

# The Cleanliness Classification of Air-handling Components- A success Story in Finland

Laura Sariola<sup>1</sup>, Pertti Pasanen<sup>\*2</sup>

*1 The Building Information Foundation RTS sr,  
Malminkatu 16 A,  
00100 Helsinki,  
Finland*

*2 University of Eastern Finland,  
Department of Environmental and Biological  
Sciences,  
P.O. Box 1627,  
70211 Kuopio, Finland*

*\*Corresponding author: pertti.pasanen@uef.fi*

## ABSTRACT

**INTRODUCTION:** The Finnish Society of Indoor Air Quality and Climate (FiSIAQ) introduced over twenty years ago in 1995 a Classification of Indoor Climate, Construction Cleanliness, and Finishing Materials and the third edition will be published autumn in the year 2017. Based on the criteria set in the classifications, The Building Information Foundation RTS sr started the M1-labelling of air handling components in 1999. Name of the classification is Cleanliness Classification of Air Handling Components.

**METHODS:** The criterion of the M1-classification of air handling components has not been revised during the years. The committee of Indoor Air PT17 has an authorization to accepted new criteria and test criterion groups for the class M1. Classified ducts and joints and other parts has been classified almost twenty years. The test scheme has to be accepted according to specified criteria in the classification working group before the tests. The classification criteria concern also dust-free warehousing and use on site. The new Indoor Air Classification 2017 and especially the changes made to the Cleanliness Classification of Air handling Component criteria and product groups will be presented.

**RESULTS:** The Finnish classification system has established a solid position in air -handling markets in Finland. Most of the factories producing duct-work components are located in Finland and some of them are located also in Sweden and Estonia. In February 2017 there were almost 330 M1-labelled air handling products from 13 companies representing 70% of the Finnish markets. The cleanliness classification of air handling components follows the changes, developments and needs of the market. According to development of the products and their features, new group of products will be gathered to keep the system practical.

**CONCLUSIONS:** The Indoor Air Classification 2017 includes the Cleanliness Classification of Air Handling Components. A result of implementation the system is that manufactures have developed HVAC components, products and production processes continuously in order to fulfil cleanliness criteria with low dust, low oil contamination and low odour emissions. The adopted system improves high quality of supply air in the ventilated offices, homes and other conventional buildings.

## KEYWORDS

HVAC, emissions, oil, dust, cleanliness, classification

## 1 INTRODUCTION

High indoor air quality is recognized as an important issue for both national health and economy in Finland. The Finnish Society of Indoor Air Quality and Climate (FiSIAQ) introduced over twenty years ago in 1995 a Classification of Indoor Climate, Construction Cleanliness, and Finishing Materials and the third edition will be published in 2017. Based on the criteria set in the classifications, The Building Information Foundation RTS sr started the M1-labelling of air handling components in 1999. Name of the classification is Cleanliness Classification of Air Handling Components.

The Cleanliness Classification of Air Handling Components is a part of the Classification of Indoor Air updated later on the year 2017. The whole classification system is part of the new

environmental classification system called RTS Green Leadership Tool (RTS GLT) published on the spring 2017.

The RTS environmental classification (RTS GLT) is based on European standards (CEN TC 350 standards) and it brings together the common best practices in the sector in Finland, such as the Finnish Classification of Indoor Environment representing Indoor Air Class S1 and S2, M1-classification for building products and air-handling components, Cleanliness classification of construction work P1. The connections between classifications and their components are introduced on the following figure (**Error! Reference source not found.**).

## Classifications and certifications at RTS

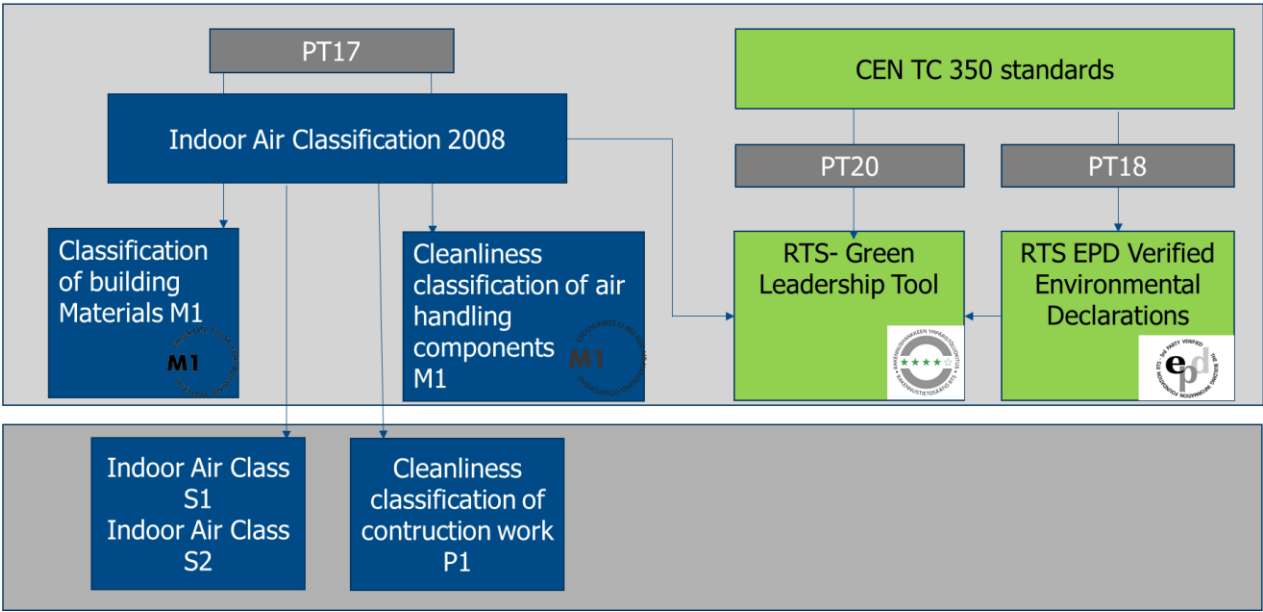


Figure 1 Classification connections in the Building Information Foundation RTS sr

### 1.1 Confidentiality and impartial operator

The Building Information Foundation RTS sr is a private, non-profitmaking Foundation whose task is to foster both good planning and building methods and good property management practices. The Foundation and its activities are directed by a Board and an Assembly that represents the entire building and construction industry through 54 associations and organisations. One of the main activities are organization and finance of the extensive committee work.

The Committee PT 17 Indoor Air is responsible for development and update of the Indoor Air Classification. The classification work is developed and supervised by the committee appointed by the Director General of the Building Information Foundation RTS sr. Other mission for the committee is to promote building methods aimed at good indoor climate in other ways as by active participation and discussion to regulatory preparation work.

Classification applications and matters relating to classification decisions are examined by a separate classification working group nominated by the Committee PT17. The working group consists of a representative of the Finnish Society of Indoor Air Quality (FISIAQ), technical expert and the secretary of the classification working group. There are high demands

for ethics, trust and confidentiality and therefore The Building Information Foundation RTS process all documents and information submitted by applicants in support of their application in high confidence. None of the background information leaks outside the foundation. However, the product fulfilling the criteria and permitted to label with M1-classification status are published.

The classification system is voluntary for the manufacturers, importers and exporters of air-handling components and systems outside the Finland as well. Cleanliness Classification of Air-handling Components is based on general and component-group-specific requirements. The general requirements for a classified component are:

- a) a classified component shall not increase the concentration of contaminants that are detrimental to health or comfort in the air handling system or supply air
- b) a classified component shall not produce odours, or gaseous or particulate contaminants that decrease the quality of supply air
- c) a classified component shall be easy to clean

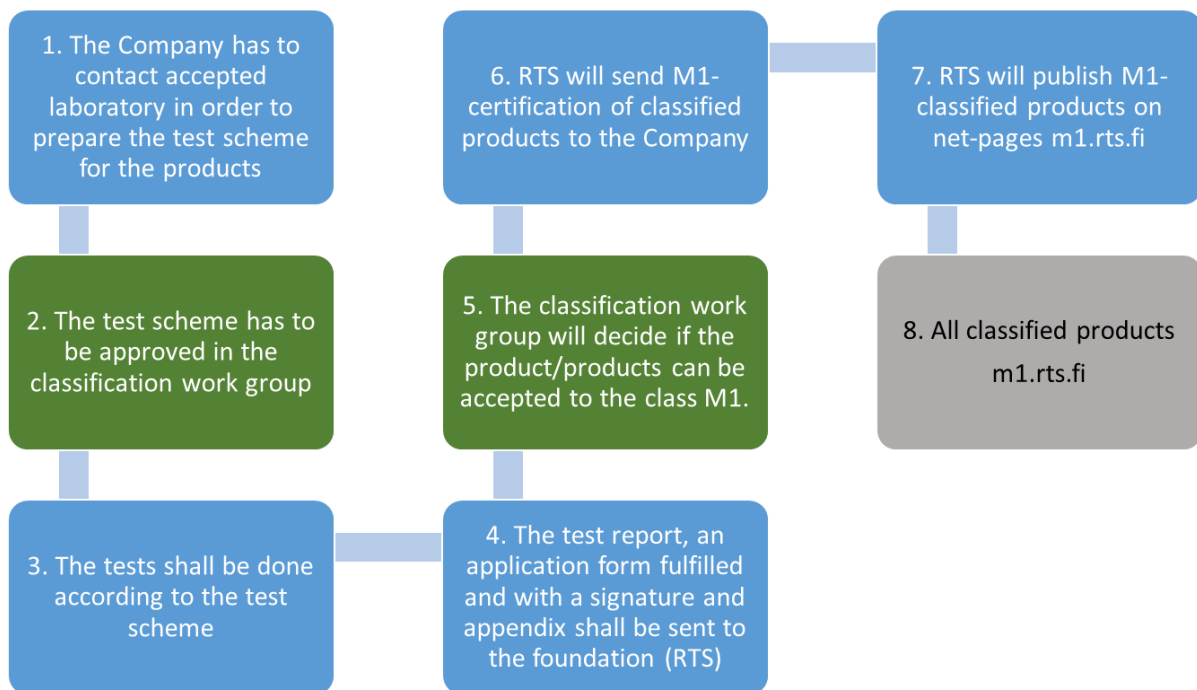


Figure 2 Classification procedure

## 2 METHODS

The criterion of the M1-classification of air handling components has not been revised during the years. The committee of Indoor Air PT17 has an authorization to accepted new criteria and test criterion groups for the class M1. Classified ducts and joints and other parts has been available almost twenty years. The test scheme has to be accepted according to specified criteria in the classification working group before the tests. The classification criteria concern also dust-free warehousing and use on site. Principles for classifying air-handling components are product specific. Similar principle for all air-handling components is that the products shall be protected to get dirty inside during factory storage, transportation and on construction

site. The protection has to be effective enough. For example both duct ends have to be capped and joint and other parts have to be protected e.g. by covering them by plastic film.

## 2.1 Tests and product grouping before classification

There are multiple steps to be fulfilled before M1-classification status. First the company has to contact approved testing laboratory in order to prepare test scheme. The applicant is responsible for documentation. After that the test scheme has to be approved in the classification work group. After acceptance the tests shall be done according to the test scheme. After the tests, the test report, an application form fulfilled and with appendix as product information shall be sent to the foundation. The classification work group will decide if the product/products can be accepted to the class M1.

- a) Product testing before classification: Classification requires the product to be tested by an approved testing laboratory in accordance with the required methods.
- b) Selection of testing laboratory: The products shall be tested by a competent and impartial laboratory approved by the classification working group. A list of approved laboratories can be found on the Internet. The applicant is responsible for documentation.
- c) Testing methods: The products must be tested according to the cleanliness testing instructions for air handling products (dated 2 November 2001) or according to later updated or new product specific instructions. The research report must contain the details listed in the model test report.

Criteria for air-handling components: Group specific requirements for metal ducts and accessories.

<i>Pollutant</i>	<i>Criterion</i>
Surface density of oil in ducts	0.05 g/m <sup>2</sup>
Surface density of oil in accessories, terminal units, and air and fire dampers	
Parts manufactured by cutting, bending or jointing	0.05 g/m <sup>2</sup>
Parts manufactured from deep-drawn sheet metal, processes requiring oil	0.3 g/m <sup>2</sup>
Mineral fibres released into air flow	0.1 fibres/m <sup>3</sup>
Amount of surface dust (after manufacture)	<0.5 g/m <sup>2</sup>

## 2.2 Principles for air-handling components

### 2.2.1 Sheet metal ducts and parts, valves, dampers, and fire dampers

- a) The product shall be tested in accepted laboratory
- b) The ducts, ducts parts, regulators and fire dampers, as well as the cleaning openings and hatches, can be cleaned in accordance with Finnish construction regulations or type approval instructions and the SFS-EN 12097 (Ventilation for Buildings. Ductwork. Requirements for ductwork components to facilitate maintenance of ductwork systems) standard.
- c) The ducts and duct parts can withstand at least 10 cleaning cycles using the cleaning procedures intended for them without their structure being subject to harmful changes. Ducts and duct parts must not allow fibres to become detached into air intakes during or after cleaning by more than 0.01 piece/cm<sup>3</sup> (Cleanliness testing instructions for ventilation products 2000).

- d) Any insulation materials that are used inside the ductwork fulfil the requirements set for fireproof building materials and requirements in accordance with combustibility Sh1 and fire spread class PII 1 (B-s1,d0) (RakMK E1).
- e) The regulators, valves and fire dampers do not prevent ducts from being cleaned. It is possible to restore regulators to their original position after cleaning. It is possible to check the position of dampers without opening the channel.
- f) The internal surface of the products is of a type that does not promote the accumulation of dirt within the products. The roughness of the channel material is less than 1 mm. The seams of channels of diameter 200 mm or less and their related connecting parts are not more than 2 mm high inside the channel. The seams of ducts of diameter 315 mm or more and related connecting parts are not more than 3 mm high inside the channel. The products do not contain burrs that could complicate cleaning or break cleaning equipment.
- g) The seals of the products fulfil the requirements of class C of the SFS-EN 12599:en (Ventilation for buildings. Test procedures and measurement methods to hand over air conditioning and ventilation systems) standard.
- h) The sealants do not discharge harmful materials into the air flow or any agents that may cause poor air quality
- i) Classified products are marked in such a way that they can be easily distinguished from unclassified supplies. The marking can withstand normal transportation, storage and handling on construction sites.
- j) The products are protected from becoming dirty on the inside during factory storage and transportation by means of closing off the ends of the ducts or packing the parts in closed boxes and protecting the load by covering it or using similar methods. The techniques used for protection (such as plugs) and the storage boxes are of a type that can withstand the prevailing conditions during transportation and on construction sites, as well as being opened and closed several times. If the ducts are transported inside each other, the cleanliness of their external surfaces is the same as that of their internal surfaces. Product-specific transportation, storage, installation and servicing instructions are issued and the instructions cover essential matters related to cleanliness.

### **2.2.2 Fire and noise dampers**

- a) The product shall be tested in accepted laboratory
- b) The products fulfil the requirements set out in RakMK(Finnish regulation) (fire, noise-dampening)
- c) The noise-reduction properties of the product are known.
- d) No labels or similar items are affixed to the surfaces of products
- e) The perforated metal sheet or other material used in the noise-dampener fulfils the requirements that are presented in the classification instructions in relation to processes that require oil 0.3 g/m<sup>2</sup> (300mg). The certificate is to be attached to the application.
- f) The technical noise-related features, usage and cleaning instructions of the noise-dampeners, along with the nominal air flow and any applicable usage restrictions are available with the product as well as separately.
- g) The products fulfil the requirements of Section 3.2.2.1 of the Classification of Indoor Climate. The noise-dampener does not product odour that reduces the quality of incoming air or that introduces impurities in the form of gas or particles.

- h) Classified products are marked in such a way that they can be easily distinguished from unclassified supplies. The marking can withstand normal transportation, storage and handling on construction sites
- i) The products are protected from becoming dirty on the inside during factory storage and transportation by packing the parts in closed boxes and protecting the load by covering it or using similar methods. The techniques used for protection and the storage boxes are of a type that can withstand the prevailing conditions during transportation and on construction sites, as well as being opened and closed several times. Product-specific transportation, storage, installation and servicing instructions are issued and the instructions cover essential matters related to cleanliness.

### **2.2.3 Terminal devices**

- a) The product has to be tested in accepted laboratory: Textile terminal devices shall be tested according to the testing protocol for building materials.
- b) The technical noise and flow properties are known. The certificate is to be attached to the application.
- c) No labels or similar items are affixed to the surfaces of products
- d) The perforated metal sheet, nozzle duct material or other material used in the terminal device fulfils the requirements that are presented in the classification instructions in relation to processes that require oil  $0.3 \text{ g/m}^2$ . The certificate is to be attached to the application.
- e) Usage and cleaning instructions for terminal devices, along with the nominal air flow and any applicable usage restrictions, are available with the product as well as separately.
- f) The terminal device does not product odour that reduces the quality of incoming air or that introduces impurities in the form of gas or particles.

### **2.3 Requirements for announcement of changes in the product product and production method changes**

The classification is for both the company and the product. If the product will remain the same the classification is valid for 3 years, the retests is obligatory after 6 years. The company holding the right of use the M1-label is responsible and obligated to give the foundation prior notice of changes relating to the product and its methods of manufacturing. The foundation is not responsible for the requirements guaranteed to the product or the properties. It is the responsibility of the holder of the classification to ensure that the product has an approved quality control system.

The classification is valid for three years. Right of use of a classification label provides the company which has been granted classification the right to label the classified product with the label and to use the label for marketing purposes. The company must use the valid classification symbol, which is a registered trade mark.



Figure 3

### 3 RESULTS

The Finnish classification system has established a solid position in air-handling markets in Finland. Most of the factories producing duct-work components are located in Finland and some of them are located also in Sweden and Estonia. In May 2017 there were almost 330 M1-labelled air handling products from 13 companies representing 70% of the Finnish markets. The cleanliness classification of air handling components follows the changes, developments and needs of the market. According to development of the products and their features, new group of products will be gathered to keep the system practical.

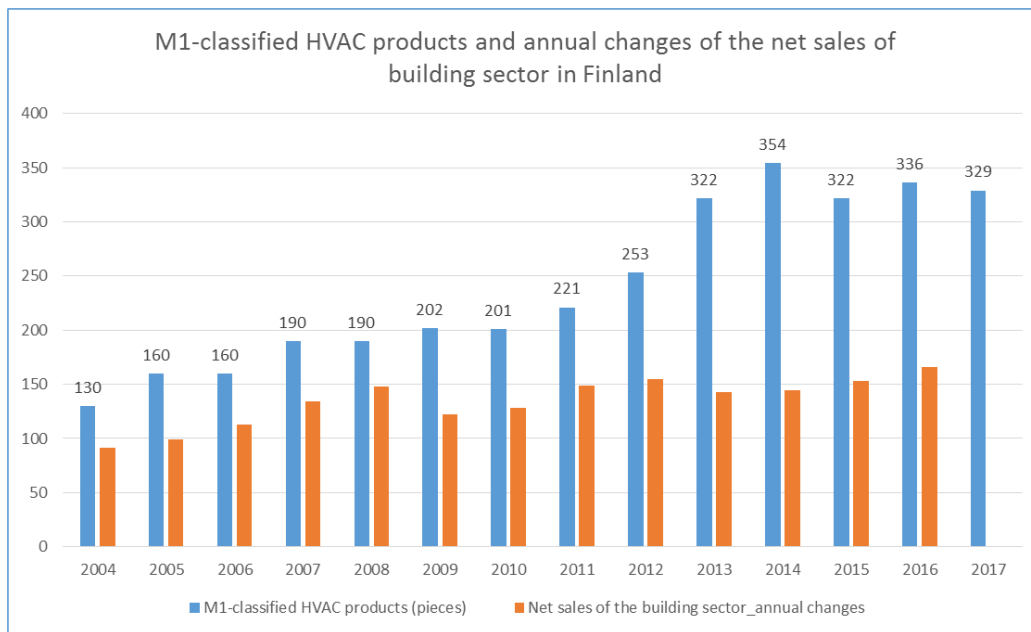


Figure 3 Development of the cleanliness classified HVAC products

### 4 CONCLUSIONS

Air-handling components and devices contribute to the indoor air quality in all kinds of buildings. This paper concludes that with an impartial certification system and with the commitment of manufacturers, it is possible to improve indoor air quality. Besides the criteria for oil and dust, there are remarkable advantages of the criteria concerning dust-free warehousing and use on site for indoor air quality and for the cleanliness class P1 for construction work.

## **ACKNOWLEDGEMENT**

The authors wish to thank Mrs. Vuokko Lappalainen (University of Eastern Finland) for information gathered to the paper.

## **7 REFERENCES**

FISIAQ( 2008). Classification of indoor climate 2008, Target values, design guidance and product requirements.

FISIAQ( 2017, draft). Classification of indoor climate 2017, Target values, design guidance and product requirements.

The Building Information Foundation RTS. 2017. <http://m1.rts.fi>

SFS-EN 12599:en Ventilation for buildings. Test procedures and measurement methods to hand over air conditioning and ventilation systems

SFS-EN 12097:en Ventilation for Buildings. Ductwork. Requirements for ductwork components to facilitate maintenance of ductwork systems