



**Association of Building
Hardware Manufacturers**

Best practice guide

**Single-axis hinges
to
BS EN 1935**

in association with



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• ABHM BEST PRACTICE GUIDES

This publication is one in a series of guides addressing the major issues that should be considered when specifying, ordering or using the products it describes. It aims to provide the reader with a concise document which includes a summary of relevant sections from the new European product standard. The reader will then be in a position to seek further specialist advice where necessary and recognise **GENUINE** conformity to the new standards.

• BS EN 1935 Single-axis hinges

This standard provides details on product types, classification by use, test cycles, door mass, corrosion resistance, as well as definitions, product performance requirements, test apparatus, test methods and marking of products. In addition, the published standard includes annexes with details for special applications.

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Note: This standard has replaced BS 7352:1990: *Specification for strength and durability performance of metal hinges for side hanging applications and dimensional requirements for template drilled hinges.*

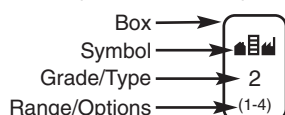
• SCOPE

This European standard specifies requirements for single-axis hinges for windows and doors opening in one direction only, whose rotation axis is no more than 30mm from the face of the sash or door. It covers both fixed pin and lift-off hinges, and contains additional requirements for hinges intended for use on fire doors.

• CLASSIFICATION

BS EN 1935 classifies door furniture by using an 8 digit coding system. A similar classification applies to all building hardware product standards so that complementary items of hardware can be specified to, for instance, a common level of corrosion resistance, category of use, etc. Each digit refers to a particular feature of the product measured against the standard's performance requirements.

The ABHM recommends the use of graphic icons to enhance clarity of information and has devised a system to facilitate assimilation of the various product classifications. Each feature within the product classification is represented by an icon comprising four elements; Symbol, Grade/Type, Range/Options and Box:-



The icon above is for a product which meets Grade 2 in the Category of Use classification, where EN 1935 stipulates a range of four possible grades from 1 to 4.

Full details on the ABHM graphic icons system can be found [on this CD](#) or at www.abhm.org.uk



Digit 1

Category of use

Four categories of use are identified:

- grade 1: light duty
- grade 2: medium duty
- grade 3: heavy duty
- grade 4: severe duty



Digit 2

Durability

Three grades are identified for single-axis hinges manufactured to this European standard:

- grade 3: 10 000 test cycles, for light duty hinges on windows only
- grade 4: 25 000 test cycles, for light duty hinges on windows and doors
- grade 7: 200 000 test cycles, for medium, heavy and severe duty hinges on doors only



Digit 3

Test door mass

Eight door mass grades related to single-axis hinges are identified in this European standard as shown in Table 1 below.

Table 1

Test door mass grade	Door mass
0	10 kg
1	20 kg
2	40 kg
3	60 kg
4	80 kg
5	100 kg
6	120 kg
7	160 kg



Digit 4

Suitability for fire/smoke door use

Two grades of suitability are identified for single-axis hinges:

- grade 0: not suitable for fire/smoke resistant door assemblies
- grade 1: suitable for fire/smoke resistant door assemblies subject to satisfactory assessment of the contribution of the single-axis hinge to the fire resistance of the specified fire/smoke door assemblies. Such assessment is beyond the scope of this European standard (see EN 1634-1).



Digit 5

Safety

Single-axis hinges are required to satisfy the essential requirements of safety in use. Therefore, only grade 1 is identified.

Digit 6 Corrosion resistance

Five grades of corrosion resistance are identified in accordance with EN 1670:

- grade 0: no defined corrosion resistance.
- grade 1: mild resistance.
- grade 2: moderate resistance.
- grade 3: high resistance.
- grade 4: very high resistance.

Digit 7 Security

Two grades of security are identified for single-axis hinges:

- grade 0: not suitable for use on burglar-resistant door assemblies
- grade 1: suitable for applications requiring a degree of security. Annex C of this European standard details the hinge grade to use for the level of security required.

Digit 8 Hinge grade

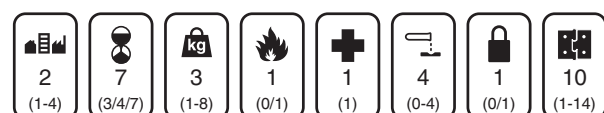
Fourteen grades are identified in this European standard and are detailed in Table 2 below. The full classification is shown in the standard.

Table 2

Hinge grade	Usage	Test cycles	Door mass
1	Window	10 000	10 kg
2	Window	10 000	20 kg
3	Window/Door	25 000	20 kg
4	Door	200 000	20 kg
5	Window	10 000	40 kg
6	Window/Door	25 000	40 kg
7	Door	200 000	40 kg
8	Window	10 000	60 kg
9	Window/Door	25 000	60 kg
10	Door	200 000	60 kg
11	Door	200 000	80 kg
12	Door	200 000	100 kg
13	Door	200 000	120 kg
14	Door	200 000	160 kg

• EXAMPLE

Example: the following marking denotes a single-axis hinge for use in medium duty situations, tested to 200 000 cycles, for use on doors with a mass up to 60 kg, with stated fire door suitability, satisfying the essential requirement of safety in use, high corrosion resistance, suitable for burglar-resistant doors and with a hinge grading of 10.



• MARKING

Each single-axis hinge manufactured to this European standard must be marked with the following:

- manufacturer's name or trademark, or other means of identification.
- the hinge grade (eighth digit of classification code).
- number of this European standard.

Note: This information can be in coded form

• CE MARKING

Single axis hinges intended for use on fire resisting doors and smoke control doors are covered by a Construction Products Directive mandate issued by the European Commission. Consequently, this standard is regarded as a "harmonised" standard and compliance with it, supported by suitable evidence, allows the application of the CE mark.

As fire/smoke door hinges have a critical safety function, application of the CE mark will require the involvement of a notified certification body to provide verification of the compliance claims. This will involve initial type-testing of the product to EN 1935, initial inspection of the manufacturer's factory production control and continuing surveillance and approval of the factory production control. On satisfactory completion of these tasks, the notified body issues an EC Certificate of Conformity which then permits the manufacturer to declare compliance and affix the CE marking to his product.

The standard requires the following additional information to accompany the CE marking:-

- the identification number of the notified certification body
- the name or identifying mark of the manufacturer
- the registered address of the manufacturer
- the last two digits of the year in which the marking was applied
- the number of the EC certificate of conformity
- reference to EN 1935:2002
- the classification code of the product

Note that, although the notified body has to be involved to verify the manufacturer's claims, the manufacturer remains responsible for designing and producing the product, for affixing the CE marking, and for ensuring that the product meets the requirements of the Directive.

Where to place the CE mark

	On product – and visible after installation	On product	With installation instructions	On product packaging	On commercial documents
CE symbol	R	R	E	R	O
Notified Body number	R	R	E	R	O
Name of Producer	O	O	E	O	O
Address of Producer	O	O	E	O	O
Year of marking	O	O	E	O	O
C of C number	O	O	E	O	O
Product std number	R	R	E	R	O
Classification code	R (last digit)	R (last digit)	E	R	O

E = Essential
 O = Optional
 R = Recommended

For some products it may be appropriate to specify a combination of locations for the CE marking and the accompanying information. For example, a minimum of information could appear on the product itself, with the complete information appearing on the installation instructions or on the accompanying commercial documents. Where the information is split in this way, the location(s) lower in the hierarchy must always repeat that part of the information already placed higher up in the hierarchy.

Additional important considerations

In addition to ensuring that products satisfy the requirements of this standard, other factors should be taken into consideration when selecting hinges. These not only include sourcing products from a reputable manufacturer, but also quality assurance, support services and unequivocal conformity to the standard as detailed below:

• QUALITY ASSURANCE

The internationally recognised standard for quality assurance, BS EN ISO 9000 provides confidence that the products are being manufactured to a consistent quality level. All ABHM members operate recognised BS EN ISO 9000 Quality Assurance Schemes.



Companies displaying this symbol are registered under the BSI Registered Firm Scheme.

• SUPPORT SERVICE

The correct installation of hinges is essential to ensure that they are able to operate efficiently within the performance levels described in this standard. Specialist advice is available from ABHM members in support of their products from specification stages through supply to effective operation on site.

• CONFORMITY

Conformity to the standard must be clearly and unequivocally stated. Such phrases as "tested to ...", "designed to conform to ...", "approved to ...", are not sufficient. To avoid misleading or confusing claims it is recommended that one of the following phrases is used when stating conformity:

a) This product has been successfully type-tested for conformity to all of the requirements of BS EN 1935. Test reports and/or certificates are available upon request.

b) This product has been successfully type-tested for conformity to all of the requirements of BS EN 1935 including the additional requirements for fire/smoke door use*. Test reports and/or certificates are available upon request.

*Add as appropriate.

c) This product has been successfully type-tested for conformity to all of the requirements of BS EN 1935 including the additional requirements for fire/smoke door use*. Regular audit testing is undertaken. Test reports and/or certificates are available upon request.

*Add as appropriate.

It is recommended that an [ARGE Declaration of Compliance](#) is also completed, as this gives a clear and unambiguous method of demonstrating test evidence and compliance.

ABHM PROFILE

Formed in 1897 to represent the interests of brassfounders, the ABHM and its members has been instrumental in the industry's advancement over the last 100 years.

Innovations in material and manufacturing technologies as well as changes in the building industry throughout the world have resulted in the development of a wide range of new products and practices. These advances have, in turn, required new skills and knowledge from the designer and manufacturer of the products themselves through to the specifiers, stockists and installers in the various sectors of the building industry.

The Association and its members have consistently risen to this challenge, creating products which meet the needs of a changing world and developing performance standards alongside national and international organisations, such as BSI

and CEN, which enable the industry to select and compare hardware with confidence.

The advances made throughout the industry are reflected in the Association's structure, the diversity of its membership and the wide range of activities in which it is involved. The ABHM now represents the United Kingdom's leading manufacturers of building hardware, architectural ironmongery and door and window fittings as well as providing the technical expertise essential for the formulation of performance standards at home and abroad.

All members are listed [on this CD](#) and on the [ABHM website \(www.abhm.org.uk\)](#), which includes a guide to the products and services available from each member.

British Hardware Federation

BHF represents some 3,500 ironmongery, hardware and DIY shops in the United Kingdom. In addition, it embraces the Independent Builders Merchants Service, a specialist division of the Federation.

Builders Merchants' Federation

The Builders Merchants' Federation represents the majority of bona fide merchants in the UK. Its members have a combined turnover of £6 billion a year. Members range from large nationals to small independents.

Guild of Architectural Ironmongers

Founded in 1961, the Guild represents 95% of bona fide distributors within the UK and the majority of manufacturers of architectural ironmongery. The Guild serves to further all aspects of architectural ironmongery by promoting the interchange of information to encourage better product design and high professional standards of ironmongery scheduling and specification.

Master Locksmiths Association

The MLA is recognised by the Home Office, Police and The British Standards Institution as being the authoritative body for locksmithing. It was formed to promote the membership to Central and Local Governments, Industry, Commerce and the Public.



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1.0 Introduction

When hinges are used on a fire-resistant doorset the door leaf should be hung on single-axis hinges in accordance with local and national regulations. Hinges fitted to fire-resistant doorsets should be able to achieve the intended fire rating, also the hinge should be able to allow the door closing devices when fitted to a fire-resistant doorset, to close the door leaf reliably from any angle to which it has been opened, overcoming the resistance of a latch or any seals when fitted.

Experience relating to escape from buildings and general safety has shown the importance of fitting doors on escape routes with suitable single-axis hinges to enable the occupants of the building to escape quickly and easily from a building in the case of fire or some other emergency.

At the same time, where escape route doors are part of the final exit from a building, there will be some additional requirements for security of the door against intrusion and burglary. In this case the hinge should be of a design such that it cannot be removed or parted whilst the door is closed so that the building and its contents are secure against crime.

Where escape route doors are part of the fire compartmentation of the building there will be additional requirements to ensure that the hinges fitted do not compromise the fire resisting performance of the doorset.

2.0 Critical recommendations

Except where otherwise noted, these recommendations apply both to hinges for fire-resistant doorsets and to hinges fitted to doors on escape routes.

- 2.1 The hinge should comply fully with BS EN 1935, including its Annex B. Preferably, this compliance should be demonstrated by the application of the CE marking.
- 2.2 When used on fire-resistant doorsets the product should have demonstrated its ability to be suitable for the intended purpose, by inclusion in satisfactory fire test to EN 1634-1, on a type of doorset and configuration in which it is proposed to be used. This evidence should be provided by an approved third party certification or testing body (see Notified Bodies in the [‘Guidance Notes on CE Marking’](#) section of this CD, clause 2.3).
- 2.3 The strength and features must be correct for the size of door to which it is to be fitted, bearing in mind:
 - the application of the door;
 - position of door stop if being used;
 - whether subject to factors such as heavy traffic use, abusive treatment, used by elderly, infirm or disabled;
 - whether or not a door closer is being used;
 - size (height and width) and mass of the door;
 - number and position of hinges.
- 2.4 A regular program of maintenance should be undertaken to ensure that the correct operational performance of the hinge is maintained for the life of the building (see [‘Installation and maintenance advice’](#)).
- 2.5 Rising butt hinges are not recommended for use on fire-resistant doorsets (see ‘Further Reading’ in the [Door closing devices](#) section of this CD, clause 2.0).
- 2.6 Spring hinges are not recommended for use on fire-resistant doorsets (see ‘Further Reading’ in the [Door closing devices](#) section of this CD, clause 2.0).
- 2.7 Fixing screws should be size No 8 and not less than 30 mm in length.
- 2.8 Hinges for use on final exit escape doors should have a corrosion resistance of not less than Grade 3 of BS EN 1670.
- 2.9 Hinges should be marked according to clause 8 and Annex ZA.3 of BS EN 1935

3.0 Commentary

3.1 Melting point

The England and Wales Building Regulations 1991 Approved Document B, Appendix B Fire doors Clause 7 states: -
 “Unless shown to be satisfactory when tested as part of a fire door assembly, the essential components of any hinge on which a fire door is hung should be made entirely from material having a melting point of at least 800°C.”

However, on FD60 fire doors it is recommended that hinges should be made of mild steel and on fire doors whose integrity is greater than FD60 it is recommended that hinges should be made of stainless steel. Stainless steel thermal conductivity is 25% of mild steel and steel has a lower thermal conductivity than brass.

3.2 Sizes

Hinges are available in a range of sizes, which relate to the mass and size of the door. These are set out in Table 1 of BS EN 1935, as shown in the extract below:-

Table 1 : Classification Summary

First Digit			Second Digit		Third digit		Fourth digit	Fifth digit	Sixth digit	Seventh digit	Eighth digit
Category of use			Endurance test cycles		Test door mass		Fire resistance	Safety	Corrosion resistance	Security	Hinge grade
Use	Grade	Use on	Grade	number of Test cycles	Grade	mass (kg)	Grades available	Grade available	Grades available	Grades available	Grade
Light	1	Window	3	10 000	0	10	0 or 1	1	0,1,2,3,4	0 or 1	1
Light	1	Window	3	10 000	1	20	0 or 1	1	0,1,2,3,4	0 or 1	2
Light	1	Door or Window	4	25 000	1	20	0 or 1	1	0,1,2,3,4	0 or 1	3
Medium	2	Door	7	200 000	1	20	0 or 1	1	0,1,2,3,4	0 or 1	4
Light	1	Window	3	10 000	2	40	0 or 1	1	0,1,2,3,4	0 or 1	5
Light	1	Door or Window	4	25 000	2	40	0 or 1	1	0,1,2,3,4	0 or 1	6
Medium	2	Door	7	200 000	2	40	0 or 1	1	0,1,2,3,4	0 or 1	7
Light	1	Window	3	10 000	3	60	0 or 1	1	0,1,2,3,4	0 or 1	8
Light	1	Door or Window	4	25 000	3	60	0 or 1	1	0,1,2,3,4	0 or 1	9
Medium	2	Door	7	200 000	3	60	0 or 1	1	0,1,2,3,4	0 or 1	10
Heavy	3	Door	7	200 000	4	80	0 or 1	1	0,1,2,3,4	0 or 1	11
Severe	4	Door	7	200 000	5	100	0 or 1	1	0,1,2,3,4	0 or 1	12
Severe	4	Door	7	200 000	6	120	0 or 1	1	0,1,2,3,4	0 or 1	13
Severe	4	Door	7	200 000	7	160	0 or 1	1	0,1,2,3,4	0 or 1	14

Clearly, an important factor is the size of the hinge with respect to the door mass

3.3 Torque

The torque between the two hinge leaves is important; limits of this torque are set down in BS EN 1935, the low torque requirement of the hinge is required to allow the door closer to overcome the resistance of the latch bolt and or seal pressure.

3.4 Number and position of hinges

It is recommended that at least 3 hinges should be used on fire and escape route doors. BS 4878 details the position of door hinges as follows:-

One hinge shall be positioned on the centre line of the door height the other two hinges being at 770mm either side of the centre hinge. This hinge layout gives stability to the door. With fire doors becoming heavier there is a practice to fit two hinges at the top of the door with the third hinge at the bottom of the door. With this configuration the hinges are positioned as follows; centre line of the top and bottom hinge 250mm from the top and bottom edge of the door, the centre line of the third hinge is 200mm from the centre line of the top hinge (this practice is supported by test evidence).

For doors heavier than 160 kg or exceeding 2250 mm in height, a recommendation from the manufacturer should be obtained. Annex D of BS EN 1935 gives additional advice regarding the use of hinges on doors of excessive width.

3.5 Influence of door closers

Door closers put extra stress on the hinges of fire resistant and escape doorsets. This has been addressed in BS EN 1935 and is covered in annex E.

For a standard door closer it is recommended that the door mass should be notionally increased by 20%. The effect of a back check door closer is greater and it is recommended that the door mass should be notionally increased by 75%.

3.6 Rising butts

The England and Wales Building Regulations 1991: Approved Document B: Appendix E states that rising butt hinges which do not meet criteria of automatic self-closing device are acceptable where the door is:-

- (i) to (or within) a dwelling
- (ii) between a dwelling house and its garage, or
- (iii) in a cavity barrier

However, in this document the use of rising butt hinges is discouraged from the fire resistance viewpoint for the following reasons:-

- a) To enable the door to function properly, it is necessary to ease the top edge of the door sufficiently to allow for the rise of the butt. When the door is returned to its closed position, this means that a gap will exist at the head of the door. This will be in excess of the 3mm gap, which is the recommended maximum for fire doors. The head of the door is the most vulnerable point of the door if a fire breaks out. It is at this point that the pressure of smoke and hot gases, searching for cracks and fissures through which to escape, is highest.
- b) The closing force exerted by rising butt hinges is extremely low and will not overcome air pressure differences or resistance from latches, seals or carpets that may be fitted and, therefore, they cannot be considered as reliable door closing devices.

3.7 Lift-off, loose pin and journal supported hinges

These hinges are considered suitable for use on fire resisting doors, providing that the hinge pins cannot be removed or the door leaf separated from its frame, when the door is in its closed position.

3.8 Spring hinges

Such hinges come in many forms. The common factor with most hinges of this type is the large amount of metal incorporated in their construction. This is likely to lead to early integrity failure. In addition, the spring tension which acts as an integral self-closing device has an inherently low resistance to pressure in the closed, or near-closed, position, making it difficult for such hinges to hold the door in the closed position without the assistance of a latch (see 'Further Reading' in the [Door closing devices](#) section of this CD, clause 3.7).

3.9 Fixing screws

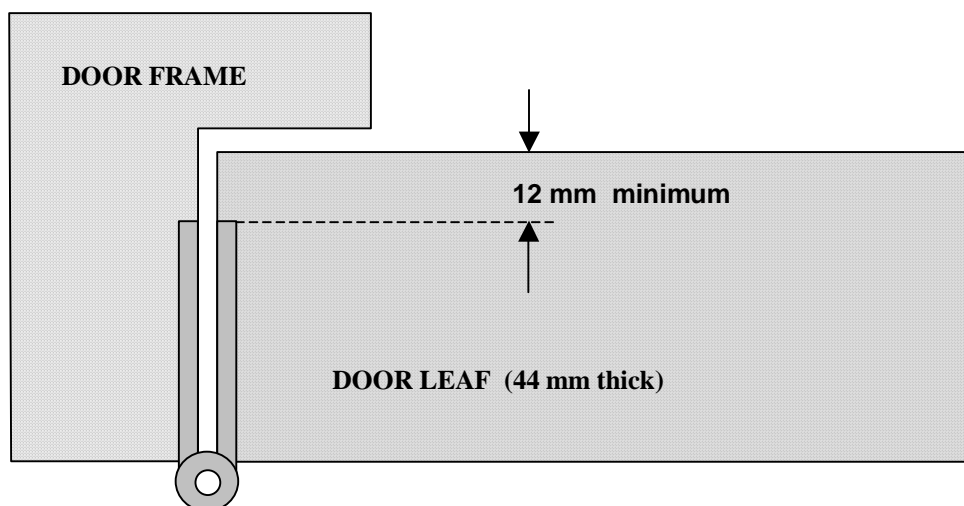
Although it is possible to use very short screws when fixing hinges it is obvious that this must stress the construction, even in the 'cold' state. When fire develops, a short screw will lose its holding ability more quickly than a long one. It is recommended that the screws used for fixing the hinges should not be less than 30mm long.

The diameter of the screw will also play a significant role in supporting the door particularly in fire. It is recommended that no screw should have a diameter of less than 3.8mm (No8).

It is recommended that the torque applied to the fixing screws should not be greater than 6 Nm per screw, to prevent stripping the timber, and it is further recommended that full thread type of screws be used and that care should be taken to ensure that the fixings do not penetrate into the brickwork, unless the brickwork is prepared to receive the screw, otherwise the screw may be stripped.

3.10 Projection

It is recommended that the centre line of the knuckle should not be greater than 30mm from the face of the door. For door leaves of 44mm thickness, no part of the hinge should extend across the door thickness to a position closer than 12mm from the non-pivoting face. For door leaves of 54mm thickness, no part of the hinge should extend across the thickness to a position closer than 18mm from the non-pivoting face.



3.11 Hold open devices

These can put extra stress into the hinge and the hinge fixings. It is recommended that the hold open device should be positioned on the horizontal axis of the door closing device and as near to the edge of the locking stile as possible.

3.12 Door preparation

To ensure the accuracy and position of the hinge rebates in the door leaf and door frame it is recommended that they should be machined in position at the door manufacturing stage.

3.13 Intumescent protection

When, it is recommended that, intumescent material be used to protect the hinges. It is recommended that advice should be obtained from the door, hinge or intumescent supplier as to the type, position and fixing method to be used

3.14 Concealed conductor hinge

See 'Further reading' clause 3.5.1 in the [Electrically powered hold-open devices](#) section of this CD.

4.0 Fire issues

Many of the best practice guides in this section refer to classification of the suitability of the associated products for use on fire resistant and/or smoke control doors.

Currently the following test methods and classification documents are relevant:

BS EN 1634-1: 2000 - *Fire resistance tests for door and shutter assemblies: Part 1 – Fire doors and shutters;*

BS EN 1634-3: 2001 - *Fire resistance tests for door & shutter assemblies: Part 3 - Smoke control doors & shutters*

BS EN 13501-2: 2003* - *Fire classification of construction products and building elements: Part 2 – Classification using data from fire resistance tests (excluding products for use in ventilation systems).*

BS 476: Part 22 - *Fire tests on building materials and structures: Part 22 - Methods for determination of the fire resistance of non-loadbearing elements of construction*

* Standard in course of publication

See also the Product /application related questions in the [FAQ section](#) of this CD.