Tech Design Spec – Default Audit Engine

Product: Default Audit Engine (Shared Logic Layer for Express Fix, Concierge, and Risk Vault)

Version: v1.1 (Patched for smarter fallback use detection)

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1. PURPOSE

The Default Audit Engine is a reusable logic module that ingests structured emissions data and flags risks related to overuse or abuse of EU-published default emissions values. It is designed to be invoked internally from CBAM Express Fix, Filing Concierge, Stress Test, and Risk Vault products. It helps declarants identify non-compliant fallback usage, suspicious copy-paste behavior, and statistical outliers before filing.

1. INPUT STRUCTURE

Input Format:

* Structured DataFrame or JSON (parsed from XLS or XML)
* Each row = 1 reported good (CN code + emissions)

Required Fields per Row:

* cn\_code
* direct\_emissions (kg CO₂e/tonne)
* indirect\_emissions (kg CO₂e/tonne)
* default\_usage\_percentage
* emissions\_source (Actual / Default)
* quantity (net mass)
* country\_of\_origin
* installation\_id (optional)

Optional Fields:

* embedded\_emissions (if available)
* verifier\_present (Y/N)

1. OUTPUT STRUCTURE

For each row, the engine returns a DataFrame or JSON with these added columns:

* flag\_default\_cap: ✅/❌
* flag\_default\_copy: ✅/❌
* flag\_outlier\_emissions: ✅/❌
* flag\_severity: Red / Yellow / Green

Output file can be merged with final XML or memo logic depending on product.

1. FLAGGING RULES (UPDATED)

Rule 1: Default Usage Cap

* If default\_usage\_percentage > 20 → flag\_default\_cap = ❌

Rule 2: Default Copy-Paste Detection (PATCHED)

* If fallback use > 0%, and either direct\_emissions or indirect\_emissions match EU default (within 0.001) → flag\_default\_copy = ❌
* Rationale: Copying is only flagged if fallback is used at all, even partially. Avoids false positives for valid fallback within limits.

Rule 3: Outlier Detection (Fallback-Based)

* Compares declared emissions to EU default values
* Flag if:  
  + emissions ≥ 2× EU default
  + emissions ≤ 0.5× EU default
* Applies independently to direct and indirect

Final Flag Aggregator:

* Red: Any rule fails (cap breach or multiple ❌)
* Yellow: One warning flag (copy or outlier only)
* Green: All checks passed

1. MODULE STRUCTURE

5.1 Default Value Loader:

* Loads "Default values for the transitional period of the CBAM.xlsx"
* Converts to: {cn\_code: {direct: x, indirect: y}}

5.2 Flag Engine:

* Accepts emissions row
* Checks against loader output
* Returns 4 audit flags per row

5.3 API Wrapper (Internal):

* Function: audit\_emissions(dataframe) → dataframe\_with\_flags
* Used by: Express Fix, Concierge, Risk Vault, Stress Test

1. FILE VALIDATION LOGIC

* Missing required column → reject row with error
* Unsupported CN code → skip audit, soft flag
* NA/null emissions → skip outlier & copy checks, soft warn only

1. STORAGE & SECURITY

* Outputs are volatile unless embedded in product ZIP or memo
* GDPR Compliant: No contact or personal info stored
* Zero PII risk; pure audit logic

1. DEPENDENCIES

* EU default values Excel (updated quarterly)
* Pandas / Numpy
* Shared schema parser
* Markdown → PDF memo renderer (if embedded)

1. UNIT TESTS & ACCEPTANCE CRITERIA

Test Case 1: Fallback usage = 25% → flag\_default\_cap = ❌  
 Test Case 2: Emissions = exact EU default, fallback used → flag\_default\_copy = ❌  
 Test Case 3: Emissions ≥2x or ≤0.5x EU default → flag\_outlier\_emissions = ❌  
 Test Case 4: All flags pass → flag\_severity = Green  
 Test Case 5: One warning (copy or outlier only) → flag\_severity = Yellow  
 Test Case 6: Cap or multiple flags triggered → flag\_severity = Red

1. INTEGRATION STATUS

* Fully integrated in Express Fix engine
* Concierge integration underway (ZIP generator)
* Risk Vault ZIP dependency confirmed
* Stress Test engine uses downgraded version (Yellow default for copy)

1. OWNER

* Logic Author: Filentra Founder
* Reviewed by: QA + Engineering Lead (TBD)