SLOVENSKI STANDARD
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Energijske izgube pri vratih v industrijske prostore

Energy losses by industrial door

Energieverluste durch Industrietore

Perte d'énergie par les portes industrielles

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TECHNICAL REPORT

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Energy losses by industrial door

Perte d'énergie par les portes industrielles

Energieverluste durch Industrietore

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Foreword

This document (CEN/TR 16676:2014) has been prepared by Technical Committee CEN/TC 33 “Doors, windows, shutters, building hardware and curtain walling”, the secretariat of which is held by AFNOR.

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Introduction

The calculation method in EN 12428 gives a *U*-value in $W/m^2 \cdot K$ for thermal resistance of an industrial door used for access of vehicles accompanied by pedestrians.

With a view to energy efficiency (energy saving) it should be remembered, however, that this performance is only achieved when the door is closed.

In practice the evidence shows that doors are left open for longer periods than is perhaps necessary or acceptable. Therefore, it is difficult to see how reducing *U*-values can improve energy efficiency without radical changes in work place practices or operation mode of the door.

In keeping with the whole building approach mandated by the EPBD[1)] building designers should be working on a whole building principle rather than an elemental basis which results in a beneficial evaluation of those factors in the construction of the building envelope that contribute significantly to energy conservation in the buildings use.

Therefore, it is important that building designers and specification writers should seek to:

— set achievable values for products calculated in accordance with EN 13241-1;

— consider awareness of the classification possibilities and the availability and need to implement appropriate technologies;

— consider specifying improved power operated doors specification including appropriate control systems;

— consider changes to supporting constructions (e.g. lobbies, screens);

— consider the use of double doors (e.g. insulated external doors, rapid acting internal doors for operational use).

There is a common misconception that energy conservation is best achieved (only) through *U*-value improvements.

Due to the nonlinear shape of the *U*-value/thickness graph there is a danger of achieving diminishing returns from additional thickness of doors. Up to the present time, for the *U*-values commonly specified for construction in the EU, there has been an approximately linear relationship but as the move to seek lower *U*-values continues this is no longer the case.

Concern has been expressed that much of this good work is wasted as long as the practice of leaving doors open for unnecessarily long periods prevails.

Therefore, a study with a simplified calculation basis has been undertaken by CEN/TC 33/WG 5 relating to the energy losses through doors. This Technical Report does not replace the requirements of EN 13241-1 regarding EN 12428.

For the purpose of this Technical Report the term “door” and/or “doorset” is used as a general term for “industrial door”.

1) Energy Performance of Buildings Directive (Directive 2002/91/EC).

1 Scope

This Technical Report gives simplified calculation relating to the energy losses through doors taking into account:

— heat transmission with closed door by temperature difference,

— air leakage through a closed door due to wind,

— air leakage through a closed door due to a chimney effect, and

— air infiltration with a door open (due to wind).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12428, *Industrial, commercial and garage doors - Thermal transmittance - Requirements for the calculation*

EN 13241-1, *Industrial, commercial and garage doors and gates - Product standard - Part 1: Products without fire resistance or smoke control characteristics*

3 Simplified calculation basis

3.1 Heat transmission with closed door by temperature difference

— Heat transmission coefficient U in W/m^2 · K is measured by notified bodies and calculated per door configuration (according to EN 13241-1).

— Outside temperature is taken out of Table 1.

— Heat transmission is then calculated with:

$$H_t = A \cdot U \cdot (T_i - T_o)$$

where

H_t is the power losses by heat transmission, in watts (W);

A is the area of exposed surface, in square metres (m^2);

T_i is the inside air temperature, in Celsius (°C);

T_o is the outside air temperature, in Celsius (°C).

— Energy losses per year will be calculated with:

$$E_t = \frac{h \cdot C_h \cdot H_t}{1000}$$

where

E_t is the energy losses per year by heat transmission, in kilogram watts per hour (kWh);

h is the time per day exposed to $\Delta T = (T_i - T_o)$ (hours = heating hours);

C_h is the amount of heating days per year, meaning inside temperature above outside temperature.

3.2 Air leakage with closed door by wind

— Connection between pressure difference P (P_a (N/m^2)) and air leakage in m^3/m^2 · h$_r$ is measured by notified bodies and put in a graphic.

— Wind speed is taken out of Table 1.

— Wind pressure on door is calculated with:

$$P = \frac{1}{2} \cdot v^2 \cdot \rho$$

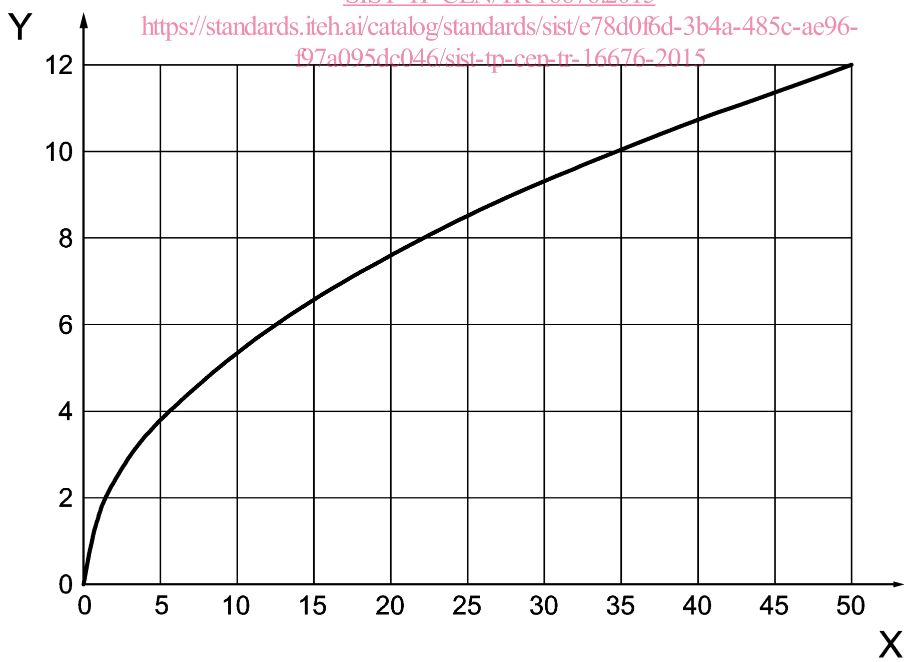
where

P is the wind pressure, in newtons per square metre (N/m^2);

v is the wind speed, in metres per second (m/s);

ρ is the density of air, in 1,293 kilograms per cubic metre (kg/m^3).

— With this wind pressure the air leakage is taken out of Figure 1.



Key

X pressure difference P (P_a (N/m^2))

Y leakage in m^3/m^2 · h

Figure 1 — Air leakage

— Air volume flow by wind pressure is calculated with:

$$Q_v = \frac{\text{airleakage} \cdot A}{3\,600}$$

where

air leakage is in cubic metres/square metre × hour ($m^3/m^2 \cdot h$);

Q_v is the air volume flow by wind pressure, in cubic metres/second (m^3/s).

— Power losses by air leakage is calculated with:

$$H_v = C_p \cdot \rho \cdot Q_v \cdot (T_i - T_o)$$

where

H_v is the power losses by air leakage, in W;

C_p is the specific heat capacity of air, in 1 007 J/kg · K).

— Energy losses per year will be calculated with:

$$E_v = \frac{h \cdot C_h \cdot C_w \cdot H_v}{1\,000}$$

where

E_v is the energy losses per year by air leakage, in (kWh);

C_w is corrected because of position of the door compared to wind direction.

3.3 Air leakage with closed door by chimney

Connection between pressure difference P (P_a in N/m²) and air leakage, in $m^3/m^2 \cdot h_r$ measured by notified body and put in a graphic.

— Under pressure on inside of door because of chimney is calculated with:

$$P = \frac{9{,}81 \cdot (h - h_{nph}) \cdot \rho \cdot (T_i - T_o)}{(T_o + 273)^3}$$

where

P is the chimney pressure, in newtons per square metre (N/m^2):

h is the height of interest (half of door height), in metres (m);

h_{nph} is the neutral pressure height in building (± half of inside building height), in metres (m).

— With this chimney pressure the leakage is taken out of Figure 1.

— Air volume flow by chimney is calculated with: