CLEANING OF VENTILATION AND AIR CONDITIONING PLANTS : THE EUROPEAN STANDARD ENV 12097

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ABSTRACT

The aim of the study was to evaluate the technical and financial impact of the ENV 12097 requirements and to compare them with the "state of the art" in France. The comparison has been carried out on the basis of a case study consisting in a three-floor office air-conditioned building. The results of this study lead to propose some improvements of the ENV 12097 for a practical and optimal use of the standard. Indeed, compared with the ENV 12097, the recommendations defined by the members of GHR (the French association of air duct cleaners) highlight the possibility to reduce the number of access doors (up to 50%) and to allow a reduction of the corresponding investment cost by about 30%.

KEYWORDS

Ventilation, air conditioning, air duct cleaning, access doors

INTRODUCTION

The CEN Technical Committee 156 Working Group 4 has developed a standard dealing with the cleaning of the air ducts systems in buildings (ENV 12097, 1996). COSTIC, with the support of ADEME (French agency for environment and energy savings), carried out an assessment of this standard (Feldmann and al., 2000). The aim was to compare the requirements of the ENV 12097 with the common practice of designers and air duct cleaners in France on the one hand, and to evaluate the over cost corresponding to the application of the ENV 12097 on the other hand. In the following, we briefly describe the case study and present the results and analysis of this study.

METHODOLOGY

The methodology aims at comparing equipments required by the ENV 12097 and the minimum equipment needed to obtain a satisfactory cleaning operation. This point has developed with the help of the members of GHR, the French association of air duct cleaners. The comparison of both requirements of the ENV 12097 and a good practice of the French air duct cleaners was done for a case study consisting in a three-floor air-conditioned building.

CASE STUDY

The building used as case study is a three-floor office building of a total surface of 1200 m^2. The cooling capacity of the chiller is 46 kW and the total airflow rate is 17000 m^3/h (i.e. 19 m^3/h by square meter of air-conditioned floor). Air ducts are sized according to the COSTIC recommendations on the basis of an average drop of 0,7 Pa/m (COSTIC, 1990).
Three levels of equipment (noticed level 1 to level 3) were compared. Level 1 is the lower equipment level (the basic level) and corresponds to an air duct system without any access doors. Level 2 fully satisfies the ENV 12097 requirements. Level 3 corresponds to the equipment based on the good practice according to the members of GHR.

RESULTS AND DISCUSSION

Figures 1, 2 and 3 respectively describe the air ductwork for the building ground floor, intermediate floor and second floor. On these figures, the main components (air terminal devices, fire dampers, balancing dampers and access doors) of the air ductwork are highlighted. All access doors required by the ENV 12097 are represented.

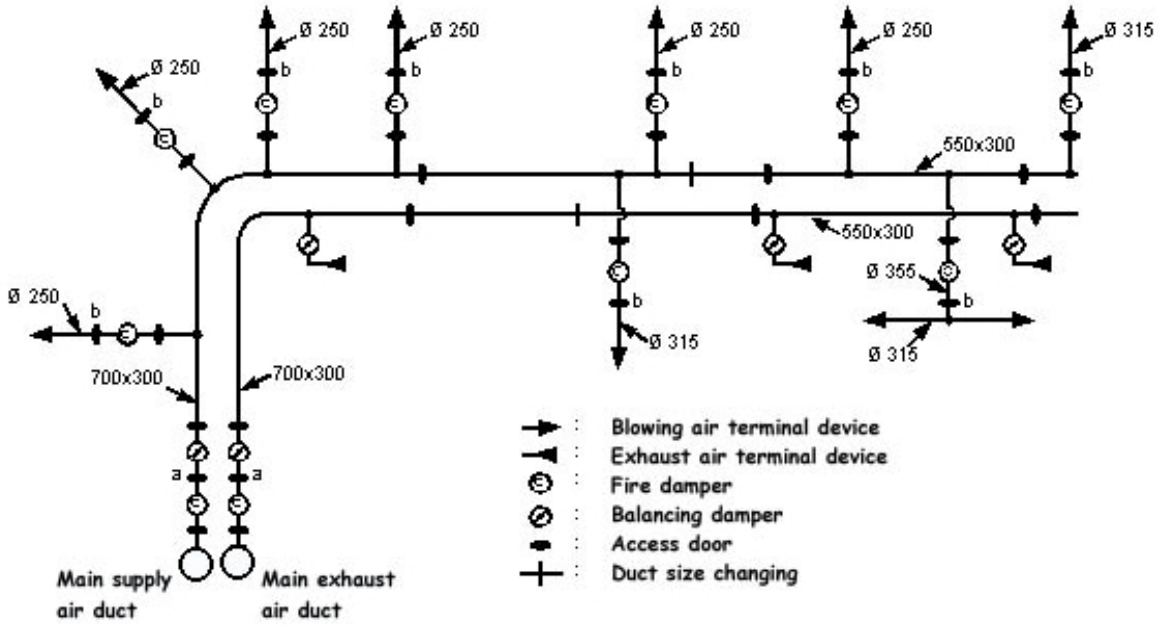

Figure 1 : Ground floor air ductwork

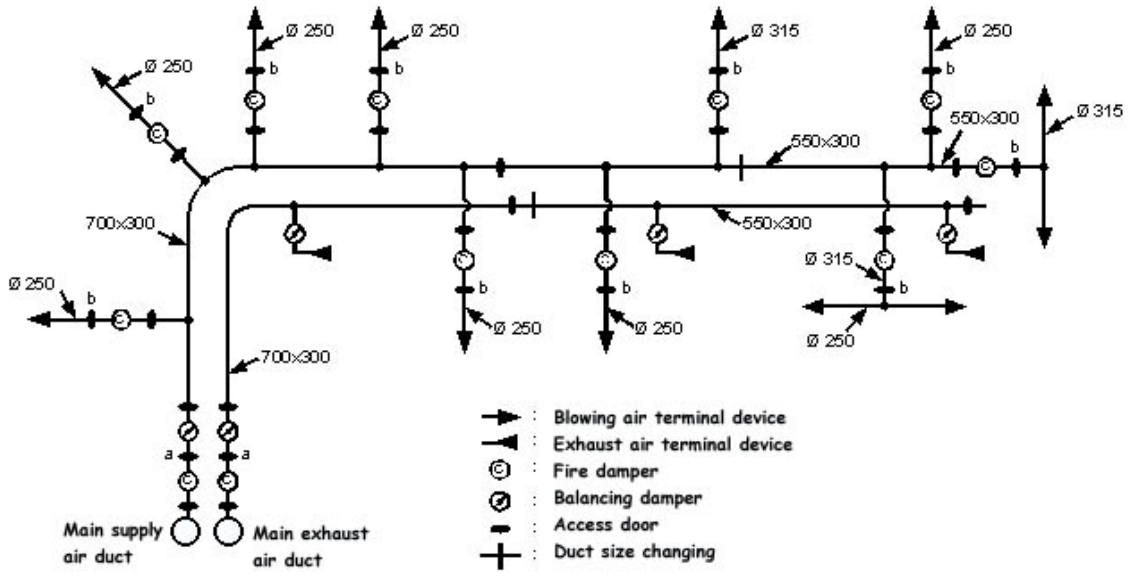

Figure 2 : Intermediate floor air ductwork

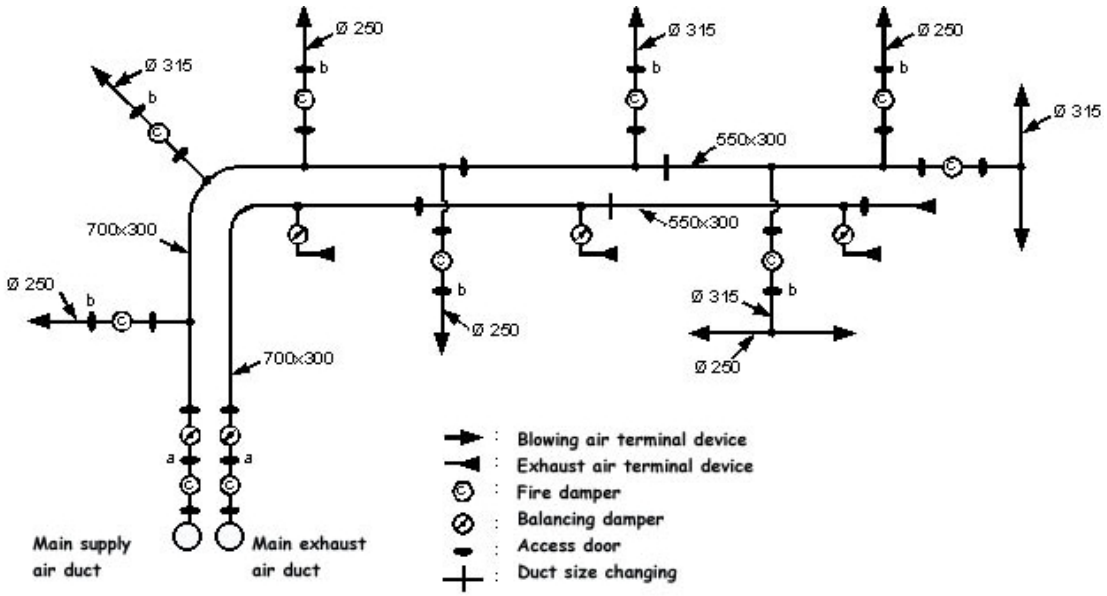

Figure 3 : Second floor air ductwork

The location of access doors as required by the ENV 12097 standard is discussed for the whole air distribution ductwork on the basis of the GHR-COSTIC recommendations. It appears that the number of access equipments can be decreased for the configuration studied. Indeed, according to the air cleaners members of GHR, some of these components can be removed for the following reasons. For the access doors denoted “a” (figures 1 to 3), this is due to the fact that it is possible to open the balancing damper in maximum position (after having located the actual setting) to reach the interior of the duct. For the access doors denoted “b” (figures 1 to 3), this approximation derives from the possibility to remove the flexible duct located between the fire damper and the blowing air terminal device.

Table 1 gives the detail of access doors defined by the ENV 12097 requirements on the one hand, and by the GHR-COSTIC recommendations on the other hand. Moreover, the number and the type of components in relation with the shape (rectangular or circular) and the dimension of the duct are mentioned.
In table 1, shaded cells highlight significant reduction of the number of access doors between the ENV 12097 requirements and the GHR-COSTIC recommendations.

TABLE 1
Type and number of access doors according to the ENV 12097 requirements and the GHR-COSTIC recommendations

			Rectangular duct		Circular duct			
		Duct size (mm)	**700 x 300**	**550 x 300**	**Ø 355**	**Ø 315**	**Ø 250**	**Ø 500**
Part of the ductwork		**Type of access door**	**500 x 400**	**400 x 300**	**300 x 200**	**300 x 200**	**200 x 100**	**500 x 400**
Ground floor	According to ENV 12097	Number of access doors	**8**	**4**	**2**	**4**	**12**	
	According to GHR-COSTIC		**6**	**4**	**1**	**2**	**6**	
Intermediate floor	According to ENV 12097	Number of access doors	**8**	**3**		**4**	**14**	
	According to GHR-COSTIC		**6**	**2**		**2**	**7**	
Second floor	According to ENV 12097	Number of access doors	**8**	**3**		**6**	**8**	
	According to GHR-COSTIC		**6**	**2**		**3**	**4**	
Supply and exhaust ductwork	According to ENV 12097	Number of access doors						**4**
	According to GHR-COSTIC							**4**

For a circular duct with a 250 mm or 315 mm diameter, the number of access doors can be reduced by half in comparison with the ENV 12097 standard.

FINANCIAL IMPACT

Additional costs induced by the installation of access doors on air ductwork have been evaluated in comparison with the basic level which corresponds to an air duct system without any access doors (level 1). Both product and workmanship costs have been taken into account in the cost evaluation. The product cost was estimated on the basis of manufacturers price list. The workmanship cost (10,67 € HT) was estimated on the basis of a panel of the members of GHR. Tables 2 and 3 give details about these costs.

TABLE 2
Additional costs required by the ENV 12097 standard in comparison with level 1

Ductwork	Component cost (€ HT)	Workmanship cost (€ HT)	Total (€ HT)
General supply and exhaust	414,04	42,68	456,72
Ground floor	1895,22	320,1	2215,32
Intermediate floor	2041,49	309,43	2350,92
Second floor	1815,85	266,75	2082,6
Total cost (€ HT)			***7105,56***

TABLE 3
Additional costs required by the GHR-COSTIC recommendations in comparison with level 1

Ductwork	Component cost (€ HT)	Workmanship cost (€ HT)	Total (€ HT)
General supply and exhaust	414,04	42,68	456,72
Ground floor	1286,65	202,73	1489,38
Intermediate floor	1260,77	181,39	1442,16
Second floor	1147,95	160,05	1308
Total cost (€ HT)			***4696,26***

In comparison with the ENV 12097 requirements, the GHR-COSTIC recommendations allow to reduce the overall cost by about 30%.

CONCLUSION

This study has highlighted a significant difference between the ENV 12097 requirements and the GHR-COSTIC recommendations. According to the French professionals of air duct cleaning, the ENV 12097 requirements lead to an excessive number of access doors and in most cases, to an unacceptable additional cost of the installation. However, a minimum number of components allowing for an easy cleaning of the air ductwork must be installed as early as the construction of the plant.
The requirements of the ENV 12097 lead to an average additional cost (in comparison with level 1) of 5,41 €/m^2 while the GHR-COSTIC recommendations only require an additional cost of 3,58 €/m^2.
Assuming that the average cost of an air conditioning plant is about 170 €/m^2 (in France), the additional cost due to cleaning and visiting equipments is about 2 to 3% of the total installation cost.

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REFERENCES

COSTIC (1990). Diagrammes COSTIC des pertes de charges linéiques – TUB A : Acier. SEDIT EDITEUR, 12p.

ENV 12097 (juin 1996). Prénorme européenne : Ventilation for buildings – Ductwork – requirements for ductwork components to facilitate maintenance of ductwork systems, 21p.

Feldmann, C. and Tocci, S. (novembre 2000). Evaluation de la prénorme européenne ENV 12097 sur la conception des réseaux aérauliques. *Rapport ADEME*, 50p.