Smoke and Heat Ventilation Systems

RWAupdate 3

Solutions for the planning, manufacture, installation and use of power-operated windows.

Advice on safe use, with examples.

Legal background.

Power-operated windows

ZVEI:
Specialist group for electrically driven smoke ventilation and natural ventilation

Contents

Imprint

Publisher:
ZVEI specialist group for electrically driven smoke ventilation and natural ventilation

Editor:
Working group for public relations

Photos:
Getty-Images; Wero; GEZE; Simon-RWA; Fotolia; A. Meier

Production:
Werbeagentur Armin Meier

Edition:
Revised 04/2009

References

[1] VFF members' bulletin WP.01: 2007-05 "Wartung/ Pflege & Inspektion: Hinweise für den Vertrieb"
[2] VFF members' bulletin WP.01: 2007-05 "Wartung/Pflege & Inspektion: Maßnahmen und Unterlagen"
[3] VFF members' bulletin WP.03: 2007-05 "Wartung/ Pflege & Inspektion: Wartungsvertrag"
[4] German trade association guidelines BGR 232 BG "Rules for power-operated windows, doors and gates"
[5] Series of publication by the legal department of the ZVEI – Product liability
[6] RWAupdate 1 – Maintenance of smoke and heat ventilation systems, Specialist group for smoke and heat ventilation systems in the ZVEI, Frankfurt

1. Introduction

Increasing automation of windows

Power-operated devices such as electrically-operated windows are an increasing feature of modern building services installations. Their actuator driven units make it possible, for example

- to integrate the windows within processes of the building services management systems, providing energy efficient natural ventilation systems
- to open and close large and heavy sashes even in unfavorable wind situations,
- to achieve greater operating comfort and
- to make it possible for them to be used by people with impaired mobility.

Objective: Safe and reliable operation

Power-operation however, increases the potential risk of danger and this has to be met by taking suitable countermeasures. This publication provides advice and technical solutions for the use of power-operated windows to help ensure that they can be operated safely and without any major risk.

2. Area of applicability

This publication, as a part of reference, is particularly useful in the planning, manufacture, installation and use of power-operated windows for commercial, public and private buildings. It also applies to the retrofitting of windows with drive units.

3. Terminology definitions

Power-operated window

- A power-perated window is a building component for closing off an opening in a wall or a roof, the intended purpose of which is to provide light and ventilation and occasionally access.

Manual operation

- Manual operation is when the window sash is moved by human force only.

Actuators

- Actuators are devices for moving power-operated windows in conjunction with a supply of energy (e.g. electric, pneumatic or hydraulic), including the hardware components for the transfer of force.

Manufacturer of the power-operated window

- Company or person responsible for bringing the power-operated window into circulation or for reworking or making significant modifications to a product and bringing it into circulation again.

Installer

- Company or person legal responsible for installing (ready for use) and commissioning the power-operated window at the building site (in-situ). The installer is also the manufacture at the same time if he modifies the product or creates a new product out of several products and then brings the window into circulation again.

Dead man's controller

- Manually-operated controller which shuts down the drive unit when the button is released.

4. Fundamentals

4.1 Legal background

EC directives

In the planning, manufacture, installation and operation of power-operated windows, compliance with the following European statutory regulations and associated national regulations is necessary:

- EC Construction Products Directive, implemented in Germany by the Building Products Act (Bauproduktengesetz);
- EC Machinery Directive, implemented in Germany by the Product Safety Act (Geräte- und Produktsicherheits-Gesetz [GPSG]), the 9th Ordinance Implementing the Product Safety Act (Machinery Regulations) [9. Verordnung zum Gerätesicherheitsgesetz (Maschinen-Verordnung)] and the building regulations of the federal states;
- EC Low Voltage Directive (LVD), implemented in Germany by the Product Safety Act (GPSG) and the 1st Ordinance Implementing the Technical Plant and Equipment Act (Low Voltage Regulations) Gerätesicherheitsgesetz (Niederspannungs-Verordnung);
- EC EMC Directive, implemented in Germany by the EMC Act (EMC = Electromagnetic compatibility)

These regulations set out mandatory requirements for performance characteristics in buildings in relation to the prevention of mechanical dangers, safeguards against electrical dangers and the prevention of electromagnetic interference.

4.2 Standards and regulations

General standards and regulations

The general requirements of the EC directives are generally interpreted in more detail in European standards. Power-operated windows fall within the scope of product standard EN 14351-1. The requirements of drive units are therefore covered by standard EN 60335-2-103 „Particular requirements for drives for gates, doors and windows“ (VDE 0700 Part 103).
In relation to the operational safety of power-operated windows it is generally necessary to take account of other regulations as well in order to help comply with the requirements of the „Machinery Directive“. These include:

- EN ISO 12100 Safety of machinery - Basic concepts; general principles for design - Part 1: Basic terminology and methodology, and Part 2: Technical principles
- EN ISO 60204-1 Safety of machinery - Electrical equipment of machines - Part 1: General requirements
- EN 61000 Series on „Electromagnetic compatibility (EMC)“

The German trade association regulation on power-operated windows, doors and gates (BGR 232) is a national regulation, but it only contains limited information.
This publication, along with code of practice KB.01 published by the VFF, fills a gap in the standards and describes the measures required to be taken into account in relation to the operational safety of power-operated windows.

4.3 Responsibility

Architect/Planner of the building

The architect/planner of the building must provide clear specifications for the requirements of power-operated windows, particularly in relation to protective measures. This includes consultation and agreement with the client and relevant authorities (e.g. the building control authority), as well as the involvement of relevant accident insurance companies if commercial or public use buildings are involved.

Contractor/Installer

The contractor who installs the power-operated window should be responsible for ensuring compliance with the project specification and full compliance with approved technical practice.

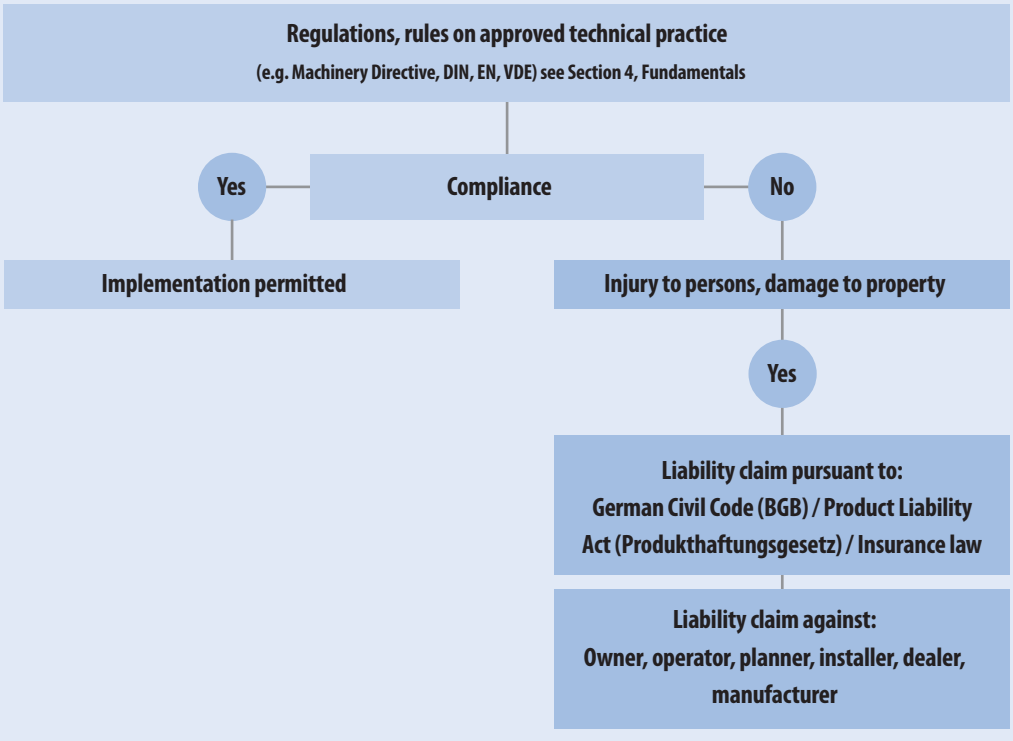
Client/Operator/User

The client/owner/user is responsible for ensuring that power-operated windows are used, operated and maintained in accordance with the user information/operating instructions.

5. Liability

Those responsible for the construction of the building are liable to third parties. In order to avoid any possibility of injury to persons or damage to property and the associated claims, compliance with regulations and approved technical practice is essential in connection with the operation of power-operated windows. Figure 1 shows the interrelationships involved in liability. Information on product liability is available in, e.g. the ZVEI publication "Product liability – Statutory liability of the manufacturer with particular reference to the Product Liability Act (Produkthaftungsgesetz)" [[5]].

Fig. 1: Diagram illustrating the position in relation to liability



6. Documentation

Along with meeting the various statutory requirements in relation documentation, it is also always advisable to provide adequate documentation of the contributions made to the workflows involved in the construction of the building by those responsible for its construction. (see Fig. 2)

Fig. 2: Diagram showing the documentation for power-operated windows

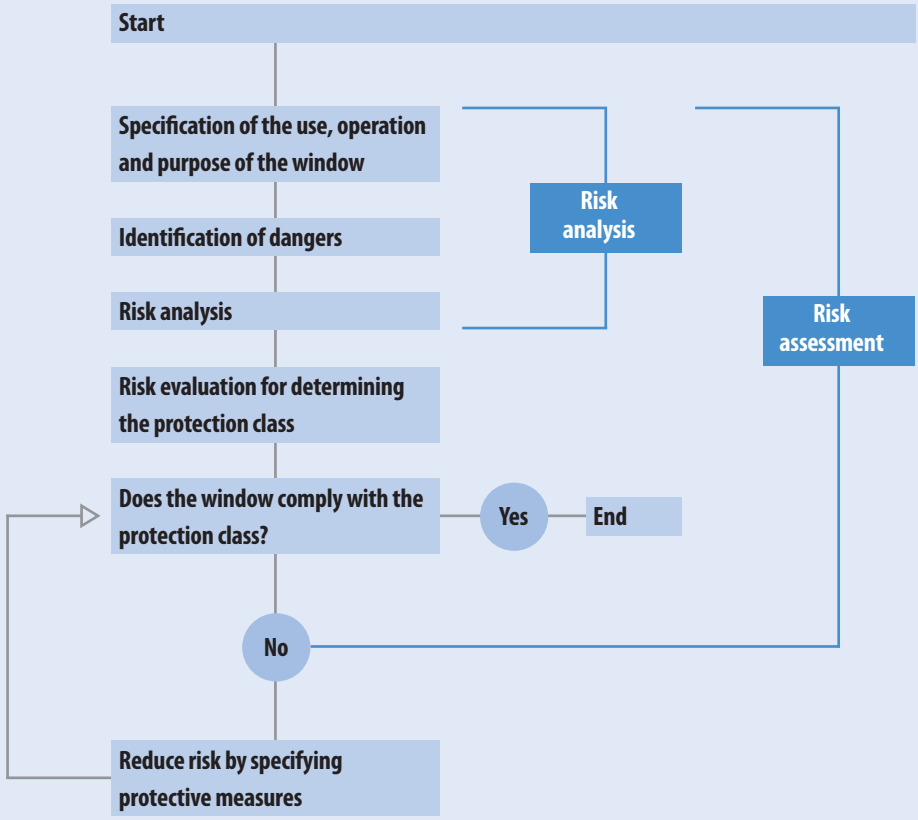
Power-operated window	Responsible:	Documents:
	Window manufacturer	• Construction documentation • User information for the window • CE mark for the window (Construction Products Directive, plus Machinery Directive if applicable) • Declaration of Conformity in accordance with EN 14351-1, with specification of conditions of use if the window is traded with a drive unit
	Drive manufacturer	• User information for the drive • Safety instructions • Installation declaration for incomplete machines and installation instructions • Declaration of Conformity and CE mark for the electric drive (EMC and LVD)
	Control system manufacturer	• User information for the control system • Safety instructions
	Installer	• Installation diagram • Hand-over report • User information / Operating instructions • In the case of the installation of an exclusively power-operated window, the permissibility of its use must be checked • Risk assessment to check plan specifications
	Planner	• User concept • Risk assessment • Invitation to tender with technical / construction requirements
	Owner	• User specifications • Planning consent / building regulations approval • Conditions imposed by authorities
	Operator	• Maintenance documentation • Obtain „technical approval for a particular case“ under the building regulations if required in order to clarify the requirements of the relevant authorities in respect of the product for which tenders are to be invited (window) and to ensure that it has verification of suitability for use.

7. Risk assessment

7.1 General information

In order to be able to gauge the potential danger associated with power-operated windows and to implement appropriate protective measures, a risk assessment has to be provided at the outset of the planning stage. The risk assessment should comprise a sequence of logical steps which make it possible to analyse the dangers associated with the window. Fig. 3 provides an overview of the steps involved in a risk assessment.

Fig. 3: Steps involved in a risk assessment



The risk analysis provides the information required for the risk assessment, which in turn provides a basis for making decisions about the safety of the window elements.

The risk assessment is based on calculated decisions. The risk assessment must be carried out in such a way that the processes involved and their outcomes can be documented and verified.

7.2 Identification of dangers and risk analysis

7.2.1 General information

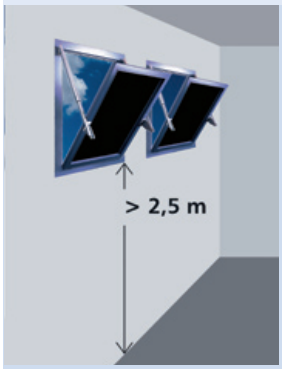
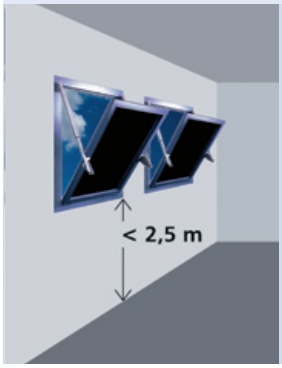
All potential dangers and risks must be identified which could arise in association with the installation, use and actuation of the power-operated window.

7.2.2 Installation situation (position, accessibility)

Risk associated with the installation situation

The location at which the window is installed within the building must be taken into consideration. It has to be checked whether the windows are capable of being reached at any time without the use of any aids. This provides the basis for a risk assessment as shown in Table 1:

Table 1: Case-study risk assessment in dependency on the installation situation

	Case-study installation situation	Risk classification	Risk parameters
	a) Installation height of the bottom edge of the sash a minimum of 2.5 m above floor level or permanent access level	Low Risk	E1
	b) Permanently installed devices in front of the window preventing access c) Window ledges or soffits preventing unhindered access to the window for the user		
	Installation height of the bottom edge of the sash above floor level or access level below 2.5 m with clear access to the window	High Risk	E2

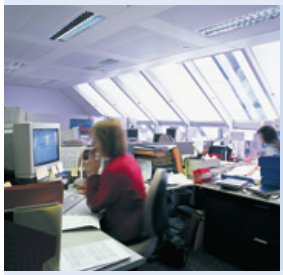
7.2.3 Type of use of the premises

The risk analysis must also cover the type of use of the premises. In this connection a distinction has to be made on the basis of whether or not the potential users are always capable of using the product. It is therefore necessary to assess, for example, whether the user

- is always the same person and is familiar with the device or
- is not familiar with the device, and
- which group of persons he/she belongs to (e.g. persons in need of protection)

This provides the basis for a risk assessment as shown in Table 2:

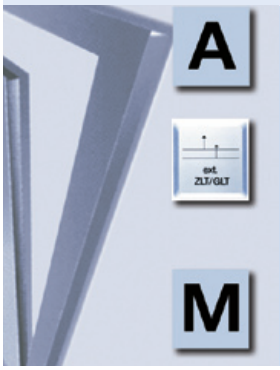
Table 2: Risk assessment in dependency on type of use of the premises

	Type of use of the premises	Risk classification	Risk parameters
	Commercial premises, the users of which have been instructed in the use of the technical equipment (e.g. offices, industrial premises).	Low risk	N1
	Residential premises, the occupants of which have been instructed in the use of the technical equipment. Premises in which the users/visitors are capable of gauging the risk or are supervised.	Medium risk	N2
	Premises intended for regular use by persons who cannot be instructed in the safe and reliable use of the technical equipment (e.g. retail outlets, places of assembly, etc.).	High risk	N3
	Premises intended for regular use by persons requiring protection or who are unable to reason (such as nurseries, schools and hospitals, etc.).	Very high risk	N4

7.2.4 Control system/method of operation

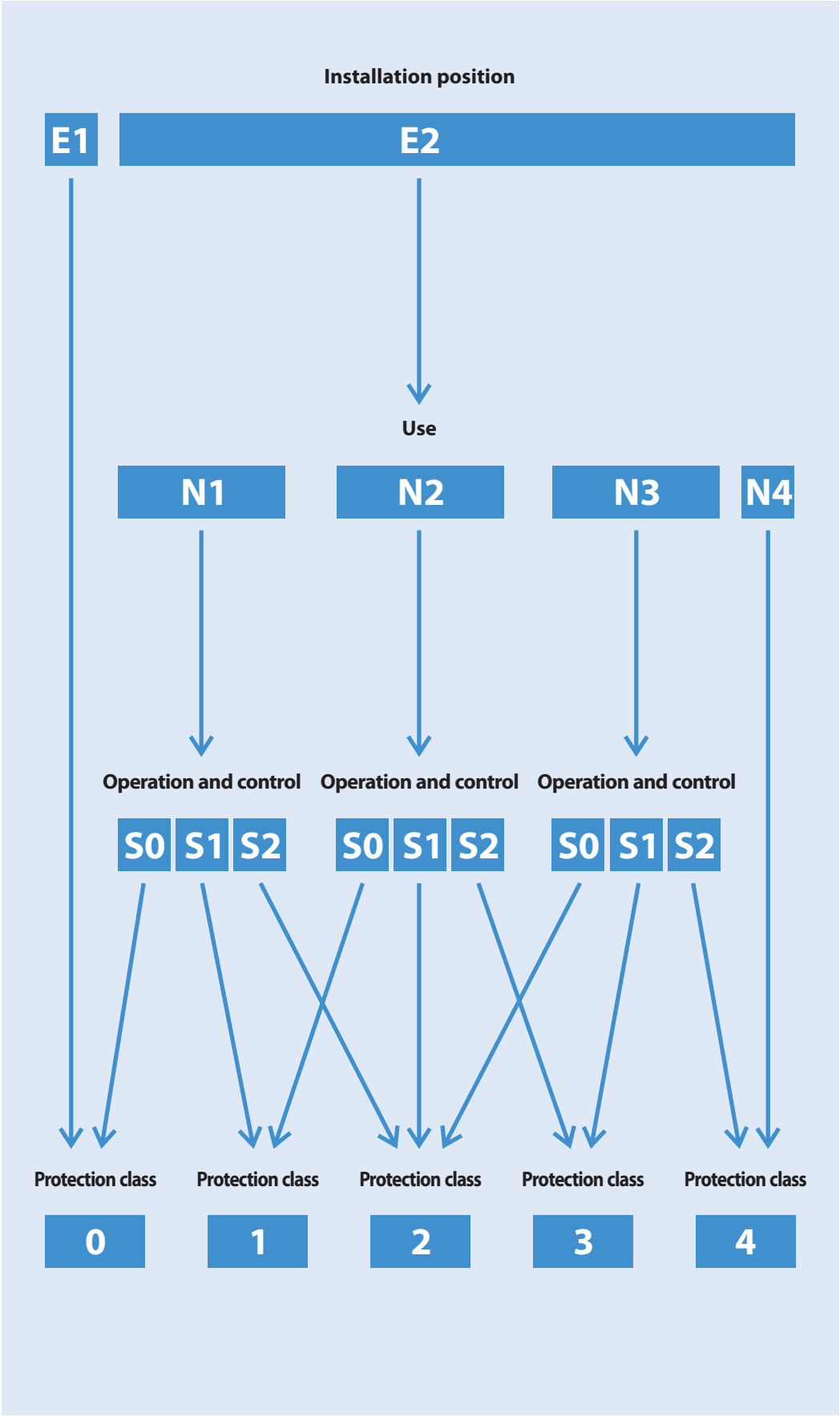
The risk analysis also depends on the way in which the window is opened and closed. The following risks can be classified on the basis of Table 3:

Table 3: Risk assessment in dependency on the control system and method of operation

	Control system or method of operation	Risk classification	Risk parameters
	Manual operation without lock (dead man's controller) with visual monitoring of all windows (e.g. use of a keylock switch)	Very low risk	S0
	Manual operation with lock with visual monitoring of all windows	Low risk	S1
	Automatic operation (e.g. wind and rain based control system, building management system equipment) or manual operation without visual contact with all windows	High risk	S2

7.3 Risk evaluation and determination of the protection class

On the basis of the individual risks described in Section 7.2, a protection class for the overall risk associated with the development proposal can be determined using the risk parameters.



8. Solutions for protective measures

Protective measures are measures which contribute to the reduction of risk. Different protective measures for risk minimization will be required depending on the specific risk involved. There are no standard protective measures for power-operated windows in buildings. A building-specific risk analysis is always required whenever the use of power-operated windows is planned for a building in order to find solutions which are optimized in terms of function and economics.

8.1 Classification of protective measures

Protective measures can be assigned to the following protection classes on the basis of Table 4.

It never does any harm to have a higher level of protection

A protection class is achieved by implementing one of the described measures; measures chosen must always be suitable for the specific situation, however, protective measures can also be combined and those in a higher protection class also cover lower protection classes at the same time.

Table 4: Classification of protective measures

Class	Examples of protective measures
Protection class 0	• No protective measures required
Protection class 1	• Warning signs
Protection class 2	• Access safeguards in the form of constructional measures or • Rounded, padded edges; closing forces of 80 to 150 N, no shearing effect or • Acoustic warning signals or • Warning lamps or • EMERGENCY OFF switch on the window or • Moveable devices in front of the window to prevent access
Protection class 3	• Dead man's controller without higher level central control system or • Movement stops 25 mm before the end position over 10 s; tripped by an optical or acoustic signal; further movement with signal up to the end position or • Slow window sash movement of max. 5 mm/s or • Access width less than 8 mm or • Rounded, padded edges; low closing forces of less than 80 N, no shearing effect
Protection class 4	• Safeguard in the form of contact-based protection devices, e.g. contact strips, contact sensors or • Safeguard in the form of electro-sensitive protective equipment, e.g. light barriers, light grilles or • Dead man's controller with authorized operation for each window without higher level central control (e.g. keylock switch) or • Access width less than 4 mm • Access safeguards in the form of constructional measures

8.2 Residual risk

Safety is a relative term in this technical world. It is not possible to provide a guarantee of safety to the extent of guaranteeing that something will not happen under any circumstances. The term residual risk is therefore used to describe the risk which still remains even after safety precautions have been implemented. The objective of planning safety measures is to ensure that the residual risk is minimized.

8.3 Crashing/falling window sashes

Window sashes must be hung or designed in such a way that they are prevented by structural features from crashing/falling or moving in an uncontrolled manner should any of the hanging elements fail, e.g. double hanging, safety window scissors, retainer.

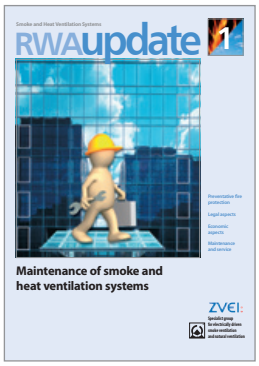
9. Maintenance / Information for users

Maintenance is a precondition for the warranty.

After successful completion of an acceptance inspection, the contractor assumes liability for the products as part of his contractual duties. In order to safeguard the long term reliability and value of the products and prevent possible injury to persons or damage to property, it is a requirement that regular maintenance inspections be undertaken by the manufacturer/installer of the power-operated window which must be documented. If this is not undertaken there is a likelihood of the warranty becoming void - but the liability of the installer, planner or owner/operator continues regardless.

A precondition for maintaining safety of use and suitability for use with products which are capable of being adjusted and/or are designed to have wearing parts replaced, is regular servicing with checks (inspections), maintenance and, if necessary, repair. This is of particular importance for power-operated windows because they generally offer greater potential for danger than manually operated windows and also require more maintenance work because of the additional fitted drive components. It should be noted that whenever a drive unit is replaced a new risk assessment will normally be required. Further information and detailed explanations in relation to warranty and maintenance obligations and the product liability of manufacturers and owners/operators can be found in VFF Code of Practice WP.02 [[2]].

The ZVEI publication RWAupdate 1 (2009 issue) contains detailed information about the maintenance of smoke and heat ventilation systems. [[6]]



The user information/ operating instructions must provide the basis for the required maintenance work

A further precondition for comprehensive warranty cover and for product liability, in addition to proper maintenance, is that the products are used as intended. To this end the manufacturer therefore provides the client with relevant information in user information/operating instructions, e.g. documents containing notes and instructions on intended use and on maintenance and operation requirements. In relation to the higher potential for danger associated with power-operated windows it is important that the following points, among others, are included in the user information/operating instructions:

- Operating instructions with clear and comprehensible product-specific safety information and warnings concerned with maloperation and misuse
- Product-specific maintenance instructions with identification of safety-related checks and maintenance measures, e.g. in the form of a checklist for the required work
- Recommended inspection intervals, if necessary in dependency on the particular use of the premises and the frequency of window actuation
- Additional notes and instructions on cleaning and care of the drive components used

For further information about user information, please refer to VFF Code of Practice WP.02 [[2]]

The client is personally responsible for ensuring that the required maintenance measures and measures for maintaining the value of the products handed over to him are carried out. Warranty claims will be rendered void in the event of non-compliance with this requirement. At the same time the manufacturer of the window must also fulfill his duties to provide information in respect of the warranty and product liability in a suitable form. Detailed practical recommendations for the manufacturer on how to fulfill his duty to provide information within the framework of order execution are contained in VFF Members' Bulletin WP.01 [[1]].

The duty to maintain value and provide information applies even to part acceptance

Maintenance contract

One good option available to the client is to transfer the responsibility for maintenance to a specialist member firm of the ZVEI in the form of a maintenance contract. This will also ensure at the same time that the measures for the maintenance of value are carried out properly and that unqualified attempts by third parties to carry out repairs are avoided at the outset.
You will find your specialist ZVEI firm at:
www.ZVEI.org/sicherheitssysteme or www.ZVEI-errichter.de

More publications are available from your specialist ZVEI firm or direct from the ZVEI.

Maintenance of smoke and heat ventilation systems

Power-operated windows

Natural smoke ventilation through facades and roofs

Stairwell smoke ventilation

Individual smoke ventilation systems in buildings and technical approval for particular cases

Effective smoke control and natural ventilation combined.

All publications are also available in German.

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Specialist group
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Printed 07/2009