the tool. Sections are dragged onto the air-flow path and reordered directly, and a live schematic redraws as the assembly changes. The governed catalogue includes inlet and mixing boxes, pre-filters, bag filters, fine filters, HEPA filters, coils, fan sections, empty plena and empty heater sections, among others.

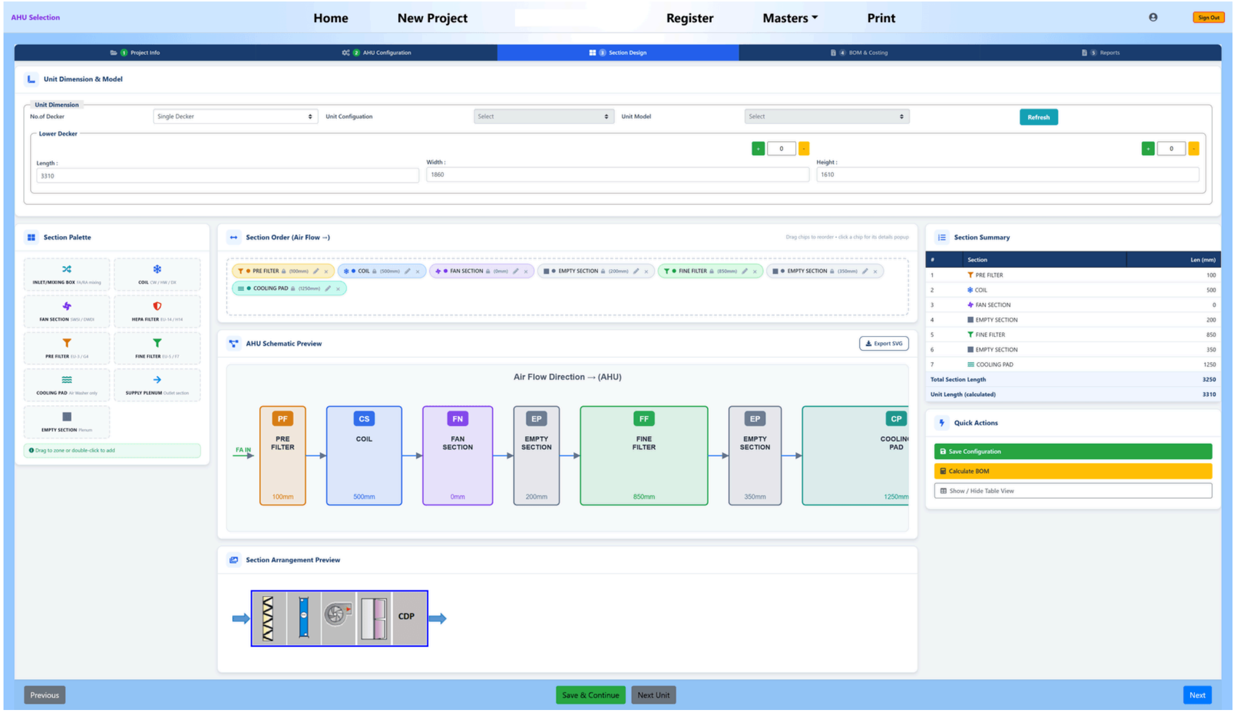

Figure 3. Step 3, section design. The engineer arranges sections along the air path and the schematic redraws continuously. This schematic is not an illustration of the design — it is the design, and it is the artefact later exported as SVG or 2D CAD.

Each section carries its own engineering dialogue rather than a shared property sheet. A mixing-box dialogue configures fresh- and return-air dampers; a filter dialogue captures the initial and final pressure drops in pascals; a coil dialogue takes rows, circuiting and fin spacing. Section ordering and component feasibility are rule-enforced, so a HEPA placed upstream of a pre-filter, or a coil that will not fit the configured casing depth, is refused at the point of placement.

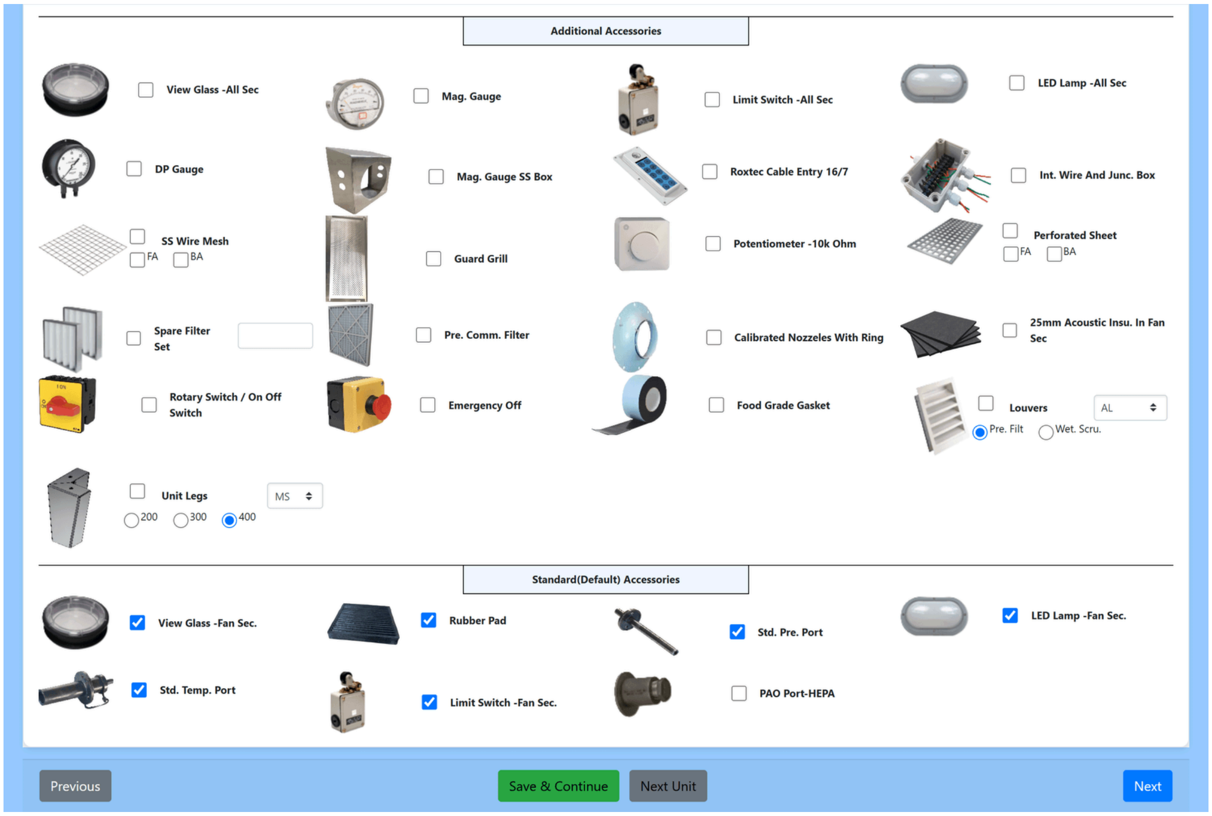

Figure 4. Accessories are governed catalogue items too — view glass, magnehelic and differential-pressure gauges, limit switches, louvers, unit legs — so they reach the bill of materials automatically rather than being appended to the quotation by hand.

3.3 Governance and the section master

Reusable section templates are maintained centrally in a section master, which is what makes a library update propagate rather than diffuse. When research and development releases a new coil family, it is added once and becomes available to every engineer on the next selection; the alternative — emailing a revised spreadsheet — is the mechanism by which a 2019 curve survives to 2026.

Inquiries are governed by branch and financial year through an explicit allocation state machine, with per-engineer attribution. This is what allows an organisation with several regional offices to hold one answer rather than one answer per office.

Figure 5. The production dashboard. Project status, task allocation, cost and timeline are held at portfolio level, which is the level at which an engineering manager can see that two offices are quoting the same customer differently.

4 Computational Methods

Notation is collected in Appendix A; worked numerical examples in Appendix B.

4.1 Pressure accumulation along the air path

The defining computation is the simplest one, and it is the one catalogue tools omit. Sections placed in series each impose a pressure drop at the design airflow, and the fan must develop their sum plus the external system resistance.

$$dP(total) = dP(external) + \text{SUM over sections } i \text{ of } dP(i) \text{ at the design airflow} \quad \text{(dp)}$$

where dP(i) is the drop across section i evaluated at the design volume flow. Because each dP(i) is itself a function of airflow, changing the airflow re-evaluates every term rather than scaling one number.

For filter sections the term is a band rather than a value, bounded by the initial and final pressure drops the filter dialogue captures. Selecting the fan against the initial value guarantees the unit loses airflow before the filters are changed, so the design duty is taken at the final condition.

$$dP(filter, design) = dP(filter, final) \text{ not } dP(filter, initial) \quad \text{(dpfilter)}$$

the fan is selected at the loaded end of the filter's service band, so airflow is held for the whole change interval rather than only on commissioning day.

4.2 Coil duty at the actual entering state

The coil is rated at the air state the preceding sections deliver, not at a catalogue reference point. For an air-side mass flow, the total and sensible duties follow from the enthalpy and dry-bulb differences across the coil, and the latent duty is their difference.

$$Q(total) = m(air) \times [\ h(in) - h(out)\ ],\ Q(sensible) = m(air) \times cp(air) \times [\ T(in) - T(out)\ ],\ Q(latent) = Q(total) - Q(sensible) \quad \text{(coil)}$$

where h is specific enthalpy and T dry-bulb temperature at the coil faces. The sensible heat ratio SHR = Q(sensible) / Q(total) is the quantity a mis-stated entering state distorts most.

The reason this matters for section-level design is that the entering state is itself an output of the assembly. A mixing box upstream sets it from the fresh and return proportions; a pre-heater shifts it. Rating the coil against a fixed reference discards exactly the information the configuration produced.

4.3 Specific fan power

Once total pressure is derived rather than assumed, fan power follows, and specific fan power becomes computable at selection time rather than estimable afterwards.

$$SFP = P(fan) / V(flow) = dP(total) / eta(total) \quad \text{(sfp)}$$

where eta(total) is the combined fan, drive and motor efficiency at the operating point taken from the certified fan curve. The identity makes the dependence explicit: specific fan power is total pressure divided by total efficiency, so every section added raises it.

> This is the compliance-relevant consequence of section-level design. Under Regulation (EU) No 1253/2014 the specific fan power of a non-residential ventilation unit is regulated, and it can only be demonstrated if total pressure was derived from the sections actually placed.

4.4 Cost roll-up from section to project

The bill of materials is derived from the same configuration object that produced the performance. Each section contributes its components; each component resolves to a part code, a quantity, a unit of measure and a rate.

$$C(unit) = [\ \text{SUM over sections } s, \text{ SUM over components } c \text{ in } s \text{ of } q(c) \times r(c)\ ] \times (1 - discount) \times (1 + margin) \quad \text{(bom)}$$

where q is quantity and r the unit rate for component c. Discount and margin are applied at unit level after the component roll-up, so the build-up remains inspectable line by line.

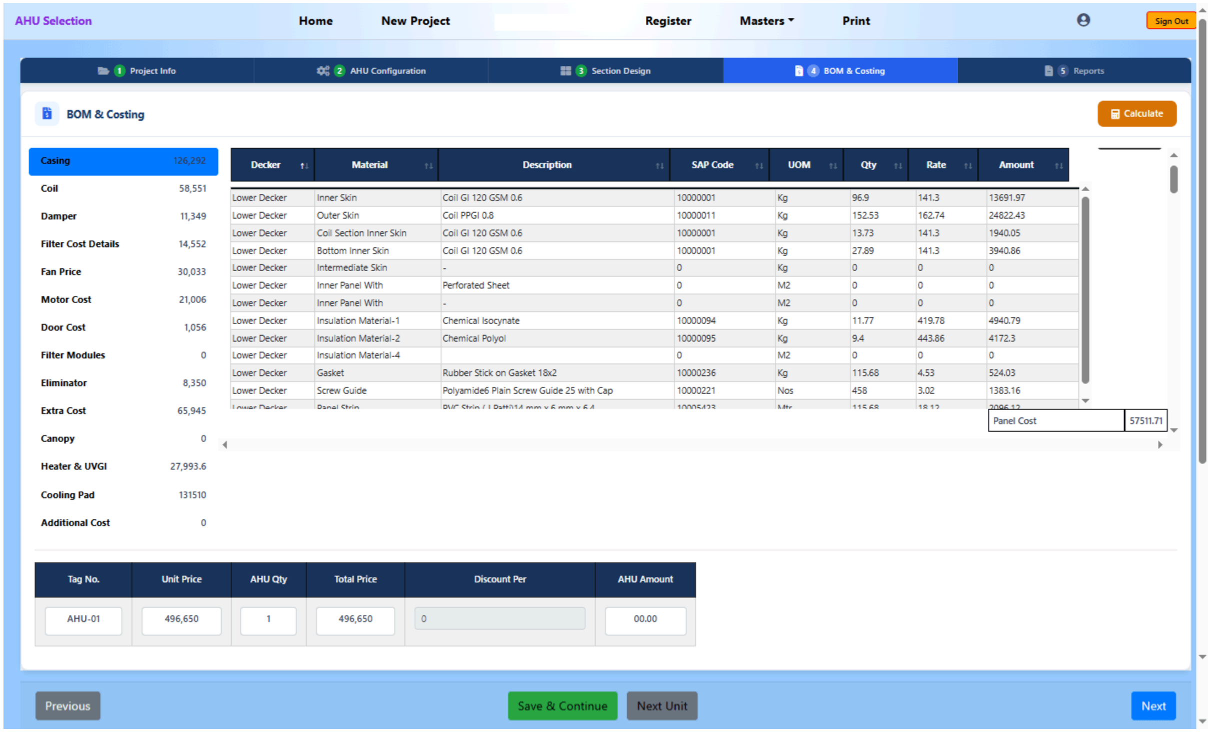

Figure 6. Step 4, bill of materials and costing. The build-up resolves casing, coil, damper, fan, motor, filter, heater and accessories into a per-decker, per-tag price with SAP part codes. Because it is emitted by the selection engine, a change to the coil moves the capacity and the price in one action.

The per-decker granularity is what makes the output usable downstream. A project total is a commercial number; a per-decker bill of materials with part codes is a manufacturing instruction, and it exports to SAP, Oracle or Microsoft Dynamics over standard formats and REST interfaces at the enterprise boundary IEC 62264 describes.

4.5 Schematic and submittal generation

The live schematic is the design artefact, so exporting it is a serialisation rather than a re-drawing. It is written as SVG directly, or through a single plugin as a 2D CAD general-arrangement drawing in DXF or DWG.

The engineering value is not the time saved drawing. It is that there is one description of the unit. Where a general arrangement is redrawn by hand, the drawing and the selection are two artefacts that can disagree, and the disagreement is typically discovered on the shop floor.

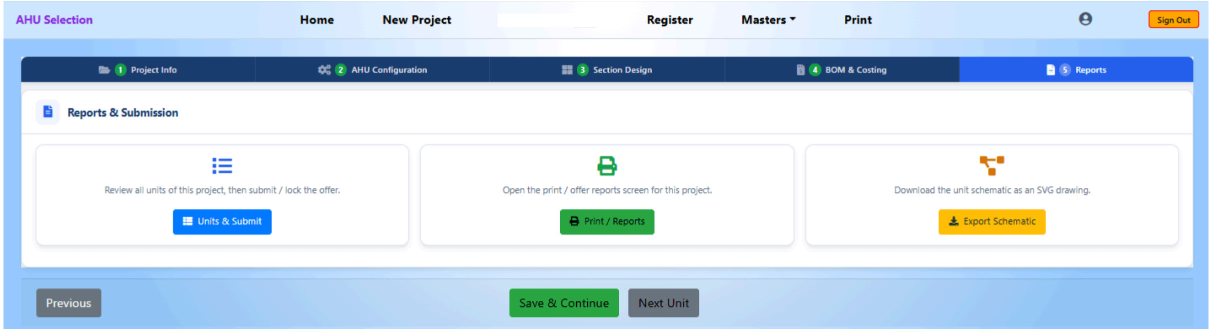

Figure 7. Step 5, reports and submission. Every unit in the project is reviewed, then the offer is submitted and locked. Locking is what converts a working selection into a citable record — the version an auditor or a commissioning engineer will later be shown.

5 Reported Outcomes and Field Evidence

This section separates three kinds of number, because they carry different weight. Figures published for this module; a deployment result that belongs to a four-module programme; and a modelled scenario. Each is labelled, and each appears in the provenance table with its source.

5.1 Figures published for this module

Table 1. Outcomes published in this product's own record. These are the module's stated results, not a controlled study.

Measure	Reported	Where stated
Selection-cycle time	60-70% reduction, typically within the first quarter	AHU blog post
Audit findings after adoption	Zero in the first quarter	AHU blog post
Manufacturing lead time	40% reduction	AHU product page
Workflow speed, inquiry to submittal	10x	AHU product page
Adoption	50+ HVAC manufacturers	AHU product page
Time to live deployment	4-8 weeks	AHU FAQ

The implementation figure is worth reading alongside the architecture. Four to eight weeks is not integration time; the critical path is loading the customer's own coil, fan and accessory libraries into the section master. That is a direct consequence of the design: a tool whose selections are bound to governed component data cannot be useful until that data is present.

5.2 A deployment in which this module was one of four

MileSoft's published HVAC case study describes a deployment at an HVAC OEM in which this module was installed alongside FCU Selection, Chiller Selection and Lifecycle Cost Analysis. The programme reported a 70% reduction in selection-cycle time, zero audit findings since rollout, three times as many proposals per engineer per month, and a 12 percentage-point uplift in proposal-to-order conversion, across four regional offices.

> Those four figures belong to the programme, not to this module. Four tools were deployed together with process change; no attempt was made to isolate the contribution of AHU Selection alone, and this paper does not claim it.

What can be said more narrowly is mechanistic rather than quantitative. The reported operator experience — that work which took a week now takes an afternoon, and that submittals are audit-ready without preparation — is consistent with removing the redraw step and emitting the bill of materials from the selection engine, which are properties of this module specifically.

5.3 Modelled engineer-hour recovery

MileSoft publishes an open return-on-investment model for this module whose assumptions are stated rather than embedded. It is a modelled scenario, not a measurement, and is labelled as such throughout.

Table 2. Published model parameters and the default-case result. Every input is adjustable; the values below are the published defaults.

Parameter	Default
Manual selection time	120 minutes
Selection time in MileSoft	15 minutes
Selections per month	40
Engineer-hours released per year	840

The model's structure is more informative than its output. It attributes the saving entirely to selection time and claims nothing for rework avoided, drawing time, or costing effort — all of which the architecture also affects. It is therefore a conservative floor rather than a projection.

6 Discussion

6.1 Derived duty is the load-bearing decision

Of everything described here, the decision that produces the rest is that total pressure is derived from the sections placed rather than entered beside them. Once duty is derived, the coil is rated at a real entering state, specific fan power becomes computable, ecodesign compliance becomes demonstrable, and a change anywhere in the assembly propagates rather than requiring a manual sweep.

The corollary is that a catalogue tool cannot be improved into this. Adding more models to a lookup does not make the lookup account for the section upstream of the coil. The change is structural, which is why the section rather than the unit has to be the object the tool manipulates.

6.2 Why costing must live in the selection engine

It is tempting to treat the bill of materials as a downstream concern — select first, cost afterwards in the enterprise system. The argument against it is not effort but consistency. Selection and costing describe the same physical object, and when they are produced by different tools they drift at exactly the moments that matter: late design changes, value engineering, and tender revisions.

Emitting both from one engine also changes what a discount means. A discount applied to a per-component build-up is inspectable line by line, so a margin decision can be examined rather than merely accepted. A discount applied to a lump sum conceals which component absorbed it.

6.3 A capability reference framework for AHU selection tooling

Table 3. Capability reference framework. Each dimension is answerable by demonstration against a running system in under an hour, with no access to source code.

Dimension	Question the tool must answer by demonstration
D1 Section granularity	Is the object being configured a section, or a model number with options?
D2 Derived duty	Add a filter section. Does the fan duty change without anyone retyping it?
D3 Filter band	Is the fan selected against the filter's final pressure drop or its initial one?
D4 Real entering state	Is the coil rated at the state the upstream sections deliver, or at a catalogue reference?
D5 Rule enforcement	Attempt an infeasible section order. Is it refused at placement or discovered at review?
D6 One engine, one price	Change the coil. Do capacity and price both move in the same action?
D7 Single drawing	Is the exported general arrangement the same artefact as the design, or a redraw?
D8 Library governance	Publish a new coil family. How long until every engineer is selecting from it?

D2 is the single most diagnostic question. A tool that cannot make fan duty move when a section is added is a catalogue with a configurator on top.

6.4 Generalisability

The architecture generalises to any engineered-to-order assembly whose performance is a property of its ordering, which in HVAC includes air handling units and, with a different section vocabulary, packaged and rooftop equipment. It generalises poorly to genuinely catalogue products, where the assembly is fixed and a lookup is the correct model. The published figures are specific to AHU manufacturers and MEP consultants and should not be read across to those cases.

7 Threats to Validity and Limitations

1. Vendor-reported figures. Every quantitative claim in Section 5 is published by the vendor from its own record. None is independently audited, and no controlled comparison against an alternative tool was performed.
2. Confounded deployment result. The 70% selection-cycle figure belongs to a four-module programme with concurrent process change. This module's individual contribution was not isolated.
3. Range without dispersion. The 60-70% selection-cycle figure is a range across customers with no sample size, distribution, or definition of the baseline it improves on.
4. Modelled ROI is not measurement. Appendix B's engineer-hour recovery follows from published assumptions about manual and software selection times. Those times are vendor estimates, not observed distributions.
5. Baseline heterogeneity. A 60-70% reduction against a mature spreadsheet estate and against an undisciplined one are different claims; the published record does not distinguish them.
6. No cost data. Licence, implementation and library-loading costs are not reported, so no return-on-investment conclusion is drawn.

> The architecture in Sections 3 and 4 is reproducible from this text. Section 5 should be read as the vendor's reported experience, and the deployment figure as a programme result.

8 Future Work

- Isolating the module's contribution. Instrumenting selection time per module in a multi-module deployment would let the programme figure be decomposed, replacing a shared attribution with a measured one.
- Acoustic prediction at section level. Sound at the neck and casing is currently a design check; deriving it from the placed sections the way pressure already is would close the last assumption in the assembly.
- Filter loading over the service interval. Selecting at the final pressure drop is conservative but static; modelling the loading trajectory would let energy over the change interval be reported rather than bounded.
- Ecodesign declaration output. Specific fan power is computed at selection time but is not yet emitted as a conformity declaration in the form Regulation (EU) No 1253/2014 anticipates.
- Measured versus predicted follow-up. No published data compares the submittal's stated performance against commissioning measurements. That comparison is the only test that would settle whether derived duty closes the gap it is designed to close.

9 Conclusion

An air handling unit behaves as an assembly, and a selection tool that models it as a catalogue entry will mis-state the quantity that gets measured on site. This paper has described a tool built on the opposite premise — the section as the unit of selection — and traced the consequences: pressure accumulates along the air path so fan duty is derived, the coil is rated at the state the assembly actually delivers, specific fan power becomes computable at selection time, and the bill of materials is emitted by the same engine that produced the performance.

The published record for this module reports a 60-70% reduction in selection-cycle time with zero audit findings in the first quarter, a 40% reduction in manufacturing lead time, and adoption by more than fifty HVAC manufacturers. A four-module deployment reported larger programme figures, which this paper deliberately does not attribute to this module alone.

The capability reference framework of Section 6.3 is offered as the durable contribution, and its second question is the one that separates architectures rather than vendors: add a filter section, and see whether the fan duty moves on its own.

Appendix A Nomenclature

Table 4. Symbols and abbreviations used in this paper.

Symbol / term	Meaning
V(flow)	Design volume flow rate through the unit
dP(total)	Total pressure the fan must develop
dP(external)	External system resistance, outside the unit
dP(i)	Pressure drop across section i at the design airflow
dP(filter, initial/final)	Clean and loaded pressure drop bounding a filter section's service band
m(air)	Air-side mass flow rate
h(in), h(out)	Specific enthalpy of the air entering and leaving the coil
T(in), T(out)	Dry-bulb temperature of the air entering and leaving the coil
cp(air)	Specific heat capacity of moist air at constant pressure
Q(total), Q(sensible), Q(latent)	Total, sensible and latent coil duty
SHR	Sensible heat ratio, Q(sensible) divided by Q(total)
SFP	Specific fan power, fan power per unit volume flow
eta(total)	Combined fan, drive and motor efficiency at the operating point
q(c), r(c)	Quantity and unit rate of component c in the bill of materials
C(unit)	Unit price after component roll-up, discount and margin
AHU	Air handling unit
BOM	Bill of materials
MERV	Minimum Efficiency Reporting Value (ANSI/ASHRAE 52.2)
ISO ePM1 / ePM2.5 / ePM10	ISO 16890 filter classes by particulate fraction

Appendix B Worked Numerical Examples

Appendix B.1 Why the filter band changes the fan selection

A unit is designed for 8,000 m3/h against 250 Pa of external resistance. The assembly is a mixing box (40 Pa), a pre-filter rated ISO Coarse (initial 55 Pa, final 250 Pa), a fine filter rated ISO ePM1 (initial 105 Pa, final 450 Pa), a cooling coil (160 Pa) and an attenuator (35 Pa).

Applying Equation (dp) at the clean condition: dP(total) = 250 + 40 + 55 + 105 + 160 + 35 = 645 Pa. At the loaded condition, applying Equation (dpfilter): dP(total) = 250 + 40 + 250 + 450 + 160 + 35 = 1,185 Pa.

The difference is 540 Pa, or 84% above the clean figure. A fan selected at 645 Pa does not merely lose a little airflow as the filters load — it is selected for a duty the unit spends almost none of its service life at. The filters alone move from 160 Pa to 700 Pa, which is why the band, not the value, is the design input.

Applying Equation (sfp) with a combined efficiency of 0.62 at the operating point: SFP at the loaded condition is 1,185 / 0.62 = 1,911 W per m3/s, against 645 / 0.62 = 1,040 W per m3/s clean. A compliance statement made on the clean number understates the regulated quantity by nearly half.

Appendix B.2 How the mixing box moves the coil duty

The same unit handles 8,000 m3/h at an air density of 1.2 kg/m3, so the air-side mass flow is 8,000 x 1.2 / 3,600 = 2.667 kg/s. Take a specific heat of 1.02 kJ/kg-K.

Case A, rated at a catalogue reference of 27 degrees Celsius dry-bulb and 55.5 kJ/kg enthalpy, leaving at 13 degrees and 36.0 kJ/kg. Applying Equation (coil): Q(total) = 2.667 x (55.5 — 36.0) = 52.0 kW; Q(sensible) = 2.667 x 1.02 x (27 — 13) = 38.1 kW; Q(latent) = 13.9 kW; SHR = 0.73.

Case B, rated at the state the mixing box actually delivers — 30% fresh air at 38 degrees and 95.0 kJ/kg mixed with 70% return at 24 degrees and 47.5 kJ/kg, giving 28.2 degrees and 61.7 kJ/kg — leaving at the same 13 degrees and 36.0 kJ/kg. Q(total) = 2.667 x (61.7 — 36.0) = 68.5 kW; Q(sensible) = 2.667 x 1.02 x (28.2 — 13) = 41.4 kW; Q(latent) = 27.1 kW; SHR = 0.60.

Total duty is 32% higher and the sensible heat ratio falls from 0.73 to 0.60. The second number is the operationally dangerous one: a coil selected for SHR 0.73 and asked to deliver 0.60 will not dehumidify to the design condition, and the complaint arrives as humidity rather than as temperature. Nothing in Case A is arithmetically wrong; it is simply rated at a state the unit will never see.

Appendix B.3 The published engineer-hour model

MileSoft's published model assumes a manual AHU selection takes about 120 minutes against about 15 minutes in the tool, at 40 selections per month.

Time saved per selection is (120 — 15) / 60 = 1.75 h. Annual selections are 40 x 12 = 480. Engineer-hours released are 1.75 x 480 = 840 h per year, which is roughly half a full-time engineer.

Two caveats belong with the figure. The 120 and 15 minute times are vendor estimates rather than observed distributions, and the model claims nothing for rework avoided, drawing time, or costing effort — so it is a floor rather than a projection. It is reported here because its assumptions are published and adjustable, which is the property that makes a vendor ROI model examinable at all.

Data provenance

Every quantitative claim in this paper resolves to one of the entries below. Figures marked as modelled estimates are not deployment measurements; their assumptions are stated.

Metric	Reported value	Provenance
Selection-cycle time, AHU	60-70% reduction	**Product specification** /products/ahu — Stated in the AHU blog post: most customers reach this within the first quarter.
Audit findings after adoption, AHU	0 within the first quarter	**Product specification** /products/ahu
Manufacturing lead time	40% reduction	**Product specification** /products/ahu — Published on the AHU product page as a headline figure.
Workflow speed, inquiry to submittal	10x	**Product specification** /products/ahu
HVAC manufacturers using the AHU module	50+	**Product specification** /products/ahu
Time to live deployment	4-8 weeks	**Product specification** /products/ahu — Critical path is loading the customer's coil, fan and accessory library.
Engineer-hours released per year, AHU selection	840 h/yr (modelled)	**Modelled estimate** A manual AHU selection takes ~120 min; the same selection takes ~15 min in MileSoft; 40 selections per month, 480 per year; Model and defaults published in src/data/roiModels.ts
Selection-cycle time	approx. 70% reduction	**Operator-reported — A EUROVENT-certified AHU manufacturer**
Proposal-to-purchase-order conversion	+12%	**Operator-reported — A EUROVENT-certified AHU manufacturer**

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