NORSOUND

SPECIALISTS IN ACOUSTIC DOOR SEALS

NOR350

The anti finger-trapping door hinge

Technical Manual

NOR350 : Technical Manual

This manual is intended to outline the performance capabilities of the NOR350 in fire, acoustic and mechanical disciplines. For manufacturing details, including doorset sections, component installation instructions and seal options, please see Manufacturing Guidelines: NOR350.

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Introduction

Finger Trapping – The Problem

The Royal Society for the Prevention of Accidents (RoSPA) estimates that 30,000 children trap and seriously injure their fingers in doors every year and more than 1,500 of these will need surgery. The estimated cost of these injuries to the National Health Service is £200 million per annum.

Further research carried out at the Royal Sick Children's Hospital in Glasgow highlighted the severity of the injuries which occur. In six months, 136 children were admitted to A&E after trapping their fingers in a door with 45% suffering bone/joint injuries and 11% amputation. The cost of litigation for these injuries can be substantial. The responsibility for reducing these injuries falls to those who have children in their buildings.

Damaged Hinge Guards

Until now hinges have been shielded by unsightly plastic hinge guards. These products have limited durability in high traffic areas and are prone to vandalism in schools and hospitals. Once damaged or split these 'protectors' can, in fact, create problems because of sharp edges (as shown) and trapped dirt.

All Age Groups are at Risk

Contrary to common perception, finger trappings happen to all age groups. A study of children only, aged 0-14 years, shows a spread of incidents occurring across children age groups from primary to secondary.

0 - 4 years	43%
5 - 10 years	35%
10 - 14 years	22%

"Isolated finger injuries in children – incidence and aetiology", NV Doraiswamy (March 2000)
Department of Acc & Emergency Medicine, Royal Hospital for Sick Children, Glasgow

People with special needs, the elderly and people with sensory impairments are often more susceptible to finger trappings, but reports of fully-abled adults having fingers injured by doors highlight the fact these accidents can happen to anyone.

Which Doors to Protect

The Department for Children, Schools and Families (DCSF) recommends considering the risk of finger injuries on doors that will not be held open during peak periods of pedestrian movement. Doors to spaces where young children may be present - such as classrooms, wards, corridors and receptions - also represent a high risk of injury. Specify finger protection in high risk areas to eliminate injury.

Life Cost Comparison

Life cost analysis highlights the true cost of plastic hinge guards. Local authorities and building owners report they are replacing hinge guards every 6 – 24 months in schools and hospitals, depending on when they break.

Based on a 24-month replacement cycle, typical costs of £30 for a hinge guard and £20 labour for installation accumulate to a significant sum (£625) over the 25-year life of a building.

The life cost of the NOR350 is up to 75% less than hinge guards. The NOR350 also eliminates the hassle of sub-contractors on-site prior to completion and again repeatedly during operation of the building to retrofit or replace hinge guards.

Product Summary – NOR350

The Solution

The NOR350 is an integrated safety hinge which prevents finger trapping through clever design. The hinge pivots the door at the top and bottom, which maintains a small, constant gap at the hinge side of the door thus minimising the chance of fingers being jammed. Since the NOR350 is designed to be integrated by the door manufacturer, it is as strong and durable as the door itself, eliminating any worries about maintenance and lifetime cost compared to other anti-trap products.

Test Methodology

The NOR350 has been rigorously tested as part of an integrated doorset - as opposed to individual components - in fire, mechanical and acoustic disciplines. Integrated testing is more onerous because it tests the product as part of an overall assembly (replicating the real-life situation more closely), rather than artificially isolating components. Successful outcomes from such testing provide the specifier with total confidence that the product is fit for purpose.

Summary

Single/double swing doorset incorporating anti-finger trap pivot set and aluminium edge profile.

Door blanks

Halspan (44mm), Blankfort 30

Fire/smoke

FD30, FD30 (S) rating

Mechanical

Severe Duty rating

Acoustic

R_w rating up to 32dB

Standard finish

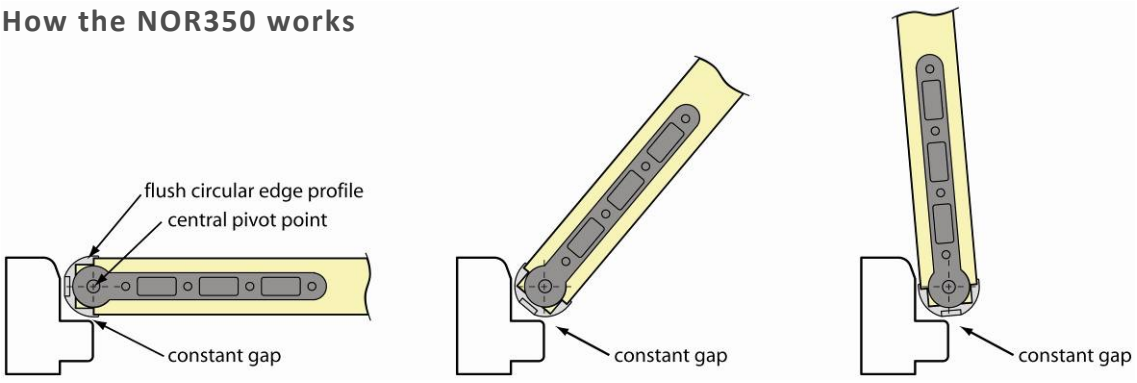
Aluminium edge profile - natural anodised finish.

Suitable for use with veneer, laminate, paint-grade and other door finishes.

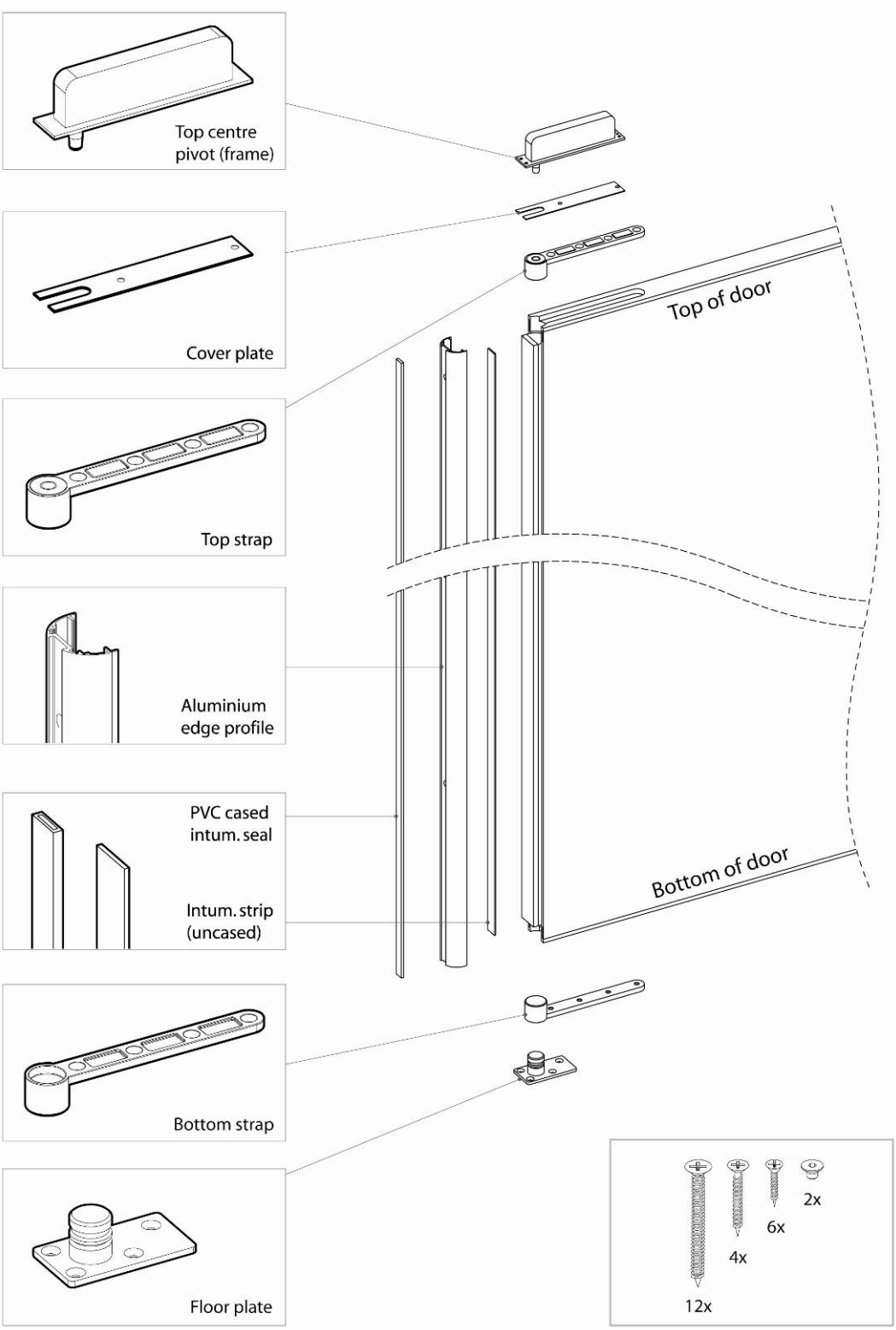
Standard lengths

2.1m standard supply length (longer lengths available upon request)

How the NOR350 works

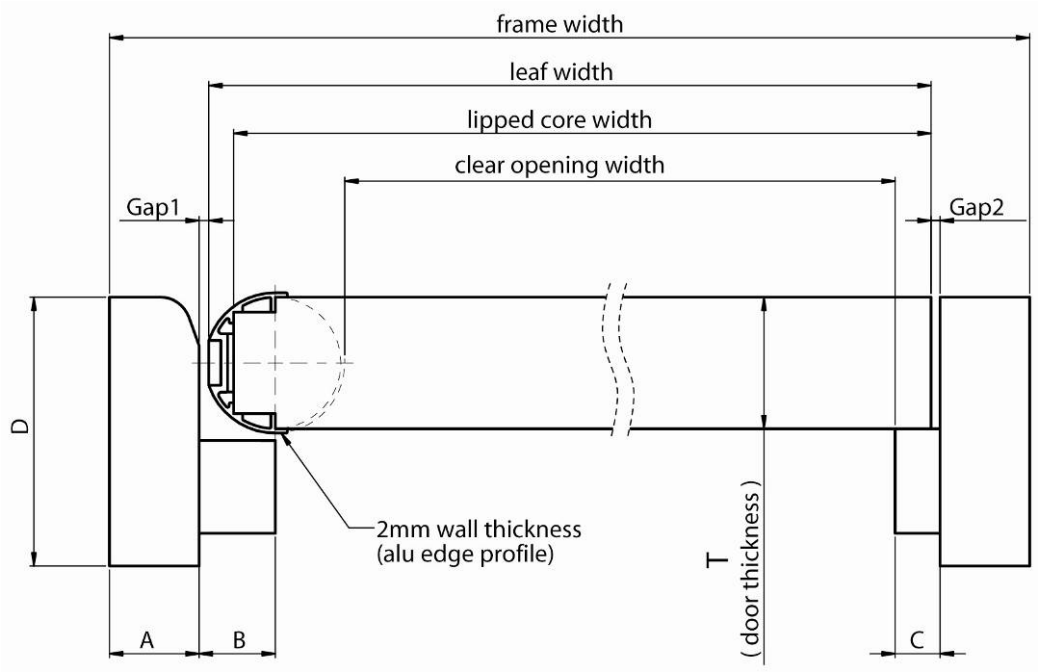


NOR350 Components



Determining Sizes – Doorset Dimensions

See below our guidance on establishing overall doorset dimensions using the frame width, clear opening width or preferred door leaf dimension as the starting point.



Recommended Gap size

Gap1 = Gap2 = 3mm

Frame width ↔ Clear opening width:

Clear opening width = Frame width – 2A – C – T – Gap1 – 2mm

Frame width = Clear opening width +2A + C + T + Gap1 + 2mm

e.g. Clear opening width = 992mm – (2 x 30mm) – 15mm – 44mm – 3mm – 2mm = 868mm

Frame width ↔ Leaf width:

Leaf width = Frame width – 2A – Gap1 – Gap2

Frame width = Leaf width + 2A + Gap1 + Gap2

e.g. Leaf width = 992mm – (2 x 30mm) – 3mm – 3mm = 926mm

Clear opening width ↔ Leaf width:

Leaf width = Clear opening width + T + C + 2mm – Gap2

Clear opening width = Leaf width – T – C – 2mm + Gap2

e.g. Leaf width = 868mm + 44mm + 15mm + 2mm – 3mm = 926mm

Leaf width ↔ Lipped core width:

Lipped core width = Leaf width – 8mm

Leaf width = lipped core width + 8m

e.g. Lipped core width = 926mm – 8mm = 918mm

Section 1 – Fire Performance

NOR350 fire testing was conducted in accordance with BS476: Part 22: 1987 “Fire tests on building materials and structures. Methods for determination of the fire resistance of non-loadbearing elements of construction”.

Figure 1: FD30 test in progress

Figure 2: view inside furnace at 25mins, temp 825°C

Tests were successfully conducted on the following:

- Unlatched single doors of leaf size 2100 x 908 – 33mins

- Unlatched double doors of unequal width leaf sizes 2100 x 908 and 2100 x 608 – 38mins

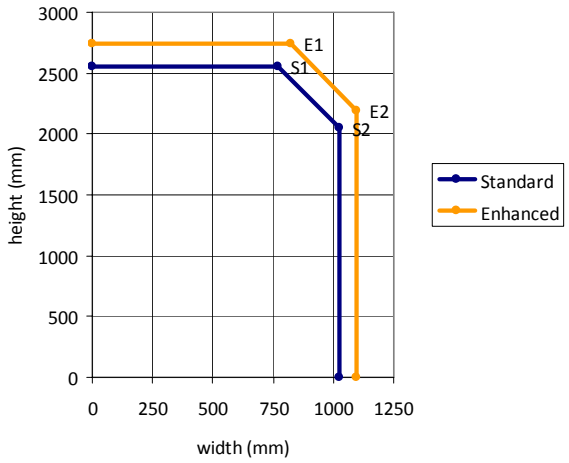
Test reports CFR0809251 (singles) and CFR0809261 (doubles) refer.

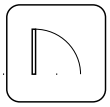
Field of Application Report IFCA/08160 permits expansion of leaf sizes, alternative frame materials, glazing, door face finishes and various ancillaries beyond the tested specifications, as summarised below.

Single Doors – Maximum Leaf Sizes

Maximum leaf sizes are affected by the doorset intumescent specification. Two options are available: **Standard** and **Enhanced** (for details see "Seal Options").

Latched, single acting, single leaf

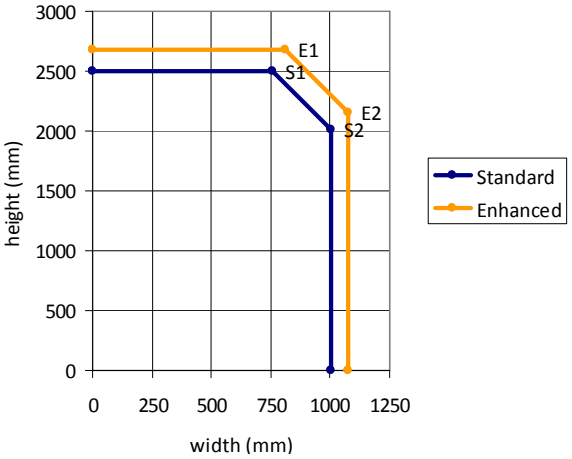


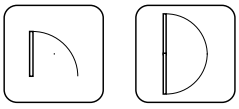


Standard	**S1**	**S2**
W	770	1022
H	2550	2045

Enhanced	**E1**	**E2**
W	826	1097
H	2738	2195

Unlatched, single or double acting, single leaf



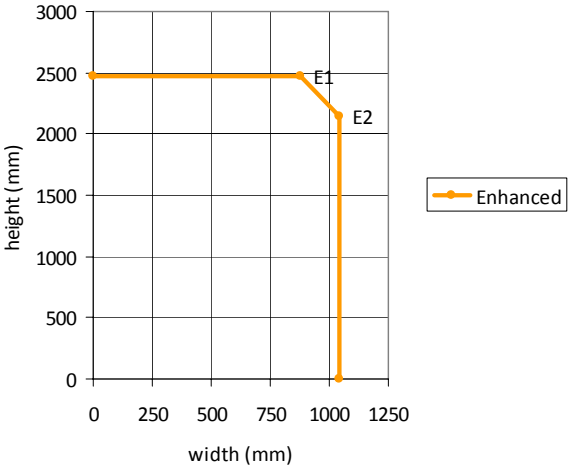


Standard	**S1**	**S2**
W	755	1003
H	2501	2006

Enhanced	**E1**	**E2**
W	810	1076
H	2684	2153

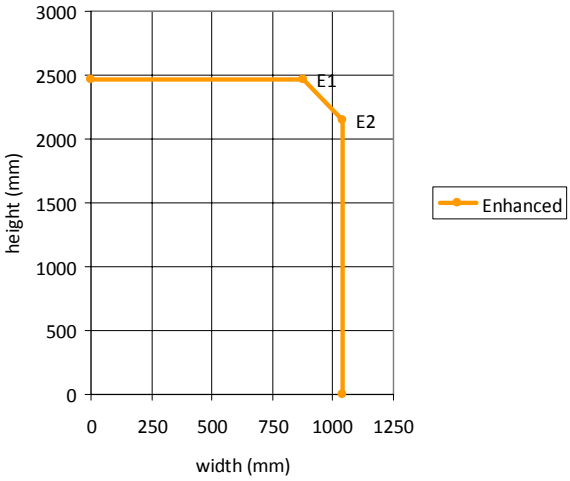
Double Doors – Maximum Leaf Sizes

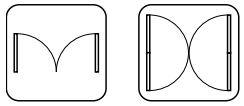
Latched, single acting, double leaf



Enhanced	E1	E2
W	878	1040
H	2469	2145

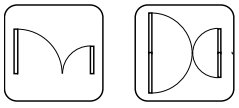
Unlatched, single or double acting, double leaf





Enhanced	E1	E2
W	869	1030
H	2445	2123

Un/equal, single or double acting, double leaf – width guidelines



In double leaf assemblies, each leaf is permitted to be of the same width, up to the maximum width indicated in the sections above.

If leaves are both unlatched/unbolted and of unequal width, **the small leaf must be no more than 550mm narrower than the large leaf**. This is to reduce the level of differential deflection in fire. If the smaller leaf is bolted, then there is no limit on the ratio of leaf widths, although the large leaf must still be within the maximum size envelope.

In all instances, **the width of the small leaf must not be less than 300mm wide.**

Frame

Softwood or hardwood minimum density 510 kg/m^3; MDF minimum density 700 kg/m^3

Minimum sections excluding stops: 75 x 48mm (head); 75 x 30mm (jambs)

Head/jamb joint: mortice & tenon or half-lapped joint with head twice screwed to jambs; mitred joint glued with non-thermally softening adhesive (e.g. PU, UF, PVA) and twice screwed, or horizontal butt joint screwed with three screw fixings.

Stops: Machined from solid; pinned and glued, or pinned only.

Recommended DD171 Severe Duty Frame:

Minimum sections excluding stops: 90 x 48 (head); 90 x 30 (jambs). MDF or hardwood.

Head/jamb joint: butt jointed. Head to jambs fixed 3No. 3.5mm x 100mm screws per joint & PU glue.

Stops: 35x15mm stops pinned at 200mm centres with 40mm pins, or integral.

Door blank

Halspan (44mm)

Blankfort 30 (45mm)

Lipping

Hardwood minimum density 640 kg/m^3

Gluelines: PU, UF, melamine-UF, cross-linked PVA, PVA, PF

Intumescent/smoke seal

Frame: Thermaseal or Thermablade (Intumescent Seals Ltd). Refer to Table 2 and Table 3.

Aluminium edge profile: 15x4 PVC-cased intumescent & plain intumescent strip (supplied by Norsound)

Top centre frame portion and top strap: intumescent wrap and pockets (supplied by Norsound)

Finishes

Timber veneers, paint finish, plastic/PVC laminate (maximum 2mm thickness)

Glazing

Maximum area of apertures: 0.39m^2

Maximum vertical length of aperture: 1540mm

Maximum horizontal length of aperture: 300mm

Minimum distance from leaf edge (sides): 100mm

Minimum distance from bottom of leaf: 200mm

More than one aperture may be included in each leaf subject to the above limitations. The minimum distance between apertures is 100mm. Aperture shape is not restricted provided the glazing system and beads are compatible with that shape.

A wide range of glazing systems are permitted. Please contact Technical Support for details.

For further details on doorset construction see “NOR350 Manufacturing Guidelines”.

Section 2 – Acoustic Performance

NOR350 acoustic testing was conducted in accordance with BS EN ISO 140-3: 1995 "Acoustics. Measurement of sound insulation in buildings and of building elements. Laboratory measurement of airborne sound insulation of building elements"

A single door 2100 x 908 achieved up to 32dB using a variety of acoustic seal combinations (see Table 2). Test report C/08/5L/20399/R01 refers.

Building Bulletin 93 (BB93) - the constructional standard for acoustics for new school buildings - recommends the following:

Type of space occupied by student	Minimum R_w Rating (dB) for doorsets
All spaces except music rooms	30
Music rooms	35

Table 1: Recommended R_w ratings for schools from BB93

Seal Options

Single/Double Acting, Single Door

		Seal Position				
Option	**Ratings**	**Frame head**	**Closing jamb**	**Hanging jamb**	**Threshold**	**R_w Rating (dB)***
1	Fire, smoke & acoustic	"Standard" 15x4 "Enhanced" 20x4 ISL Thermablade	15x4 Thermablade	15x4 Thermablade	Double Norsound NOR720	32
2	"	"	"	"	Single Norsound NOR720	31
3	"	"	"	"	Norseal NOR855**	31
4	"	"Standard" 15x4 "Enhanced" 20x4 ISL Thermaseal & NOR710**	15x4 Thermaseal & NOR710**	15x4 ISL Thermablade	same as Option 1	32
5	Fire & smoke	"Standard" 15x4 "Enhanced" 20x4 ISL Thermablade	15x4 Thermablade	"	Refer BS9999:2008 (33.1.7)	N/A
6	Fire only	""Standard" 15x4 "Enhanced" 20x4 ISL Thermaseal	15x4 ISL Thermaseal	15x4 ISL Thermaseal	N/A	N/A

Table 2

* The R_w Ratings indicated in the table above were achieved using Blankfort 30 core material. If Halspan core material is used in lieu of Blankfort, a reduction of 1dB can be expected to the R_w Rating, e.g. Blankfort 30 R_w Rating fully caulked = 34dB; Halspan (44mm) R_w Rating fully caulked = 33dB.

** Refer to Acoustic Seal Option Drawings for details

For dimensioned drawings of frame profiles and seal positions, see "Manufacturing Guidelines: NOR350".

Single/Double Acting, Double Doors

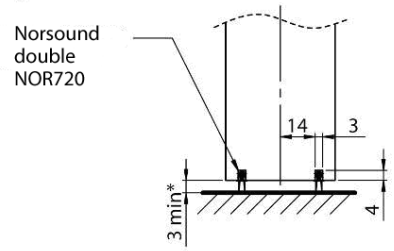
		Seal Position			
Option	**Ratings**	**Frame head**	**Meeting edge**	**Hanging jamb**	**Threshold**
1	Fire & smoke	20x4 ISL Thermablade	2No. 10x4 ISL Thermablade	15x4 ISL Thermablade	Refer BS9999:2008 (33.1.7)
2	Fire only	20x4 ISL Thermaseal	2No. 10x4 ISL Thermaseal	15x4 ISL Thermaseal	N/A

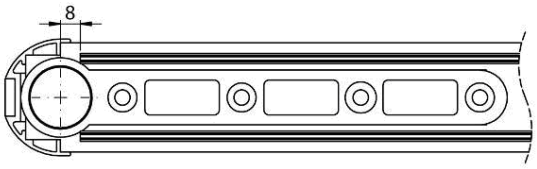
Table 3

For dimensioned drawings of frame profiles and seal positions, see "Manufacturing Guidelines: NOR350".

Acoustic Seal Option Drawings

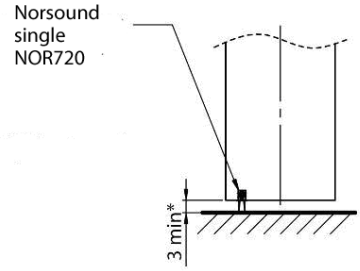
Option 1

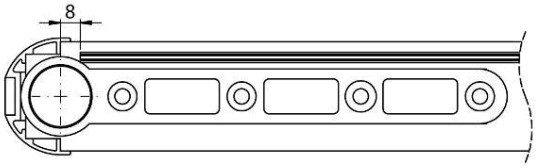




*if greater than 3mm - recommend compatible raised threshold plate

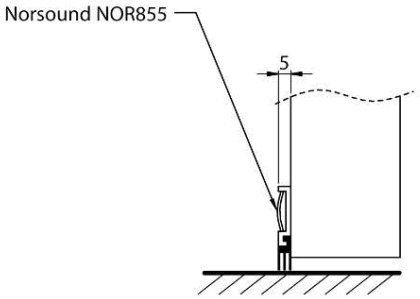
Option 2





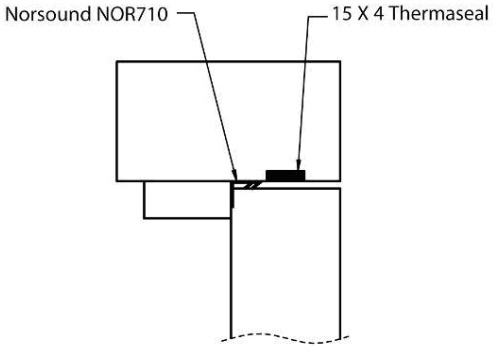
*if greater than 3mm - recommend compatible raised threshold plate

Option 3

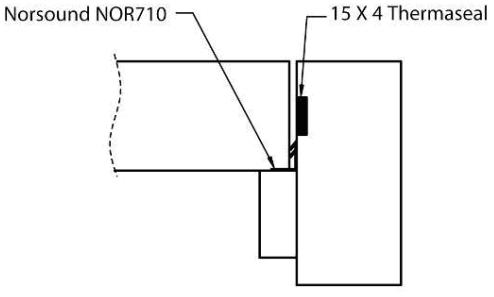


size the face-mounted seal to butt against the aluminium edge profile on the hanging side and leave a clearance gap on the closing side as per the manufacturer's instructions.

Option 4



Frame Head

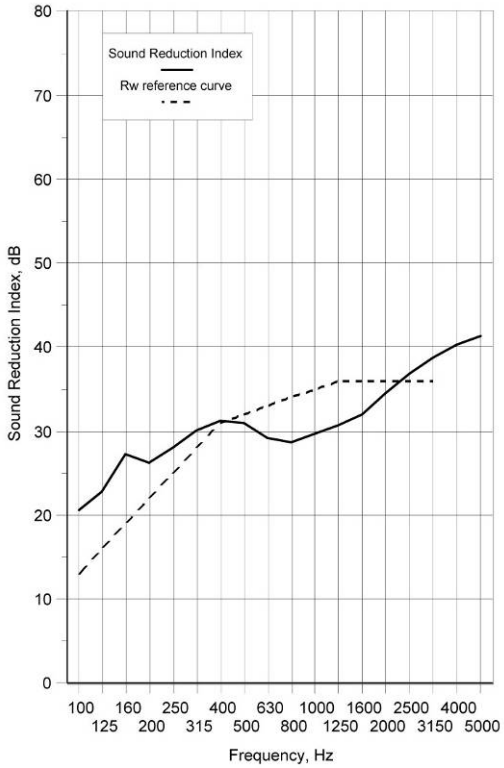


Closing Jamb

IMPORTANT: Install all seals as per manufacturer's instructions.

Sound Reduction Graphs

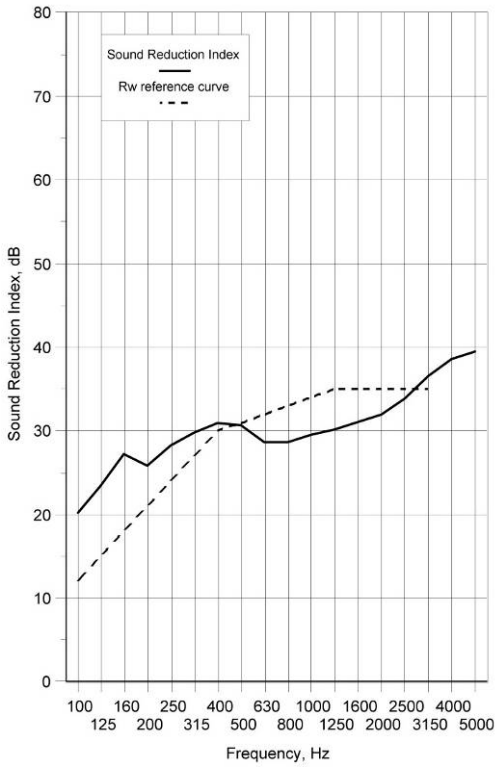
Option 1



Rating according to BS EN ISO 717-1: 1997

R_w(C;Ctr) = 32 (-1;-2) dB

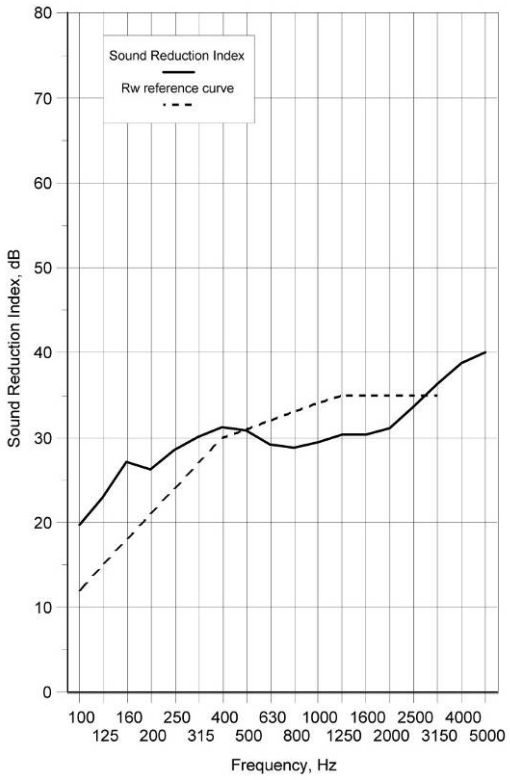
Option 2



Rating according to BS EN ISO 717-1: 1997

R_w (C;Ctr) = 31 (0;-2) dB

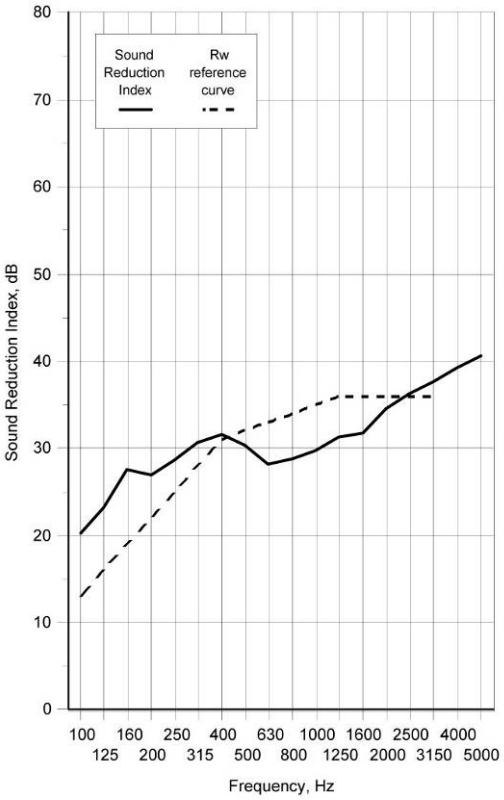
Option 3



Rating according to BS EN ISO 717-1: 1997

R_w (C;Ctr) = 31 (0;-2) dB

Option 4



Rating according to BS EN ISO 717-1: 1997

R_w (C;Ctr) = 32 (-1;-2) dB

Section 3 – Mechanical Performance

NOR350 mechanical testing was conducted in accordance with the relevant clauses of DD171: 1987 "Draft for development: Guide to specifying performance requirements for hinged and pivoted doors" and BS EN 1192: 2000 "Doors – Classification of strength requirements".

Figure 3: 300N heavy body impact test

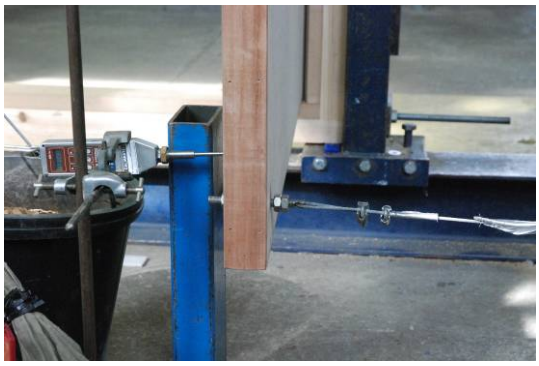


Figure 4: 400N load in torsional test

A single door of leaf size 2100 x 908 was successfully tested and achieved Severe Duty Rating – the highest duty rating possible (see Table 4). Certificate of Test Chilt/P08101 refers.

Category of Duty	Description	Examples
Light Duty (LD)	Low frequency of use. Those using the door exercise a high level of care and are unlikely to misuse the door, e.g. homeowners	Internal doors in houses, flats and other dwellings.
Medium Duty (MD)	Medium frequency of use. Those using the door exercise some care, but there is a chance of accidents or misuse occurring, e.g. office employees.	Office doors used to access public spaces but not used by the public or by people carrying or pushing bulky objects through the door.
Heavy Duty (HD)	High frequency of use. Those using the door exercise almost no care and are there is a high chance of accidents or misuse occurring e.g. member of public	Shop, hospital and other doors used by the public and people carrying or pushing bulky objects.
Severe Duty (SD)	Subject to frequent violent usage	Doors of stockrooms, corridors and educational institutions commonly opened by driving trolleys against them and/or subject to frequent impact by people.

Table 4: Categories of duty, description and examples

The mechanical test programme was compiled from the most onerous combination of applicable clauses from DD171:1987 and BS EN 1192:2000. The specimen was subjected to:

Slamming shut impact

Slamming open impact

Heavy body impact

Torsion

Downward deformation

Closure against obstruction

Resistance to jarring and vibration

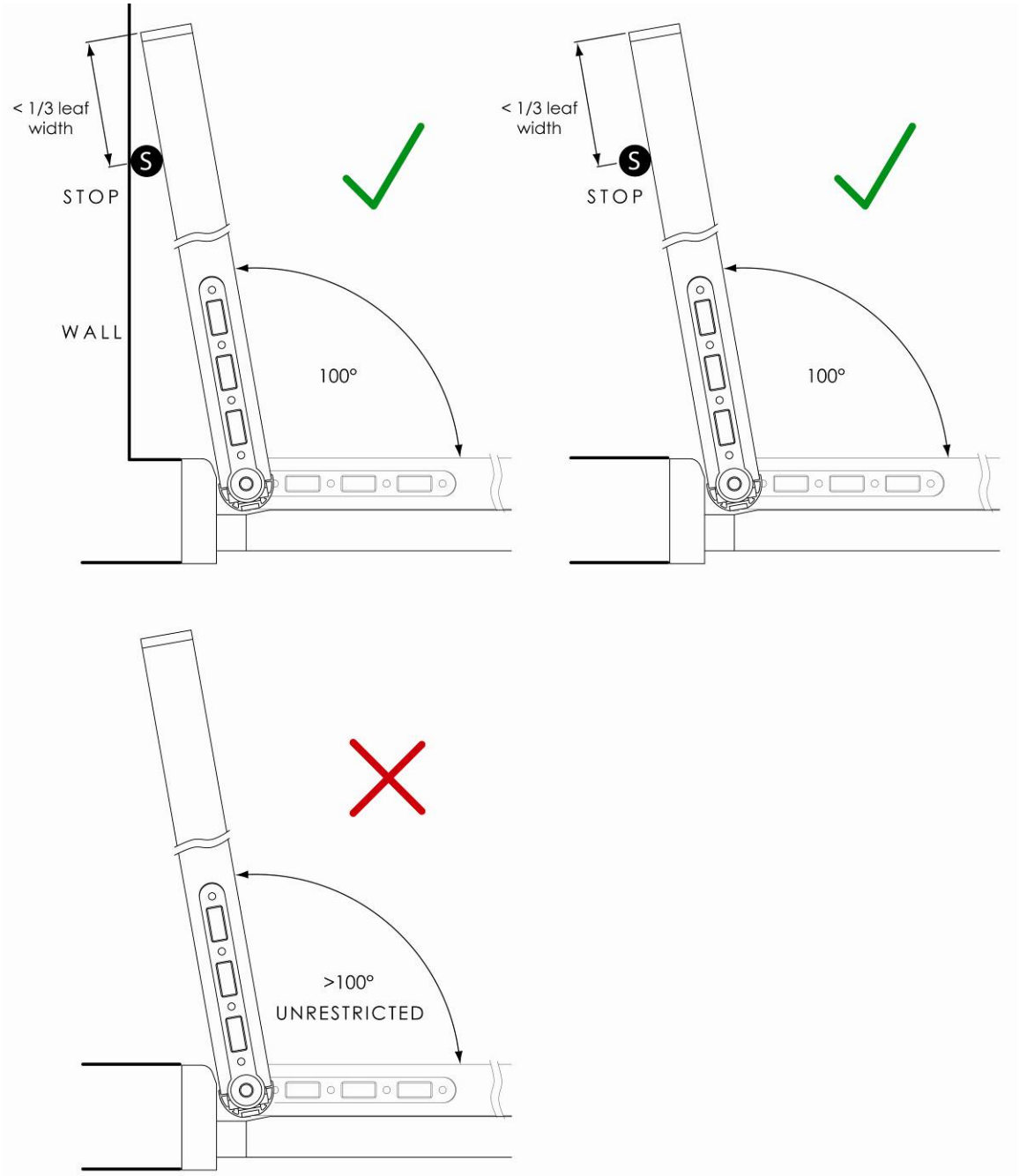
Severe Duty Rating requires the specimen to be subjected to the highest level of loading, impacts or energy dissipation that the standards dictate in each of these categories.

Installation Recommendations

Opening Angle Limit

Recommended stop angle: 100°

(Maximum opening angle: 110°)



IMPORTANT: Always choose a door stop suitable for the weight of door. Affix firmly to floor or wall in position shown (less than 1/3 leaf width from leading edge). Unrestricted opening angle may result in severe damage to doorset.