

SECTION 10

Acoustics



Acoustics Explained:

This introduction attempts to simplify what is an extremely complex subject. Where acoustic considerations are critical, reference should be made to qualified Acoustic Engineers.

'Acoustic' is a term that is used loosely in connection with doorsets. When considering the 'acoustics' of a room or space, acoustics relates to a number of considerations.

When sound is generated, the 'loudness' refers to sound pressure which is expressed in decibels 'dB'. When striking a surface, some sound will be reflected, some will be absorbed (*converted to heat*) and some will pass through the structure. Sound will lose energy with distance in accordance with the inversed square law.

The time taken for the sound pressure to drop by 60dB is measured. This loss of sound pressure related to time is measured as a 'reverberation time'. If the time it takes for the sound pressure to reduced by 60dB is less than 0.3 seconds the room will sound 'dead' with hearing made difficult due to an apparent loss of bass. If the reverberation time is in excess of 5 seconds the reverberation (*or echos*) can give rise to confusion which again makes hearing difficult. The optimum reverberation times may vary according to the intended use of the space. A reverberation time of 1 second might be ideal for a lecture hall providing for clear speech but this might not be ideal for a concert hall where a reverberation time of up to 3.5 seconds would provide for fuller and richer musical sound. For 'general purpose' use Acoustic Engineers will generally try to 'tune' the space to provide for reverberation times between 1.5 ~ 2.5 seconds.

The reverberation times can be adjusted by the use of sound absorbers. i.e. by the use of materials that are less likely to reflect sound. Soft furnishings, carpet and curtains will provide for some sound absorbing properties. Mineral wool provides for a good example of a material that will readily convert sound energy into heat energy thus absorbing sound and consequently reducing the reflected sound. The performance of a sound absorber is measured by a 'coefficient of adsorption'.

The other issue of concern to Acoustic Engineers is the influence of sound created outside of the measured space and the ability of a structure to minimise the influence of an acoustic space by preventing or reducing the transfer of external sound through a structure. This is referred to as 'sound attenuation' and it is the measure that generally applies to structures between spaces.

e.g. walls, windows and doorsets. Thus, when referring to 'acoustic' doors we generally mean 'sound attenuating' doorsets.

Sound is generated at different frequencies. The 'frequency' is the number of sound waves that pass through a given point in a second and described in 'Hertz' (Hz.) where 1 hertz = one wave per second. Differences in frequency can be identified by a change of pitch. An example of a high frequency sound might be a computer bleep (*approx. 2,500Hz.*) while a low frequency sound might be the hum of an electrical generator (*approx. 100Hz.*). Few sounds are made up of a pure single frequency. Sound is generally produced simultaneously over a range of frequencies. We might refer to the random structure of sound over a range of frequencies as noise, while sound produced over a range of frequencies in a structured manner might be referred to as speech or music. (*See Fig. 10.1 & 10.2*).

The average human ear is not a perfect sound receiver. We cannot hear some very low frequency sounds e.g. at frequencies below (*about*) 20Hz. referred to as 'sub sonic'. However, we might feel low frequency sound as vibration. At the other end of the spectrum human hearing may not notice sound at frequencies in excess of (*about*) 20,000Hz. (*20kHz.*). This is referred to as the 'ultra sound region'. Bats navigate using sound in the ultra sound range and ultra sound can be used for medical purposes to create images. (*See Fig. 10.2*).

Even within the audible range (*approx. 20Hz. ~ 20kHz.*) the human ear is less than perfect, being more sensitive to sound produced at frequencies of about 3,000 ~ 4,000Hz. (*3 ~ 4kHz.*) than sound produced at other frequencies. Thus, if sound is produced at the same amplitude (or loudness) at all frequencies, sound in the 3~4kHz. range will be perceived to be predominant. (*See Fig. 10.3*).

ISO 140 sets out the range of frequencies used for the purpose of testing for acoustic performances. The test procedure for the measurement of sound attenuation is described by reference to BS EN ISO 140-3: 1995. This measures performances over a frequency range of 100Hz. (Hertz) to 3,150Hz.

NOTE: A frequency range of 125Hz. ~ 4000Hz. is used for testing in the United States and Australia.



Acoustics Explained:

The basic principles associated with testing for sound attenuating performances are quite simple. The 'specimen' is located between a transmitting room and a receiving room. Sound is generated across the full frequency range determined by reference to the test standard in the transmitting room. The sound pressure levels on the receiving room side of the specimen are then measured. The sound pressure levels recorded in the receiving room can then be deducted from the sound pressure levels in the transmitting room with the resultant loss in sound pressure levels measured in decibels recorded at each of the measured frequencies.

For some purposes it is necessary to know the performances at particular frequencies but for most applications an average performance over the measured range is required. To determine this, the decibel reduction over the measured range could simply be averaged out. However, this would be misleading as this would not reflect human perception resulting from the imperfections of human hearing.

To relate to human perception, the average sound reduction is amended to provide for a 'weighted index' identified by the use of the prefix 'Rw'. The weighted index is calculated by reference to BS EN ISO 717-1 : 1997.

In the absence of a vacuum, most spaces will be subject to a background noise.

Typical Background Noise Levels:

	dBA
Library or Museum	40
Private Office	45
Quiet Restaurant	50
General Office	55
General Store	60
Average Restaurant	65
Mechanised Office	70
Noisy Canteen	75
Factory Machine Shop	80
Main Street (at kerbside)	85
Plant Room	90

The sound attenuating performances determined by testing can be applied by deducting the measured performance weighted index (*Rw*) from the source sound. Thus, a sound attenuating barrier providing for a performance of (say) *Rw*.30dB will reduce the sound pressure level generated in (say) a Plant Room from 90dBA to 60dBA. Conversely, to reduce the sound level in a Plant Room to the background sound level in (say) a Private Office, the sound attenuating barrier needs to provide for a performance of 90dBA - 45dBA = *Rw*.45dB.

NOTE: The 'A' suffix indicates a 'weighted' measurement.

On site, sound attenuating measurements relate to the complete barrier between the sound source and the receiving area and will measure the overall performance of the wall, doorset, window etc. that makes up the barrier. (See page 10.16).

Other Acoustic Terms:

Octave: Expressed simply, one octave is a difference in frequency (*or pitch*) that can be discerned by the average human ear. i.e. The average human may notice the difference between sound produced at (say) 200Hz. and 400Hz. (1 octave) but may not notice a difference between sounds produced at (say) 200Hz. and 250Hz. (1/3rd. octave).

STC: By reference to European tests, the weighted index is expressed by the use of the prefix 'Rw'. For tests carried out in the United States over a slightly different frequency range (125Hz. ~ 4,000Hz. as opposed to the European 100Hz. ~ 3,150Hz.) the prefix 'STC' might be used. STC = Sound Transmission Class.

For all practical purposes *Rw*. & STC may be taken to be equal performances +/- 1dB.

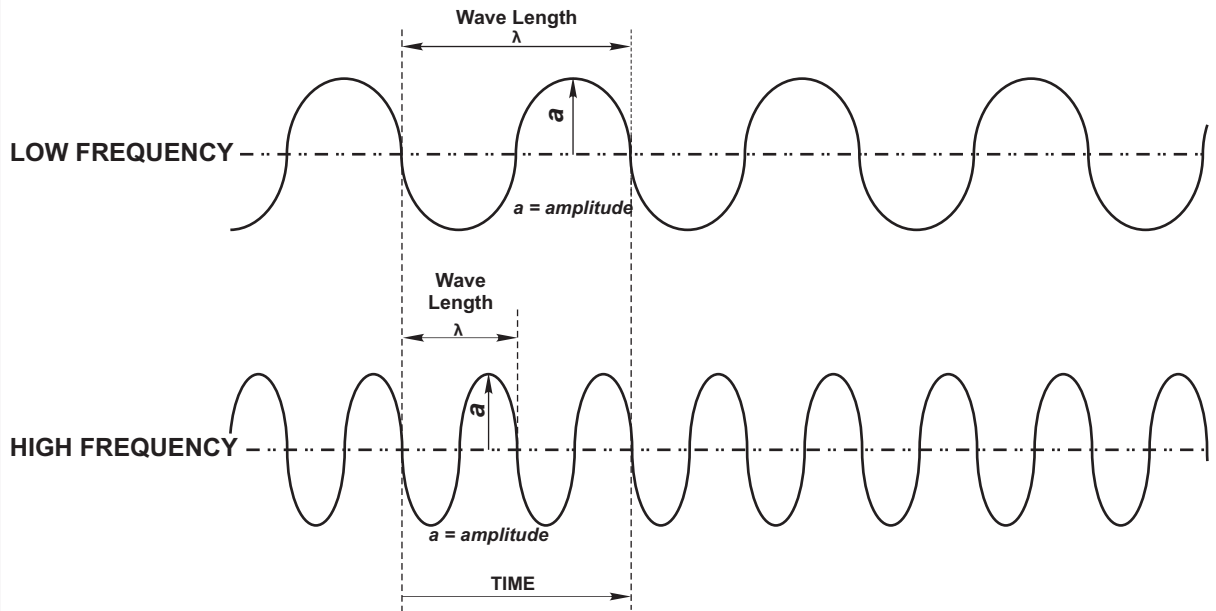
Rule of Thumb:

Sound attenuation is measured using a logarithmic scale. Within the range applicable to most doorsets, an *Rw*.3dB variation in performance may be taken to be a doubling or halving of performance. e.g. an *Rw*.36dB doorset provides for double the performance of an *Rw*.33dB doorset.



Wavelength Amplitude & Frequency

Fig. 10.1



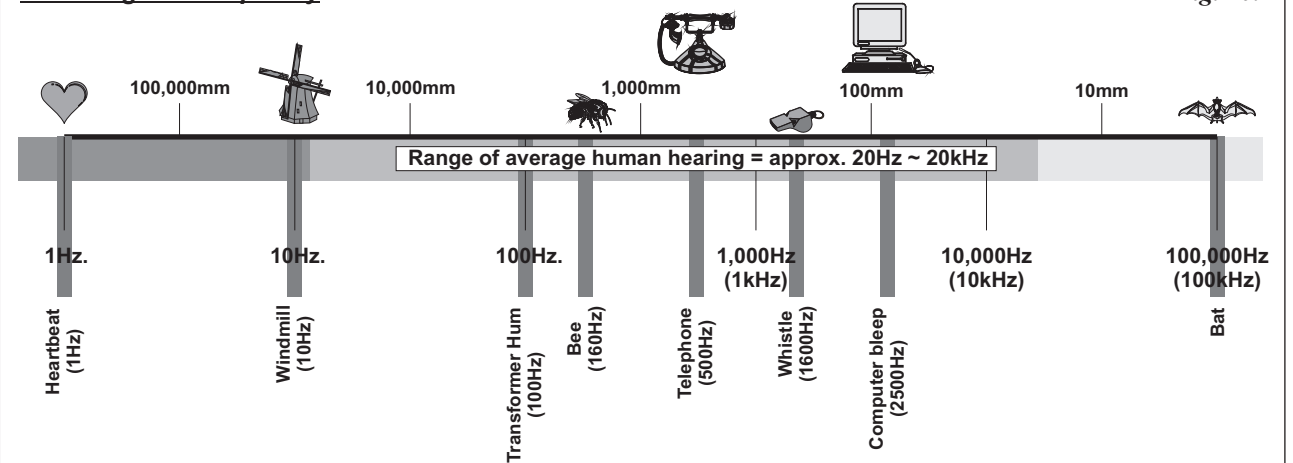
Wave Length = The dimension from one point of a wave to the next corresponding point.

Amplitude = The sound pressure or loudness.

Frequency = The number of sound waves that pass a fixed point in a second. (Hz. = Hertz.)

Wavelength & Frequency

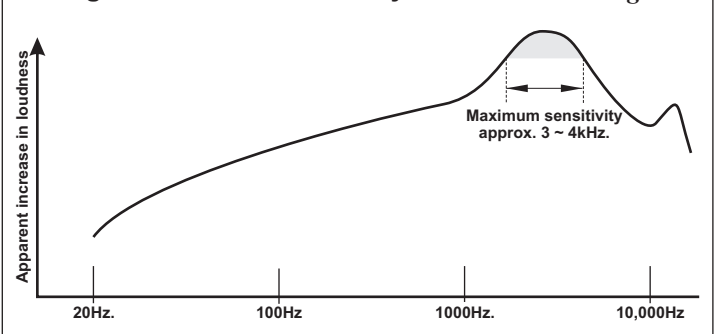
Fig. 10.2



Human sensitivity to sound is an individual thing and may vary from person to person for a number of reasons, including age. If sound is generated at the same sound pressure levels (*loudness*) over the full range of audible frequencies then sound in the region of 3 ~ 4kHz. would be perceived to be predominant. Standards for acoustic measurements relate to a frequency range between 100Hz. ~ 4,000Hz. being the most sensitive range for average human hearing.

Average Human Ear Sensitivity

Fig. 10.3





Sound Attenuating Doorsets:

Rev.D

Generally any material will provide for a sound attenuating performance if used as a barrier between a sound source and a 'protected' area. Some materials provide for better performances than others.

Doorsets are essentially functional products with a primary purpose to provide for a means for 'traffic' to pass from one side of a wall to the other. For this purpose the door must be open. As the thing that we are trying to stop is the transfer of airborne sound then an open door will not provide for any performance. When the door is closed, the sound attenuating performance will be influenced by the residual airflow across the doorset. To minimise the airflow it is necessary to use sealing systems.

Some door constructions have been specifically developed to provide for excellent sound attenuating performances when used with suitable sealing systems. Some of these 'specialist' constructions rely on the mass law technology. i.e. generally increased mass provides for improved sound attenuating performances. However, there is not a direct relationship between mass and sound attenuating performances. Adding a dense material such as lead will generally improve performances but this will also change the characteristics of the doorset resulting in significant improvements at some frequencies with no improvement or even a loss of performance at other frequencies. Other 'specialist' door constructions rely on air gap technology in a similar manner to that used for glazed units. Essentially the air trapped in a gap will convert sound energy into heat energy with an improvement in sound attenuating performances. Use of facing materials that change the stiffness of the door or hardware fittings that bridge the door thickness can have an adverse influence on doors of this design.

To determine the precise performance of a sound attenuating doorset design it is necessary to carry out testing of a specimen that is identical in all respects to the design that is intended for use. The following factors can influence sound attenuating performances:

- Door size.
- Door configuration.
- Facing materials.
- Glazing.
- Choice of hardware.
- Frame section dimensions.
- Sealing systems.
- Nature of the surround structure.
- Method and quality of installation.

The only method for determining the precise performance to be expected of a doorset design is to test a product that is identical in all respects to the product that is intended for use in the building with the specimen installed into a structure in a manner that replicates precisely the methods intended for use.

FLAMEBREAK® is essentially a general purpose door core material and has not been designed as a 'dedicated' sound attenuating product. However, Pacific Rim Wood Ltd. have carried out an extensive range of tests to determine potential sound attenuating performances and to develop the product to suit the demands of published regulations, specifically:

Building Regulations - (England & Wales) - Approved Document 'E' = Rw.29dB for entrance doors to residential units.

Building Bulletin 93 - Educational Establishments - Classroom and Lecture areas = Rw.30dB.

Building Bulletin 93 - Educational Establishments - Music Rooms = Rw.35dB.

To determine potential performances, tests were carried out using a 2040x926mm door leaf size, being the largest size single leaf dimension anticipated by reference to BS4787 Pt.1. The influence of meeting stiles was determined by use of smaller sized doors to create an unequal pair that would fit in the 'standard' frame used for the single leaf door tests.

When tested with glazing, the glass aperture dimensions were carefully calculated to provide for a clear glass area equal to 25% of the single leaf door area.

NOTE: It is important to carefully seal around the glass using suitable mastic to minimise the risk of sound leakage through the beading system.

The use of sealing systems is an essential requirement to provide for sound attenuating performances and these were carefully selected to provide for the following considerations:

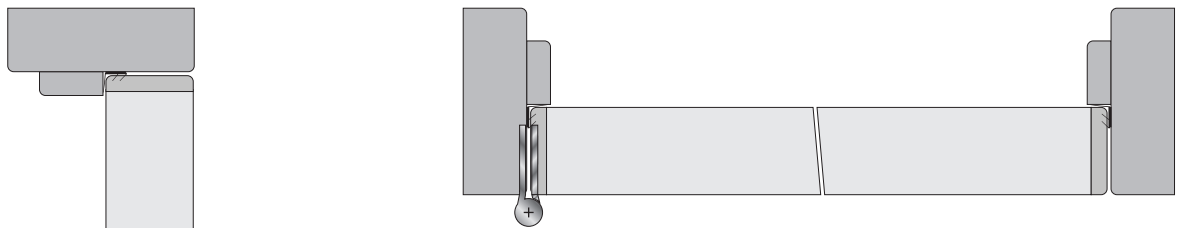
- 1/ The sealing systems should have minimal influence on the operation of the door, with due regard to BS8300 and Building Regulations - (England & Wales) - Approved Document 'M'.
- 2/ It should not be necessary to interrupt sound attenuating sealing systems to accommodate items of hardware. (i.e. provide for a minimal risk of conflict between seals and ironmongery).
- 3/ Sealing systems used for sound attenuating purposes should also be able to provide for smoke sealing performances (BS476 : Section 31.1).
- 4/ Sound attenuating sealing systems should not conflict with intumescent sealing systems.



Rw.29dB ~ Rw.30dB

FLAMEBREAK 430 - 44mm - Single Leaf - Single Swing - Flush Door.

Fig. 10.4



FLAMEBREAK 430
44mm flush door.

Fully Caulked = Rw. 30dB

Norsound 710 to head & Jambs
with Norsound 810 to threshold

= Rw.29dB.

*Norsound 810 Automatic door bottoms
may be used with Norsound thresholds
(See pages 14 & 16) - recommended where
soft floor finishes (e.g. carpets) are used*

44mm FLAMEBREAK 430®
Single leaf - Single Swing



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 430 - 44mm - Flush Door - Single Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Tested Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	N/A	C/08/5L/20184/R01 Test 56	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 850 + 650	N/A	N/A	C/08/5L/20184/R01 Test 57	Rw.30dB

FLAMEBREAK FF630 - 44mm - Flush Door - Single Leaf - Single Action

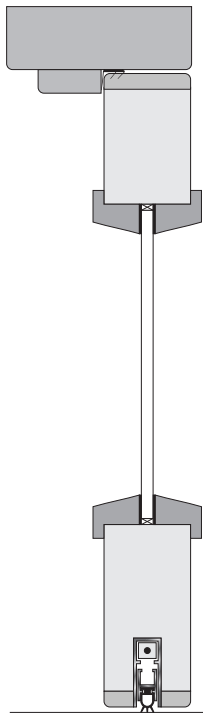
Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Tested Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	N/A	C/08/5L/20184/R01 Test 78	Rw.29dB



Rw.29dB ~ Rw.32dB

FLAMEBREAK 430 - 44mm - Single Leaf - Single Swing - Glazed Door.

Fig. 10.5



FLAMEBREAK 430
44mm glazed door.

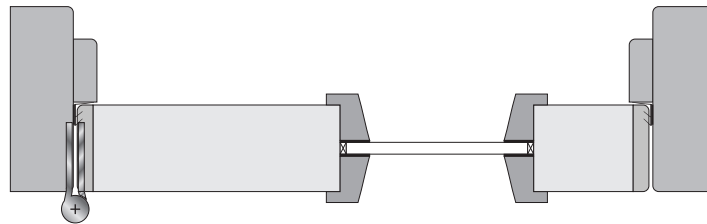
Flush Door Fully Caulked
= Rw. 30dB

Norsound 710 to head & Jambs with
Norsound 810 to threshold

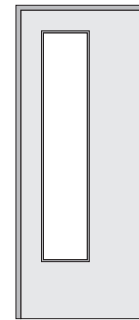
= Rw.32dB.

Door glazed with 6mm Pilkington
'Pyroshield' glass with a 25% clear
glass area.

*Norsound 810 Automatic door bottoms
may be used with Norsound thresholds
(See pages 14 & 16) - recommended where
soft floor finishes (e.g. carpets) are used*



44mm FLAMEBREAK 430®
Single leaf - Single Swing - Glazed



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 430 - 44mm - Glazed Door - Single Leaf - Single Action - 25% Glazing.

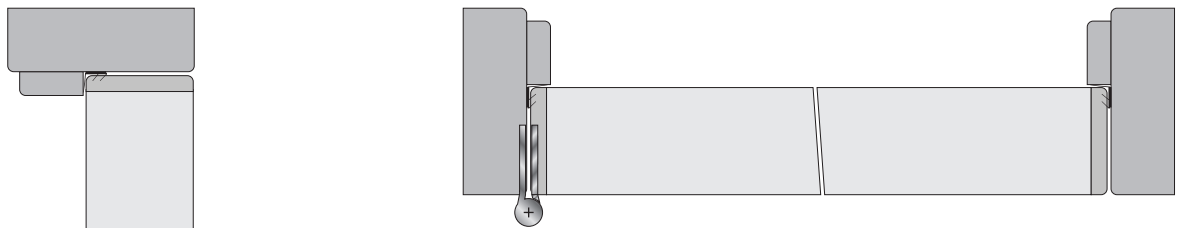
Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Tested Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	6mm Pyroshield	C/08/5L/20184/R01 Test 117	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	7mm Pyrobelite	C/08/5L/20184/R01 Test 52	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	10mm Pyrodur	C/08/5L/20184/R01 Test 118	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	12mm Pyrobelite	C/08/5L/20184/R01 Test 48	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	15mm Pyrostop	C/08/5L/20184/R01 Test 119	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	16mm Pyrobel	C/08/5L/20184/R01 Test 50	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	16.8mm Optilam Phon	C/08/5L/20184/R01 Test 120	Rw.32dB



Rw.29dB ~ Rw.34dB

FLAMEBREAK 660 - 54mm - Single Leaf - Single Swing - Flush Door.

Fig. 10.6



FLAMEBREAK 660
54mm flush door.

Fully Caulked = Rw. 35dB

Norsound 710 to head & Jamb
with Norsound 810 to threshold

= Rw.32dB.

*Norsound 810 Automatic door bottoms
may be used with Norsound thresholds
(See pages 14 & 16) - recommended where
soft floor finishes (e.g. carpets) are used*

54mm FLAMEBREAK 660®
Single leaf - Single Swing



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 660 - 54mm - Flush Door - Single Leaf - Single Action.

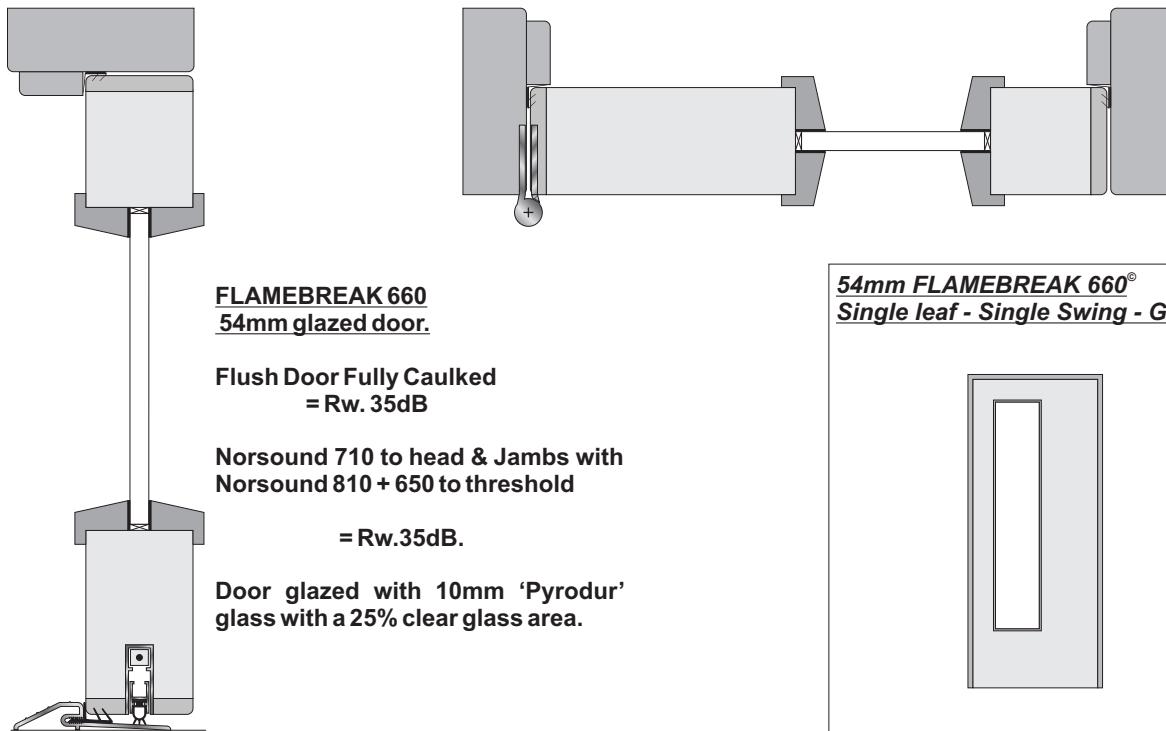
Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Tested Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	N/A	C/08/5L/20184/R01 Test 27	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 850 + 650	N/A	N/A	C/08/5L/20184/R01 Test 26	Rw.34dB



Rw.29dB ~ Rw.35dB

FLAMEBREAK 660 - 54mm - Single Leaf - Single Swing - Glazed Door.

Fig. 10.7



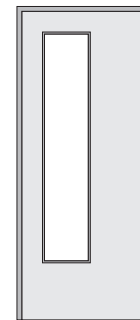
FLAMEBREAK 660
54mm glazed door.

Flush Door Fully Caulked
= Rw. 35dB

Norsound 710 to head & Jambs with
Norsound 810 + 650 to threshold
= Rw.35dB.

Door glazed with 10mm 'Pyrodur'
glass with a 25% clear glass area.

54mm FLAMEBREAK 660®
Single leaf - Single Swing - Glazed



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 660 - 54mm - Glazed Door - Single Leaf - Single Action - 25% Glazing.

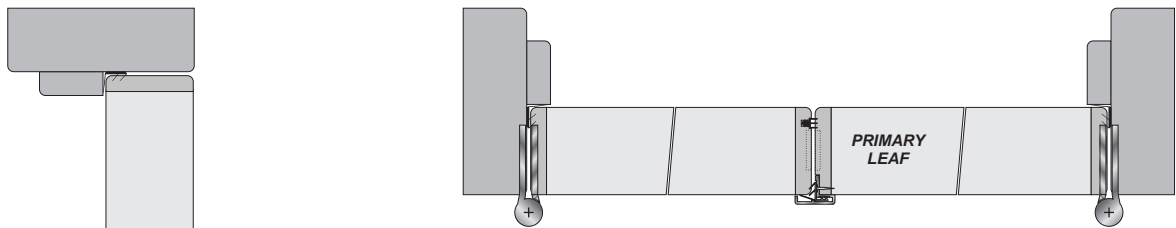
Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Tested Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	6mm Pyroshield	C/08/5L/20184/R01 Test 39	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	6mm Pyroshield	C/08/5L/20184/R01 Test 60	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	7mm Pyrobelite	C/08/5L/20184/R01 Test 34	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	12mm Pyrobelite	C/08/5L/20184/R01 Test 35 & 36	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	11.5mm 3 ply Res Glass	C/08/5L/20184/R01 Test 38	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	16.8mm Optilam-Phon	C/08/5L/20184/R01 Test 137	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	10mm Pyrodur	C/08/5L/20184/R01 Test 141	Rw.35dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	15mm Pyrostop	C/08/5L/20184/R01 Test 142	Rw.35dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	16.8mm Optilam-Phon	C/08/5L/20184/R01 Test 138	Rw.35dB



Rw.29dB ~ Rw.31dB

FLAMEBREAK 430 - 44mm - Double Leaf (pairs) - Single Swing - Flush Door.

Fig. 10.8



FLAMEBREAK 430
44mm flush door.

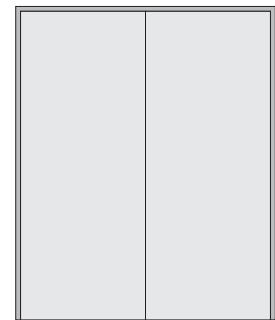
Fully Caulked = Rw. 32dB

Norsound 710 to head & Jamb
with Norsound 810 to threshold
(both doors). Norsound 720 +
Norsound 510 to meeting stiles.

= Rw.32dB.

*Norsound 810 Automatic door bottoms
may be used with Norsound thresholds
(See pages 14 & 16) - recommended where
soft floor finishes (e.g. carpets) are used*

44mm FLAMEBREAK 430®
Double leaf - Single Swing



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 430 - 44mm - Flush Door - Double Leaf (pairs) - Single Action.

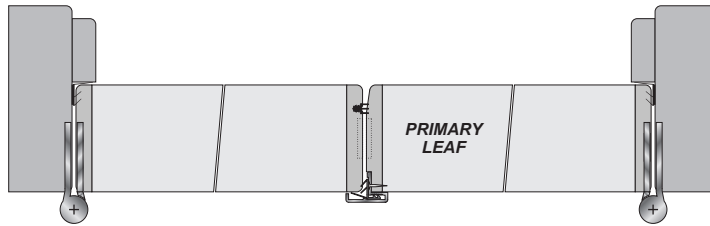
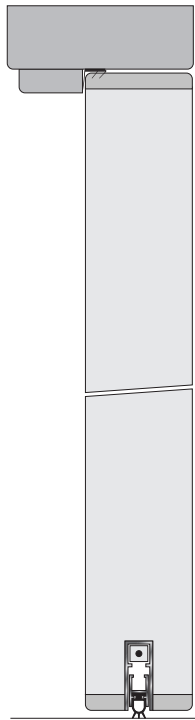
Hanging Jamb	Hanging Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Tested Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810/810	Norsound 720	N/A	C/08/5L/20184/R01 Test 72	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810/810	Norsound 720/510	N/A	C/08/5L/20184/R01 Test 69	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810/810	Norsound 2x755 + 720	N/A	C/08/5L/20184/R01 Test 70	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810/810	Norsound 855 + 855 Carrier only + 720	N/A	C/08/5L/20184/R01 Test 71	Rw.31dB



Rw.29dB ~ Rw.34dB

FLAMEBREAK 660 - 54mm - Double Leaf (pairs) - Single Swing - Flush Door.

Fig. 10.9



FLAMEBREAK 660
54mm flush door.

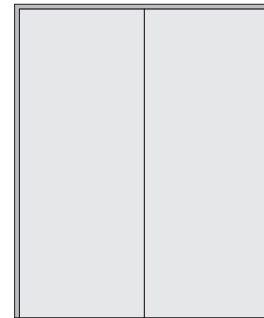
Fully Caulked = Rw. 35dB

Norsound 710 to head & Jambs with Norsound 810 to threshold (both doors). Norsound 720 + Norsound 510 to meeting stiles.

= Rw.34dB.

Norsound 810 Automatic door bottoms may be used with Norsound thresholds (See pages 14 & 16) - recommended where soft floor finishes (e.g. carpets) are used

54mm FLAMEBREAK 660®
Double leaf - Single Swing



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 660 - 54mm - Flush Door - Double Leaf (pairs) - Single Action.

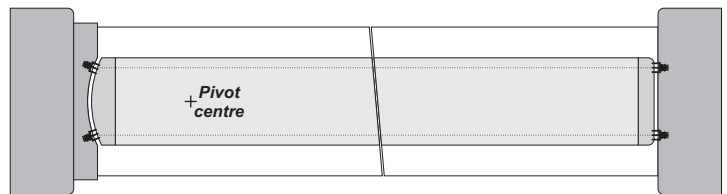
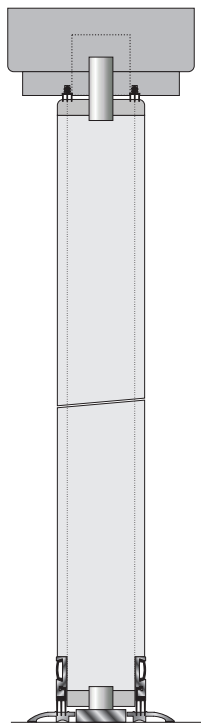
Hanging Jamb	Hanging Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Tested Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810/810	Norsound 510	N/A	C/08/5L/20184/R01 Test 83	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810/810	Norsound 510 + 720	N/A	C/08/5L/20184/R01 Test 82	Rw.34dB
Norsound 755	Norsound 755	Norsound 755	Norsound 810/810	Norsound 720 + 2x755	N/A	C/04/5L/0938/1 Test 84	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810/810	Norsound 855 + 855 Carrier only + 720	N/A	C/08/5L/20184/R01 Test 85	Rw.34dB



Rw.28dB

FLAMEBREAK 430 - 44mm - Single Leaf - Double Swing - Flush Door.

Fig. 10.10



FLAMEBREAK 430
44mm flush door.

Fully Caulked = Rw. 29dB

2x Norsound 720 to head & Jamb with 2x Norsound 855 to threshold used in conjunction with Norsound 620 low level threshold.

= Rw.28dB.

44mm FLAMEBREAK 430®
Single leaf - Double Swing



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 430 - 44mm - Flush Door - Single Leaf - Double Action.

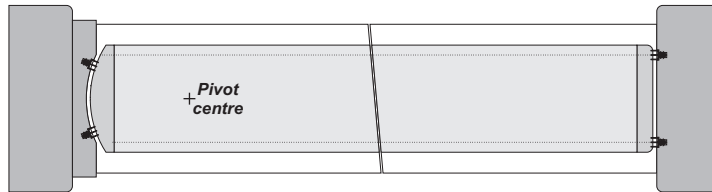
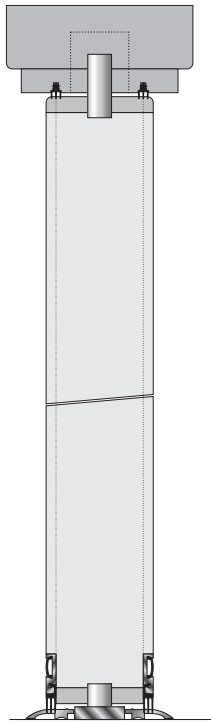
Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Tested Performance
Norsound 2x720	Norsound 2x720	Norsound 2x720	Norsound 2x855 used with 620 or 625 threshold.	N/A	N/A	C/08/5L/20184/R01 Test 111	Rw.28dB



Rw.29dB ~ Rw.30dB

FLAMEBREAK 660 - 54mm - Single Leaf - Double Swing - Flush Door.

Fig. 10.11



FLAMEBREAK 660
54mm flush door.

Fully Caulked = Rw. 32dB

2x Norsound 720 to head & Jamb with 2x Norsound 855 to threshold used in conjunction with Norsound 620 low level threshold.

= Rw.30dB.

54mm FLAMEBREAK 660®
Single leaf - Double Swing



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 660 - 54mm - Flush Door - Single Leaf - Double Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Tested Performance
Norsound 2x720	Norsound 2x720	Norsound 2x720	Norsound 2x855 used with 620 threshold.	N/A	N/A	C/08/5L/20184/R01 Test 105	Rw.30dB

Acoustic Assessments

SECTION 10a



About this document:

It would be an almost impossible task to physically test every conceivable variant to a doorset design including variations to:

- door leaf dimensions.
- doorset configurations.
- door facings.
- glazed area.
- glass types.
- beading systems.
- hardware variations.
- variations to operating gaps.
- variations to sealing systems.
- quality of installation.

All of the above considerations can influence the sound attenuating performance of a doorset and to only method for determining with certainty the performance of a particular design is to test a doorset that conforms in all respects to the product actually required.

Notwithstanding the above, it is possible to test sound attenuating doorsets to determine guidance information that is of use to acoustic engineers in determining doorset designs to meet particular application requirements.

To provide for the guidance data, Pacific Rim Wood UK Ltd. have carried out a series of sound attenuating tests under laboratory conditions to the requirements of BS EN ISO 140-3 : 1995 with test results expressed as a single weighted index in accordance with BS EN ISO 717-1 : 1997.

For single leaf doorsets, the door leaf dimension selected for test was 2040x926mm with this being the largest single leaf dimension for internal use anticipated by reference to BS4787 Pt.1 : 1980. Operating gaps used for the purpose of testing conformed with the recommended dimensions described in BS4787 Pt.1 where possible but with adjustment as necessary to ensure correct operation of the doors to accommodate sealing systems.

To permit the use of the same test frame, pairs of doors were tested in an unequal leaf configuration using a 626mm wide primary leaf with a secondary leaf sized Nom. 300mm wide so that meeting stile sealing systems could be tested.

For glazed doors, a clear glass area of 25% of the door leaf area was selected with this being a sufficient area to measure the influence of various glass types and beading systems on the door leaf while not overwhelming the door performance. i.e. measuring the influence of the glass on the door rather than the door on the glass. Further, the glazed areas generally fell within the scope of dimensional limitations that are applied to FLAMEBREAK® door constructions for fire door applications.

NOTE: Other glass areas have been tested to provide for guidance with regard to the influence of variations to glazed areas.

This document has been prepared in response to requests from the users of FLAMEBREAK® to provide for additional assessment guidance relating to doorset configurations that have not been tested up to the time of publication.

Where the particular configuration has been tested the test reference is shown in this document. Other configurations have been assessed on behalf of Norsound Ltd. on the basis of experience gained after conducting in excess of two hundred tests.

The assessed performances are related to test data owned by Pacific Rim Wood UK Ltd. and other base test data owned 'by others' but authorised for use by Pacific Rim Wood UK Ltd.

The assessed performances indicate potential performances related to variations in doorset configurations that would be expected if doorsets constructed to the illustrated designs were to be laboratory tested to the requirements of BS EN ISO 140-3 : 1995 with test results expressed as a single weighted index in accordance with BS EN ISO 717-1 : 1997. The assessed performances are based upon use of the illustrated sealing systems where these are competently installed and located in accordance with the guidance given in this document.


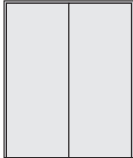

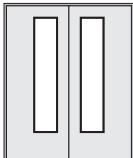

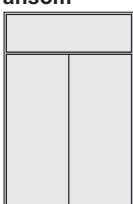

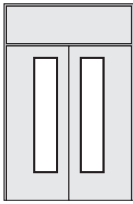

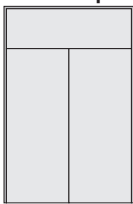

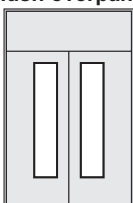
Pages 3 ~ 31 illustrate some doorset configurations with related tested and assessed performance data. Pages 32 ~ 46 includes recommendations for the use of Norsound sealing systems and provides for possible alternative sealing systems to those described by reference to pages 3 ~ 31. These pages also provide for further guidance to indicate the influence of glazing with further recommendations with regard to hardware.

2

Acoustic Assessments



Fig. 10a.1

Configuration	Tested & Assessed Performances	Configuration	Tested & Assessed Performances
Single Leaf Door Height Doorset 	<u>44mm FLAMEBREAK 430</u> [®] page 3 - Rw.29~30dB page 27 - Rw.28dB page 29 - Rw.40dB page 30 - Rw.29dB	Double Leaf Door Height Doorset 	<u>44mm FLAMEBREAK 430</u> [®] page 15 - Rw.29~31dB
	<u>54mm FLAMEBREAK 660</u> [®] page 9 - Rw.29~34dB page 28 - Rw.29~30dB		<u>54mm FLAMEBREAK 660</u> [®] page 21 - Rw.29~35dB
Single Leaf - Glazed Door Height Doorset 	<u>44mm FLAMEBREAK 430</u> [®] page 4 - Rw.29~32dB	Double Leaf - Glazed Door Height Doorset 	<u>44mm FLAMEBREAK 430</u> [®] page 16 - Rw.29~34dB
	<u>54mm FLAMEBREAK 660</u> [®] page 10 - Rw.29~35dB		<u>54mm FLAMEBREAK 660</u> [®] page 22 - Rw.29~36dB
Single Leaf Storey Height Doorset with transom 	<u>44mm FLAMEBREAK 430</u> [®] page 5 - Rw.29~30dB	Double Leaf Storey Height Doorset with transom 	<u>44mm FLAMEBREAK 430</u> [®] page 17 - Rw.29~31dB
	<u>54mm FLAMEBREAK 660</u> [®] page 11 - Rw.29~34dB		<u>54mm FLAMEBREAK 660</u> [®] page 23 - Rw.29~35dB
Single Leaf - Glazed Storey Height Doorset with transom 	<u>44mm FLAMEBREAK 430</u> [®] page 6 - Rw.29~32dB	Double Leaf - Glazed Storey Height Doorset with transom 	<u>44mm FLAMEBREAK 430</u> [®] page 18 - Rw.29~34dB
	<u>54mm FLAMEBREAK 660</u> [®] page 12 - Rw.29~35dB		<u>54mm FLAMEBREAK 660</u> [®] page 24 - Rw.29~36dB
Single Leaf Storey Height Doorset with Flush overpanel 	<u>44mm FLAMEBREAK 430</u> [®] page 7 - Rw.29dB	Double Leaf Storey Height Doorset with Flush overpanel 	<u>44mm FLAMEBREAK 430</u> [®] page 19 - Rw.29~30dB
	<u>54mm FLAMEBREAK 660</u> [®] page 13 - Rw.29~32dB		<u>54mm FLAMEBREAK 660</u> [®] page 25 - Rw.29~33dB
Single Leaf - Glazed Storey Height Doorset with Flush overpanel 	<u>44mm FLAMEBREAK 430</u> [®] page 8 - Rw.29~31dB	Double Leaf - Glazed Storey Height Doorset with Flush overpanel 	<u>44mm FLAMEBREAK 430</u> [®] page 20 - Rw.29~32dB
	<u>54mm FLAMEBREAK 660</u> [®] page 14 - Rw.29~33dB		<u>54mm FLAMEBREAK 660</u> [®] page 26 - Rw.29~34dB

The following illustrations show some sealing options offered by NORSOUND. Alternative sealing arrangements are available - contact NORSOUND Ltd. for further information.

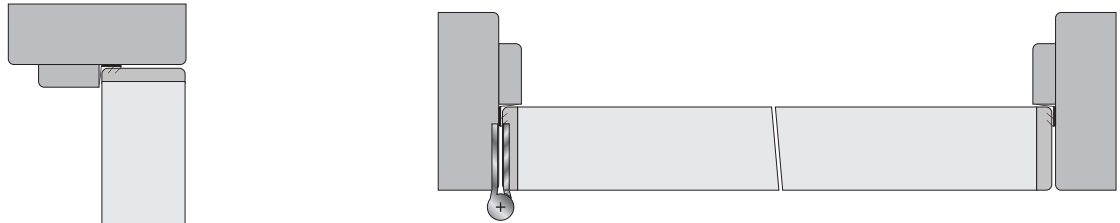


Rw.29dB ~ Rw.30dB

Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 430[®] 44mm - Single Leaf - Single Swing - Flush Door.

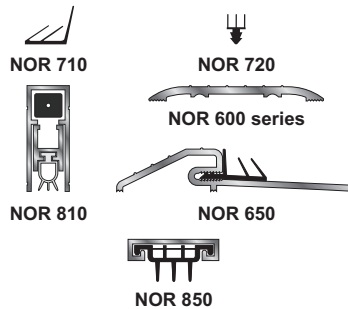
Fig.10a.1



44mm FLAMEBREAK 430[®] Single leaf - Single Swing



NORSOUND Seal Types:



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

FLAMEBREAK 430[®] 44mm - Flush Door - Single Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	N/A	C/08/5L/20184/R01 Test 56	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 615	N/A	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 850 + 615	N/A	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 2x720 + 615	N/A	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	N/A	C/08/5L/20184/R01 Test 57	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 2x720 + 650	N/A	N/A	ASSESSED	Rw.30dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

FLAMEBREAK FF630[®] 44mm - Flush Door - Single Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	N/A	C/08/5L/20184/R01 Test 78	Rw.29dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

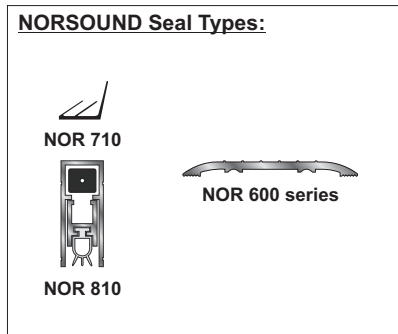
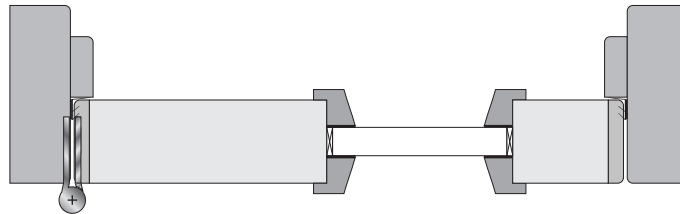
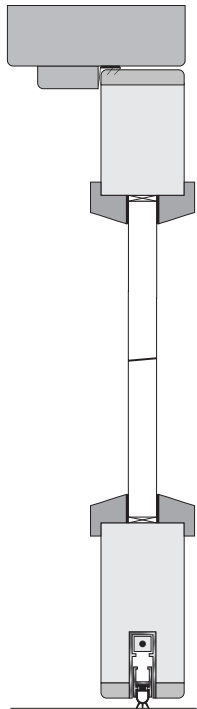


Rw.29dB ~ Rw.32dB

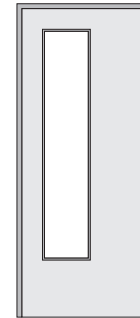
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 430® 44mm - Single Leaf - Single Swing - Glazed Door.

Fig.10a.2



44mm FLAMEBREAK 430® Single leaf - Single Swing - Glazed



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

FLAMEBREAK 430® 44mm - Glazed Door - Single Leaf - Single Action - 25% Glazing.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	6mm Pyroshield	C/08/5L/20184/R01 Test 117	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	7mm Pyrobelite	C/08/5L/20184/R01 Test 52	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	10mm Pyrodur	C/08/5L/20184/R01 Test 118	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	12mm Pyrobelite	C/08/5L/20184/R01 Test 48	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	15mm Pyrostop	C/08/5L/20184/R01 Test 119	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	16mm Pyrobel	C/08/5L/20184/R01 Test 50	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	16.5mm Optilam Phon	C/08/5L/20184/R01 Test 120	Rw.32dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

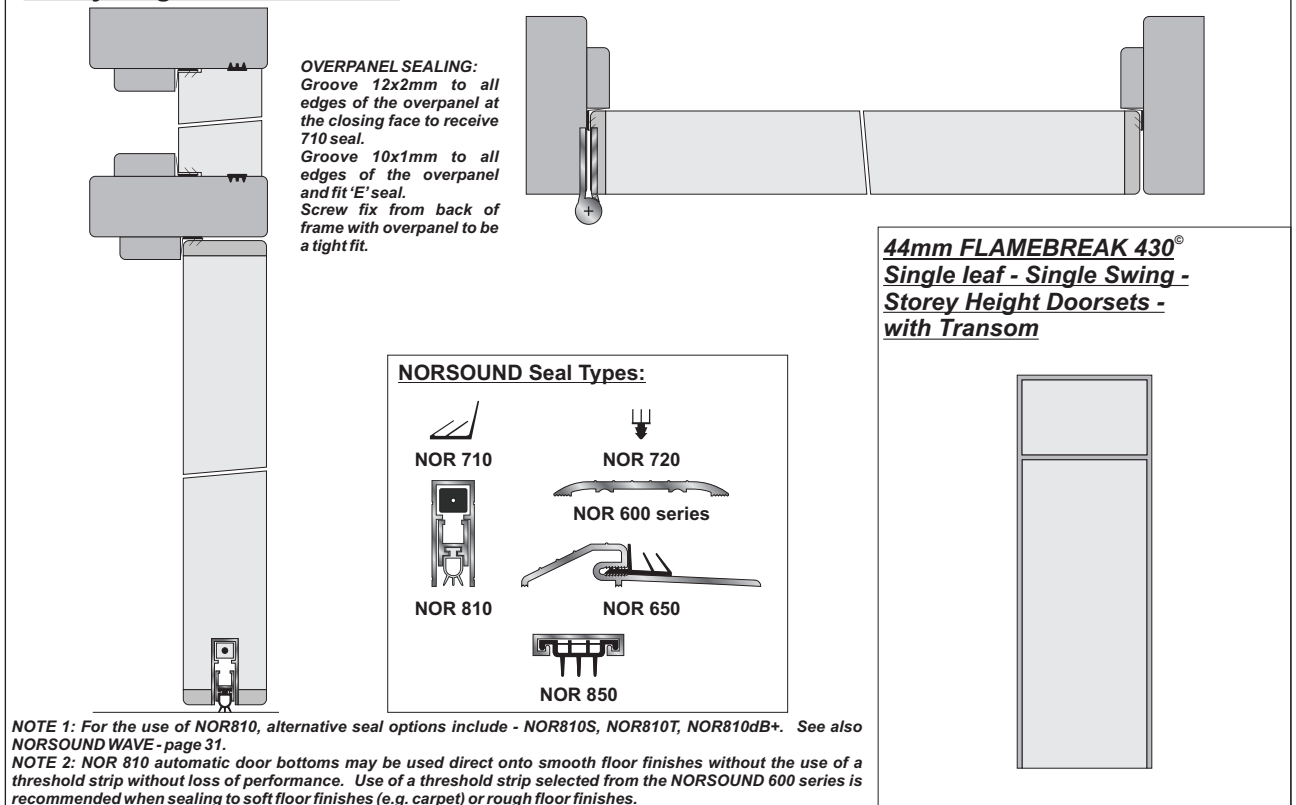


Rw.29dB ~ Rw.30dB

Diagrams for illustration purposes only.
See schedule below for further guidance.

FLAMEBREAK 430[®] 44mm - Single Leaf - Single Swing - Flush Door - Storey Height - with Transom.

Fig. 10a.3



FLAMEBREAK 430[®] 44mm - Flush Door - Single Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 615	N/A	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 850 + 615	N/A	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 2x720 + 615	N/A	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	N/A	ASSESSED	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 2x720 + 650	N/A	N/A	ASSESSED	Rw.30dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

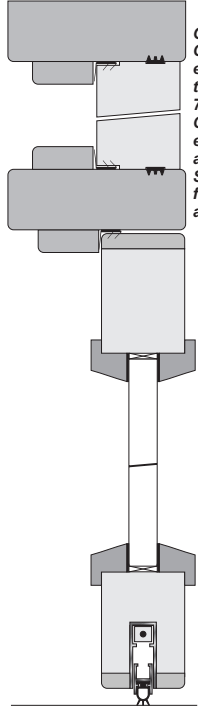


Rw.29dB ~ Rw.32dB

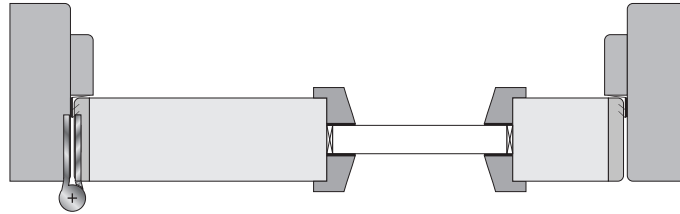
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 430® 44mm - Single Leaf - Single Swing - Glazed Door Storey Height - with Transom.

Fig.10a.4



OVERPANEL SEALING:
Groove 12x2mm to all edges of the overpanel at the closing face to receive 710 seal.
Groove 10x1mm to all edges of the overpanel and fit 'E' seal.
Screw fix from back of frame with overpanel to be a tight fit.



NORSOUND Seal Types:



NOR 710

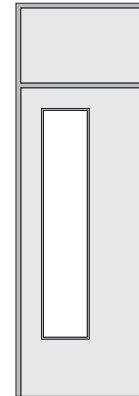


NOR 810



NOR 600 series

44mm FLAMEBREAK 430® Single leaf - Single Swing - Glazed Storey Height Doorsets - with Transom



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on all edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to all edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs and underside of the transom rail.

FLAMEBREAK 430® 44mm - Glazed Door - Single Leaf - Single Action - 25% Glazing - Storey Height - with Transom.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	6mm Pyroshield	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	7mm Pyrobelite	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	10mm Pyrodur	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	12mm Pyrobelite	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	15mm Pyrostop	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	16mm Pyrobel	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	16.5mm Optilam Phon	ASSESSED	Rw.32dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

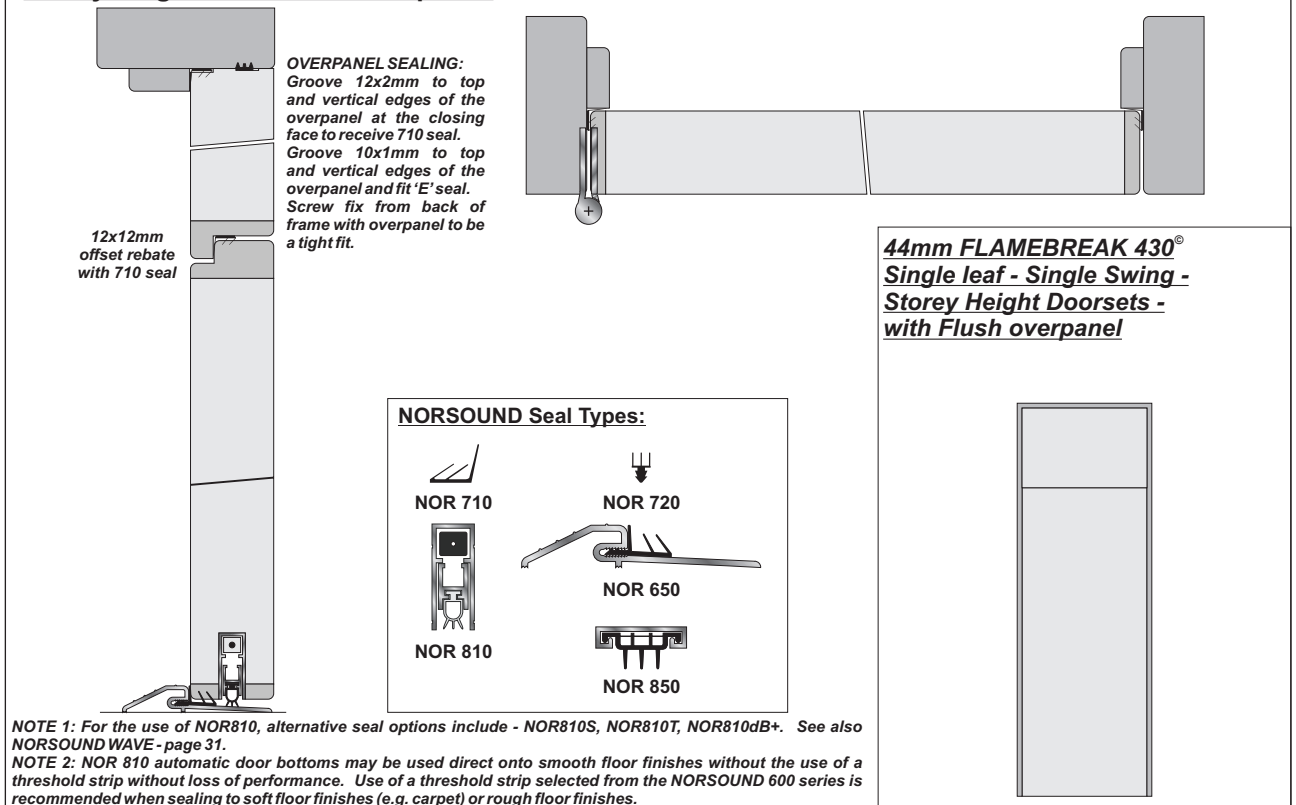


Rw.29dB

Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 430[®] 44mm - Single Leaf - Single Swing - Flush Door - Storey Height - with Flush overpanel.

Fig. 10a.5



NOTE: Overpanel sealed on top and vertical edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to top and vertical edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs. NOR710 seal to jambs to extend full threshold to frame head height. Horizontal NOR710 seal applied to bottom edge of the overpanel to full width of frame shoulder.

FLAMEBREAK 430[®] 44mm - Flush Door - Single Leaf - Single Action - Storey Height - with Flush overpanel.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 2x720 + 650	N/A	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 850 + 650	N/A	N/A	ASSESSED	Rw.29dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

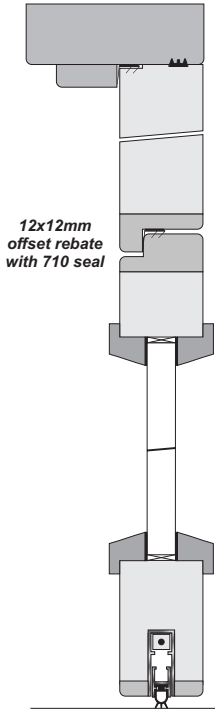


Rw.29dB ~ Rw.31dB

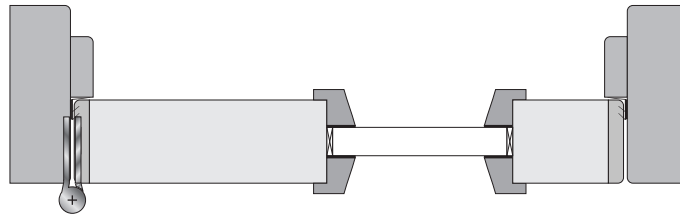
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 430® 44mm - Single Leaf - Single Swing - Glazed Door Storey Height - with Flush overpanel.

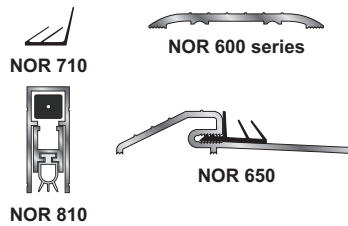
Fig.10a.6



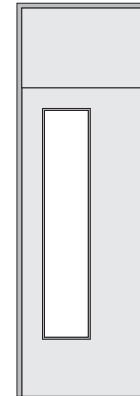
OVERPANEL SEALING:
Groove 12x2mm to top and vertical edges of the overpanel at the closing face to receive 710 seal.
Groove 10x1mm to top and vertical edges of the overpanel and fit 'E' seal.
Screw fix from back of frame with overpanel to be a tight fit.



NORSOUND Seal Types:



44mm FLAMEBREAK 430® Single leaf - Single Swing - Glazed Storey Height Doorsets - with Flush overpanel



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.
NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on top and vertical edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to top and vertical edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs. NOR710 seal to jambs to extend full threshold to frame head height. Horizontal NOR710 seal applied to bottom edge of the overpanel to full width of frame shoulder.

FLAMEBREAK 430® 44mm - Glazed Door - Single Leaf - Single Action - 25% Glazing - Storey Height - with Flush overpanel.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	10mm Pyrodur	ASSESSED	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	11.5mm 3 ply PA Res Glass	ASSESSED	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	12mm Pyrobelite	ASSESSED	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	15mm Pyrostop	ASSESSED	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	16.5mm Optilam Phon	ASSESSED	Rw.31dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

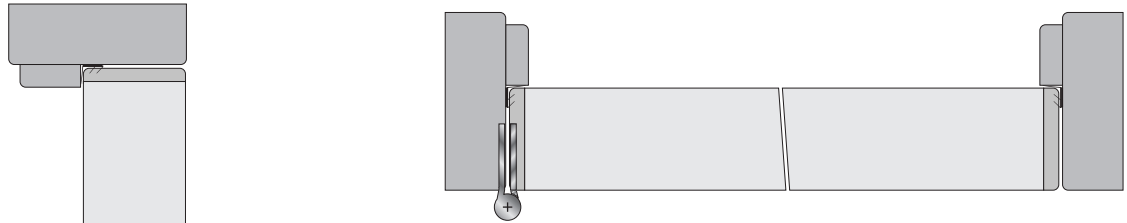


Rw.29dB ~ Rw.34dB

Diagrams for illustration purposes only.
See schedule below for further guidance.

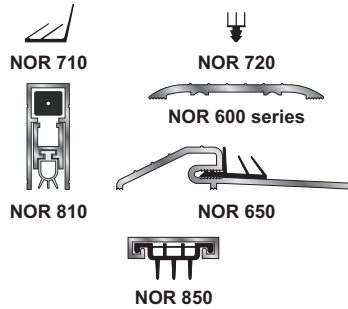
FLAMEBREAK 660[®] 54mm - Single Leaf - Single Swing - Flush Door.

Fig.10a.7



54mm FLAMEBREAK 660[®]
Single leaf - Single Swing

NORSOUND Seal Types:



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 660[®] 54mm - Flush Door - Single Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	N/A	C/08/5L/20184/R01 Test 27	Rw.32dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810	N/A	N/A	ASSESSED	Rw.33dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 850 + 625	N/A	N/A	ASSESSED	Rw.33dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 2x720 + 625	N/A	N/A	ASSESSED	Rw.33dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 650	N/A	N/A	ASSESSED	Rw.34dB
Norsound 755	Norsound 755	Norsound 755	Norsound 850 + 650	N/A	N/A	C/08/5L/20184/R01 Test 26	Rw.34dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

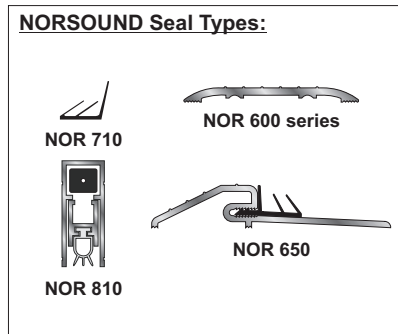
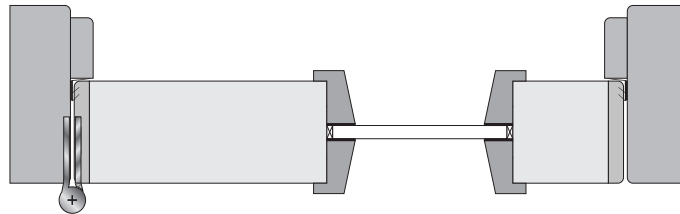
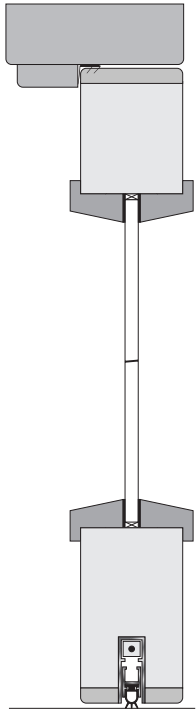


Rw.29dB ~ Rw.35dB

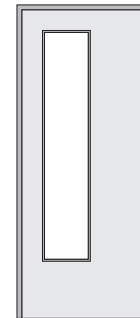
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660® 54mm - Single Leaf - Single Swing - Glazed Door.

Fig.10a.8



54mm FLAMEBREAK 660®
Single leaf - Single Swing - Glazed



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 660® 54mm - Glazed Door - Single Leaf - Single Action - 25% Glazing.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	6mm Pyroshield	C/08/5L/20184/R01 Test 39	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	6mm Pyroshield	C/08/5L/20184/R01 Test 60	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	7mm Pyrobelite	C/08/5L/20184/R01 Test 34	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	12mm Pyrobelite	C/08/5L/20184/R01 Test 35 & 36	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	11.5mm 3 ply Res Glass	C/08/5L/20184/R01 Test 38	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	16.8mm Optilam-Phon	C/08/5L/20184/R01 Test 137	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	10mm Pyrodour	C/08/5L/20184/R01 Test 141	Rw.35dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	15mm Pyrostop	C/08/5L/20184/R01 Test 142	Rw.35dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 + 650	N/A	16.8mm Optilam-Phon	C/08/5L/20184/R01 Test 138	Rw.35dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311



Rw.29dB ~ Rw.34dB

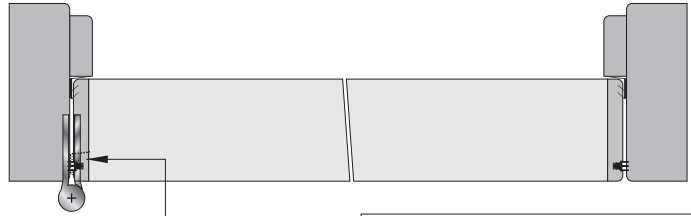
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660[®] 54mm - Single Leaf - Single Swing - Flush Door - Storey Height - with Transom.

Fig.10a.9

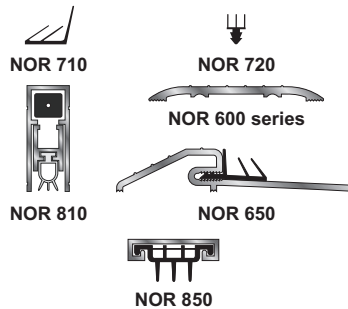


OVERPANEL SEALING:
Groove 12x2mm to all edges of the overpanel at the closing face to receive 710 seal.
Groove 10x1mm to all edges of the overpanel and fit 'E' seal.
Screw fix from back of frame with overpanel to be a tight fit.



For optimum sealing apply strips of NOR 710 seal over hinge blades with 710 seal blades to align with 720 seal blades.

NORSOUND Seal Types:



54mm FLAMEBREAK 660[®] Single leaf - Single Swing - Storey Height Doorsets - with Transom



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on all edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to all edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs and underside of the transom rail.

FLAMEBREAK 660[®] 54mm - Flush Door - Single Leaf - Single Action - Storey Height - with Transom.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	N/A	ASSESSED	Rw.32dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810	N/A	N/A	ASSESSED	Rw.33dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 850 + 625	N/A	N/A	ASSESSED	Rw.33dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 2x720 + 625	N/A	N/A	ASSESSED	Rw.33dB
Norsound 710+755	Norsound 710+755	Norsound 710+755	Norsound 850 + 650	N/A	N/A	ASSESSED	Rw.34dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 650	N/A	N/A	ASSESSED	Rw.34dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

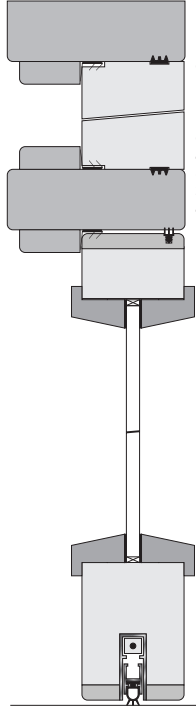


Rw.29dB ~ Rw.35dB

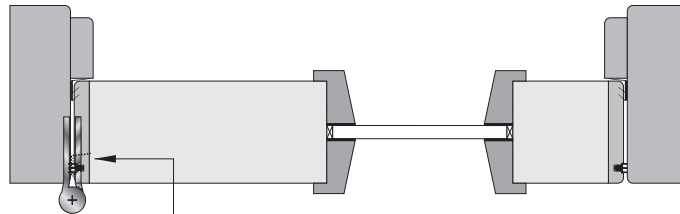
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660® 54mm - Single Leaf - Single Swing - Glazed Door - Storey Height - with Transom.

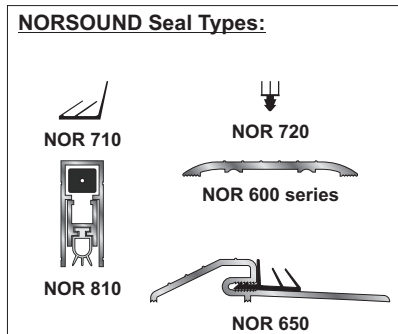
Fig.10a.10



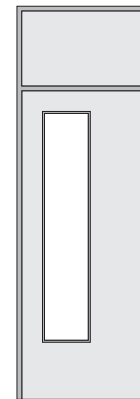
OVERPANEL SEALING:
Groove 12x2mm to all edges of the overpanel at the closing face to receive 710 seal.
Groove 10x1mm to all edges of the overpanel and fit 'E' seal.
Screw fix from back of frame with overpanel to be a tight fit.



For optimum sealing apply strips of NOR 710 seal over hinge blades with 710 seal blades to align with 720 seal blades.



54mm FLAMEBREAK 660® Single leaf - Single Swing - Glazed Storey Height Doorsets - with Transom



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on all edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to all edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs and underside of the transom rail.

FLAMEBREAK 660® 54mm - Glazed Door - Single Leaf - Single Action - 25% Glazing - Storey Height - with Transom.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	6mm Pyroshield	ASSESSED	Rw.33dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810 + 650	N/A	6mm Pyroshield	ASSESSED	Rw.34dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810	N/A	7mm Pyrobelite	ASSESSED	Rw.34dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810	N/A	12mm Pyrobelite	ASSESSED	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	11.5mm 3 ply Res Glass	ASSESSED	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	16.8mm Optilam-Phon	ASSESSED	Rw.34dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810 + 650	N/A	10mm Pyrodour	ASSESSED	Rw.35dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810	N/A	15mm Pyrostop	ASSESSED	Rw.35dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810 + 650	N/A	16.8mm Optilam-Phon	ASSESSED	Rw.35dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

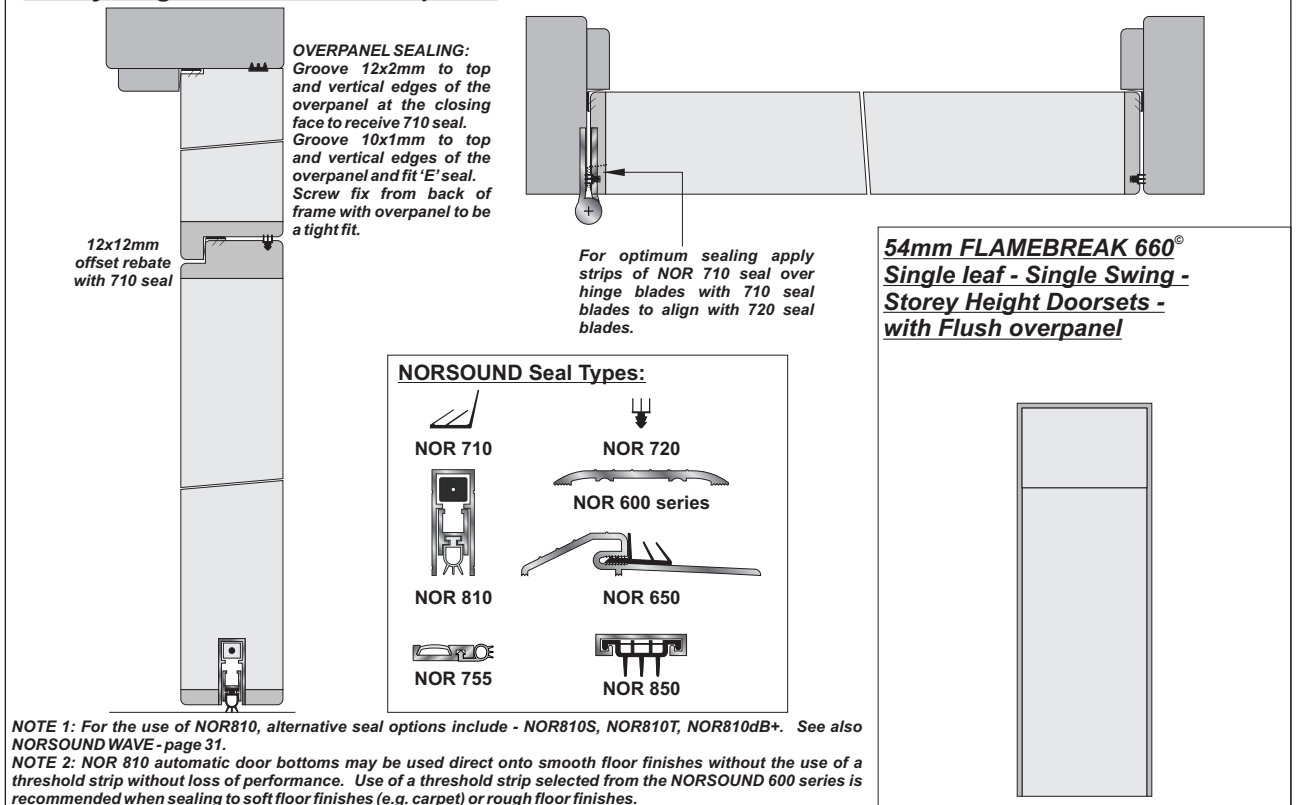


Rw.29dB ~ Rw.32dB

Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660[®] 54mm - Single Leaf - Single Swing - Flush Door - Storey Height - with Flush Overpanel.

Fig.10a.11



NOTE: Overpanel sealed on top and vertical edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to top and vertical edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs. NOR710 seal to jambs to extend full threshold to frame head height. Horizontal NOR710 seal applied to bottom edge of the overpanel to full width of frame shoulder.

FLAMEBREAK 660[®] 54mm - Flush Door - Single Leaf - Single Action - Storey Height - with Flush overpanel.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	N/A	ASSESSED	Rw.30dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810	N/A	N/A	ASSESSED	Rw.31dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 850 + 625	N/A	N/A	ASSESSED	Rw.31dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 2x720 + 625	N/A	N/A	ASSESSED	Rw.31dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 650	N/A	N/A	ASSESSED	Rw.32dB
Norsound 710+755	Norsound 710+755	Norsound 710+755	Norsound 850 + 650	N/A	N/A	ASSESSED	Rw.32dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

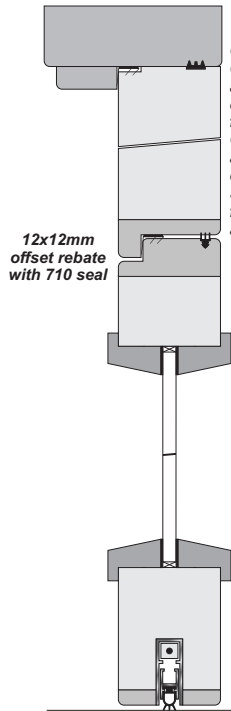


Rw.29dB ~ Rw.33dB

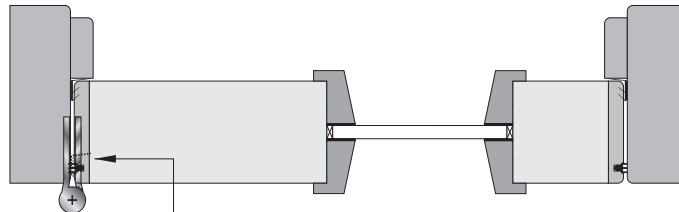
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660® 54mm - Single Leaf - Single Swing - Glazed Door - Storey Height - with Flush Overpanel.

Fig.10a.12

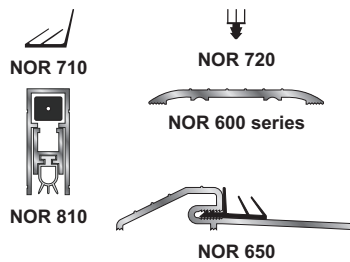


OVERPANEL SEALING:
Groove 12x2mm to top and vertical edges of the overpanel at the closing face to receive 710 seal.
Groove 10x1mm to top and vertical edges of the overpanel and fit 'E' seal. Screw fix from back of frame with overpanel to be a tight fit.

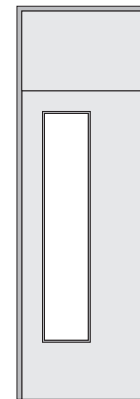


For optimum sealing apply strips of NOR 710 seal over hinge blades with 710 seal blades to align with 720 seal blades.

NORSOUND Seal Types:



54mm FLAMEBREAK 660® Single leaf - Single Swing - Glazed Storey Height Doorsets - with Flush overpanel



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on top and vertical edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to top and vertical edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs. NOR710 seal to jambs to extend full threshold to frame head height. Horizontal NOR710 seal applied to bottom edge of the overpanel to full width of frame shoulder.

FLAMEBREAK 660® 54mm - Glazed Door - Single Leaf - Single Action - 25% Glazing - Storey Height - with Flush overpanel.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	6mm Pyroshield	ASSESSED	Rw.31dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810 + 650	N/A	6mm Pyroshield	ASSESSED	Rw.32dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810	N/A	7mm Pyrobelite	ASSESSED	Rw.32dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810	N/A	12mm Pyrobelite	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	11.5mm 3 ply Res Glass	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810	N/A	16.8mm Optilam-Phon	ASSESSED	Rw.32dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810 + 650	N/A	10mm Pyrodour	ASSESSED	Rw.33dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810	N/A	15mm Pyrostop	ASSESSED	Rw.33dB
Norsound 710+720	Norsound 710+720	Norsound 710+720	Norsound 810 + 650	N/A	16.8mm Optilam-Phon	ASSESSED	Rw.33dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

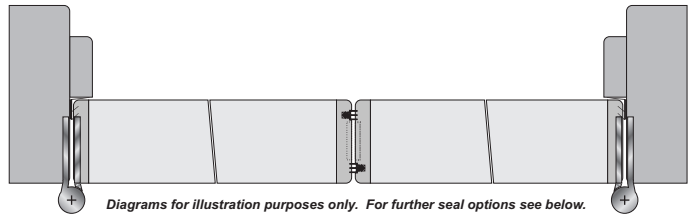
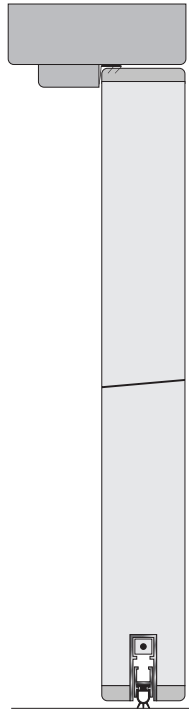


Rw.29dB ~ Rw.31dB

Diagrams for illustration purposes only. See schedule below for further guidance.

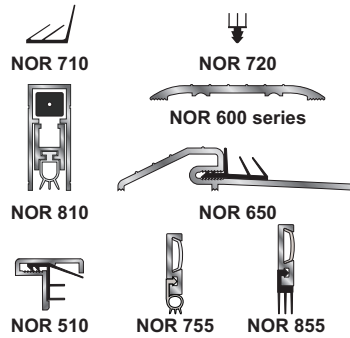
FLAMEBREAK 430[®] 44mm - Double Leaf (pairs) - Single Swing - Flush Door.

Fig.10a.13

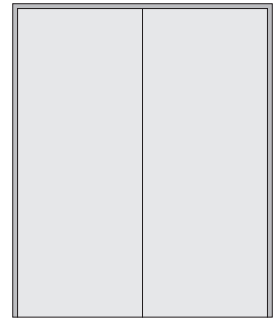


Diagrams for illustration purposes only. For further seal options see below.

NORSOUND Seal Types:



44mm FLAMEBREAK 430[®] Double leaf - Single Swing



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

FLAMEBREAK 430[®] 44mm - Flush Door - Double Leaf (pairs) - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720	N/A	C/08/5L/20184/R01 Test 72	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720+510	N/A	C/08/5L/20184/R01 Test 69	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 855 + 855 Carrier only + 720	N/A	C/08/5L/20184/R01 Test 71	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720+2x755	N/A	C/08/5L/20184/R01 Test 70	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 850 (each leaf) +625	Norsound 855 + 855 Carrier only + 720	N/A	ASSESSED	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	2No. Norsound 720 (each leaf) +625	Norsound 720+2x755	N/A	ASSESSED	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 650	Norsound 720+2x755	N/A	ASSESSED	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 650	Norsound 2x720	N/A	ASSESSED	Rw.31dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

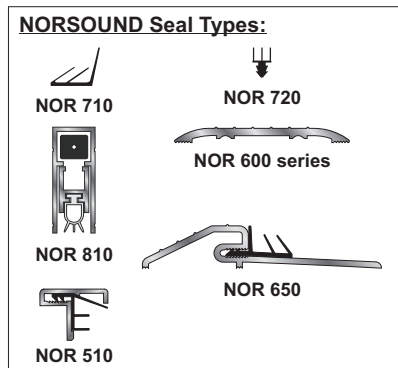
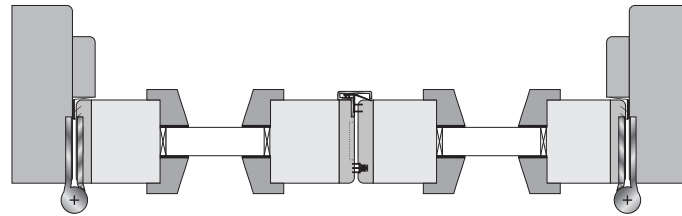
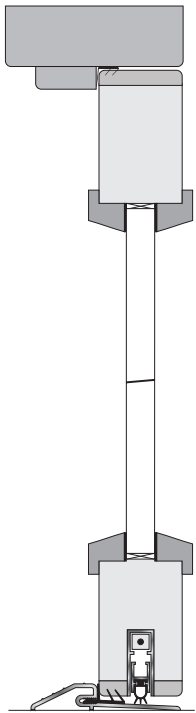


Rw.29dB ~ Rw.34dB

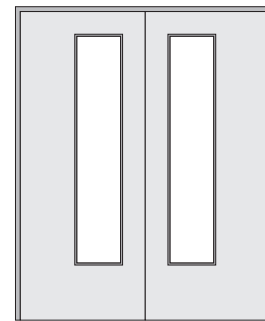
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 430® 44mm - Double Leaf (pairs) - Single Swing - Glazed Door.

Fig.10a.14



44mm FLAMEBREAK 430® Double leaf - Single Swing - Glazed



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

FLAMEBREAK 430® 44mm - Glazed Door - Double Leaf - Single Action - 25% Glazing.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 / 510	6mm Pyroshield	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 / 510	7mm Pyrobelite	ASSESSED	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 2x720	7mm Pyrobelite	ASSESSED	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf) +650	Norsound 720 / 510	12mm Pyrobelite	ASSESSED	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf) +650	Norsound 2x720	12mm Pyrobelite	ASSESSED	Rw.34dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

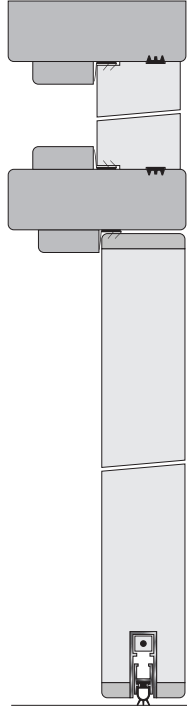


Rw.29dB ~ Rw.31dB

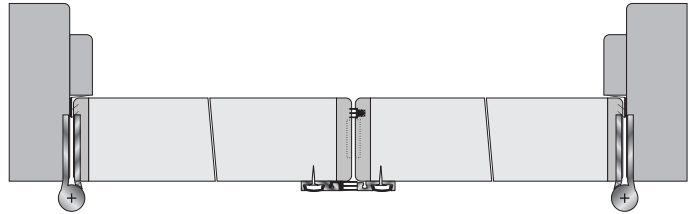
Diagrams for illustration purposes only.
See schedule below for further guidance.

FLAMEBREAK 430[®] 44mm - Double Leaf - Single Swing - Flush Door - Storey Height - with Transom.

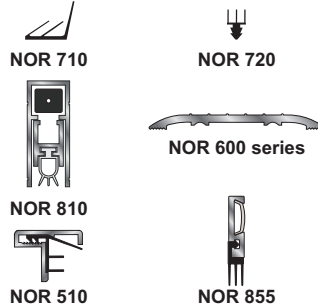
Fig.10a.15



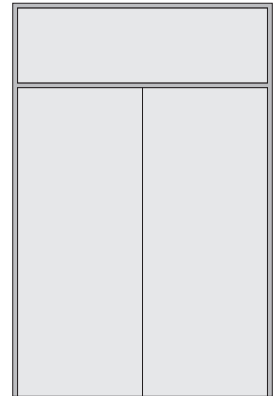
OVERPANEL SEALING:
Groove 12x2mm to all edges of the overpanel at the closing face to receive 710 seal.
Groove 10x1mm to all edges of the overpanel and fit 'E' seal.
Screw fix from back of frame with overpanel to be a tight fit.



NORSOUND Seal Types:



44mm FLAMEBREAK 430[®] Double leaf - Single Swing - Storey Height Doorsets - with Transom



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on all edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to all edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs and underside of the transom rail.

FLAMEBREAK 430[®] 44mm - Flush Door - Double Leaf (pairs) - Single Action - Storey Height - with Transom.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720	N/A	ASSESSED	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 855 + 855 Carrier only + 720	N/A	ASSESSED	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720+2x755	N/A	ASSESSED	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720+ 510	N/A	ASSESSED	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 2x720	N/A	ASSESSED	Rw.31dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

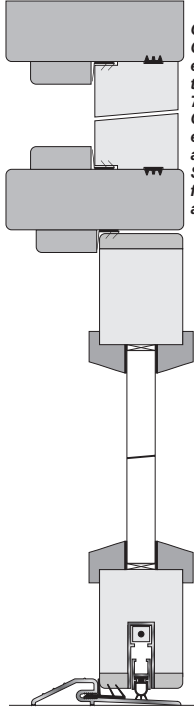


Rw.29dB ~ Rw.34dB

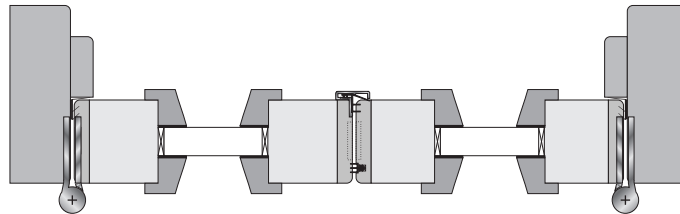
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 430® 44mm - Double Leaf - Single Swing - Glazed Door Storey Height - with Transom.

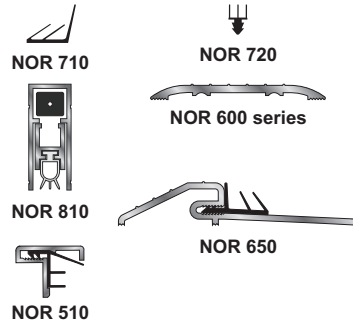
Fig.10a.16



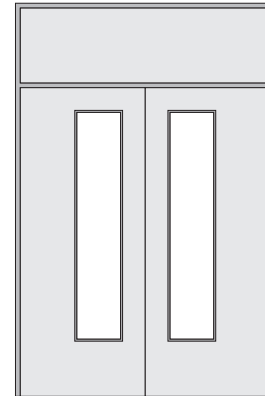
OVERPANEL SEALING:
Groove 12x2mm to all edges of the overpanel at the closing face to receive 710 seal.
Groove 10x1mm to all edges of the overpanel and fit 'E' seal.
Screw fix from back of frame with overpanel to be a tight fit.



NORSOUND Seal Types:



44mm FLAMEBREAK 430® Double leaf - Single Swing - Glazed Storey Height Doorsets - with Transom



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on all edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to all edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs and underside of the transom rail.

FLAMEBREAK 430® 44mm - Glazed Door - Double Leaf - Single Action - 25% Glazing - Storey Height - with Transom.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720/510	6mm Pyroshield	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720/510	7mm Pyrobelite	ASSESSED	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 2x720	7mm Pyrobelite	ASSESSED	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf) +650	Norsound 720/510	12mm Pyrobelite	ASSESSED	Rw.34dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

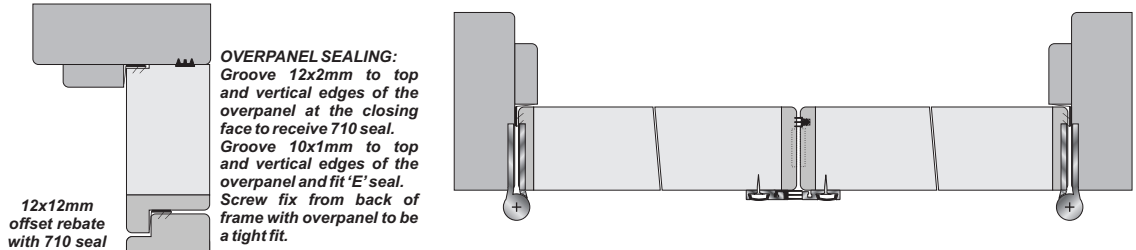


Rw.29dB ~ Rw.30dB

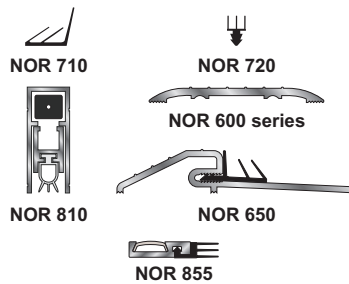
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 430[®] 44mm - Double Leaf - Single Swing - Flush Door - Storey Height - with Flush Overpanel.

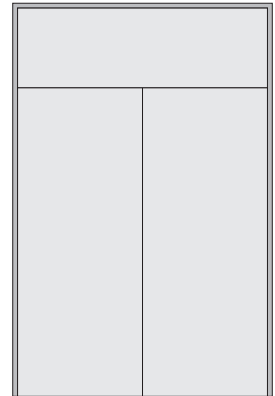
Fig.10a.17



NORSOUND Seal Types:



44mm FLAMEBREAK 430[®] Double leaf - Single Swing - Storey Height Doorsets - with Flush overpanel.



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on top and vertical edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to top and vertical edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs. NOR710 seal to jambs to extend full threshold to frame head height. Horizontal NOR710 seal applied to bottom edge of the overpanel to full width of frame shoulder.

FLAMEBREAK 430[®] 44mm - Flush Door - Double Leaf (pairs) - Single Action - Storey Height - with Flush overpanel.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 2x755 + 720	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 2x720	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 855 + 855 Carrier only + 720	N/A	ASSESSED	Rw.29dB
Norsound 710	Norsound 710	Norsound 710	Norsound 850 (each leaf) + 650	Norsound 855 + 855 Carrier only + 720	N/A	ASSESSED	Rw.30dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

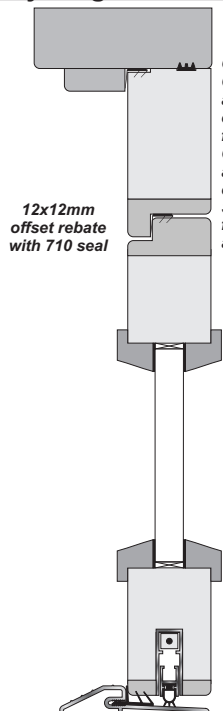


Rw.29dB ~ Rw.32dB

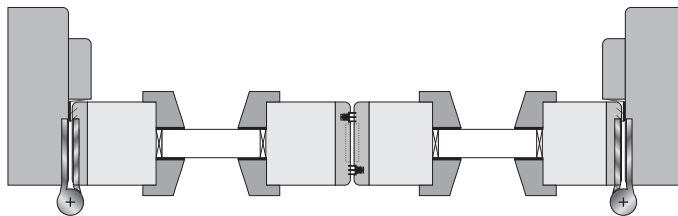
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 430® 44mm - Double Leaf - Single Swing - Glazed Door Storey Height - with Flush Overpanel.

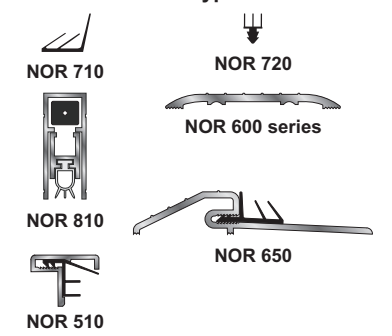
Fig.10a.18



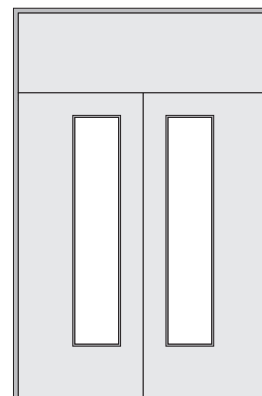
OVERPANEL SEALING:
Groove 12x2mm to top and vertical edges of the overpanel at the closing face to receive 710 seal.
Groove 10x1mm to top and vertical edges of the overpanel and fit 'E' seal.
Screw fix from back of frame with overpanel to be a tight fit.



NORSOUND Seal Types:



44mm FLAMEBREAK 430® Double leaf - Single Swing - Glazed Storey Height Doorsets - with Flush overpanel.



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on top and vertical edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to top and vertical edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs. NOR710 seal to jambs to extend full threshold to frame head height. Horizontal NOR710 seal applied to bottom edge of the overpanel to full width of frame shoulder.

FLAMEBREAK 430® 44mm - Glazed Door - Double Leaf - Single Action - 25% Glazing - Storey Height - with Flush overpanel.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 / 510	6mm Pyroshield	ASSESSED	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 / 510	7mm Pyrobelite	ASSESSED	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf) +650	Norsound 720 / 510	12mm Pyrobelite	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf) +650	Norsound 2x720	12mm Pyrobelite	ASSESSED	Rw.32dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

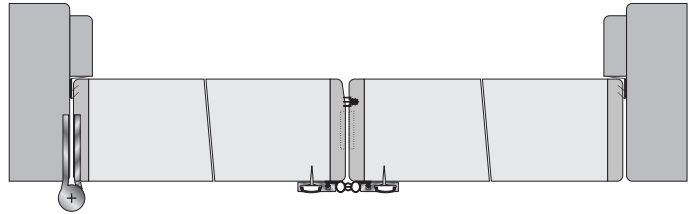
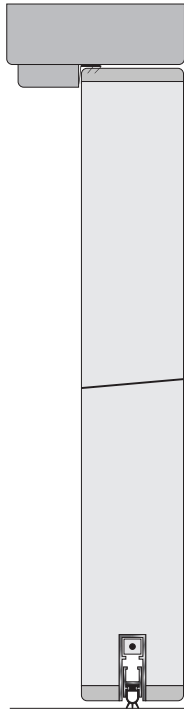


Rw.29dB ~ Rw.35dB

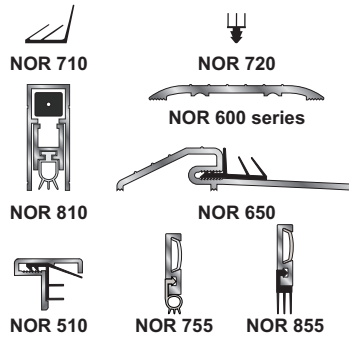
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660[®] 54mm - Double Leaf (pairs) - Single Swing - Flush Door.

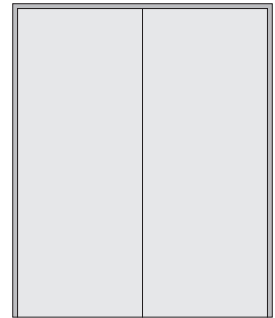
Fig.10a.19



NORSOUND Seal Types:



54mm FLAMEBREAK 660[®] Double leaf - Single Swing



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

FLAMEBREAK 660[®] 54mm - Flush Door - Double Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 510	N/A	C/08/5L/20184/R01 Test 83	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 510	N/A	C/08/5L/20184/R01 Test 82	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 2x755	N/A	C/04/5L/0938/1 Test 84	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 855 + 855 Carrier only + 720	N/A	C/08/5L/20184/R01 Test 85	Rw.34dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 625	Norsound 710 + 720	N/A	ASSESSED	Rw.34dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 625	Norsound 2x720	N/A	ASSESSED	Rw.34dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 650	Norsound 710 + 720	N/A	ASSESSED	Rw.35dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

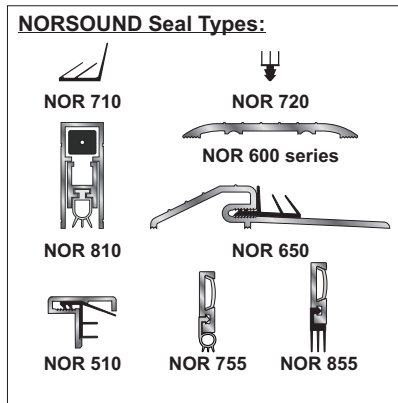
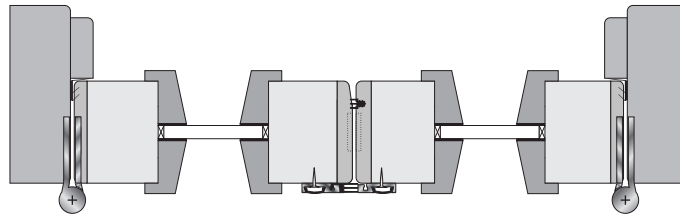
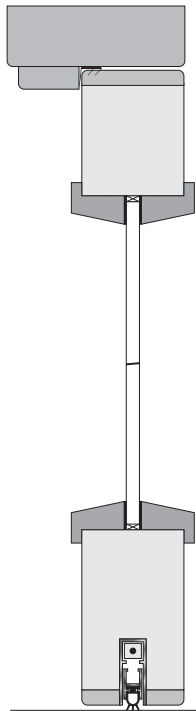


Rw.29dB ~ Rw.36dB

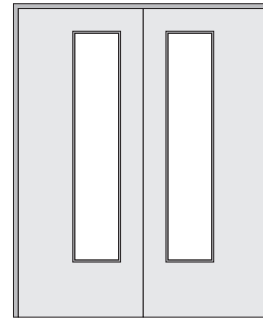
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660® 54mm - Double Leaf (pairs) - Single Swing - Glazed.

Fig.10a.20



54mm FLAMEBREAK 660® Double leaf - Single Swing - Glazed



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

FLAMEBREAK 660® 54mm - Glazed Door - Double Leaf - Single Action - 25% Glazing.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 510	6mm Pyroshield	ASSESSED	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 510	6mm Pyroshield	ASSESSED	Rw.35dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 2x755	7mm Pyrobelite	ASSESSED	Rw.35dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 855 + 855 Carrier only + 720	10mm Pyrodur	ASSESSED	Rw.35dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 625	Norsound 710 + 720	12mm Pyrobelite	ASSESSED	Rw.35dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 625	Norsound 2x720	12mm Pyrobelite	ASSESSED	Rw.35dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 650	Norsound 710 + 720	15mm Pyrostop	ASSESSED	Rw.36dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311



Rw.29dB ~ Rw.35dB

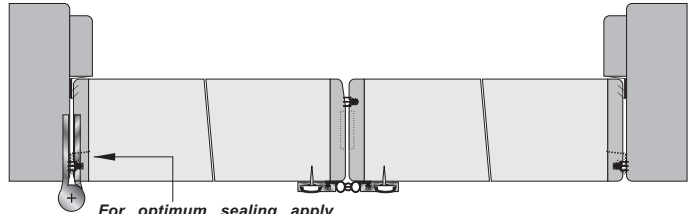
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660[®] 54mm - Double Leaf - Single Swing - Flush Door - Storey Height - with Transom.

Fig.10a.21

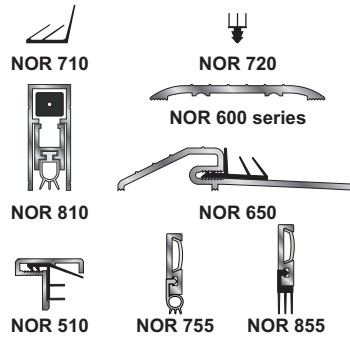


OVERPANEL SEALING:
Groove 12x2mm to all edges of the overpanel at the closing face to receive 710 seal.
Groove 10x1mm to all edges of the overpanel and fit 'E' seal.
Screw fix from back of frame with overpanel to be a tight fit.

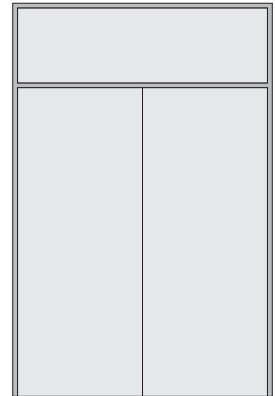


For optimum sealing apply strips of NOR 710 seal over hinge blades with 710 seal blades to align with 720 seal blades.

NORSOUND Seal Types:



54mm FLAMEBREAK 660[®] Double leaf - Single Swing - Storey Height Doorsets - with Transom



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on all edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to all edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs and underside of the transom rail.

FLAMEBREAK 660[®] 54mm - Flush Door - Double Leaf - Single Action - Storey Height - with Transom.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 510	N/A	ASSESSED	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 510	N/A	ASSESSED	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 2x755	N/A	ASSESSED	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 855 + 855 Carrier only + 720	N/A	ASSESSED	Rw.34dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 625	Norsound 710 + 720	N/A	ASSESSED	Rw.34dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 650	Norsound 710 + 720	N/A	ASSESSED	Rw.35dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 650	Norsound 2x720	N/A	ASSESSED	Rw.35dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

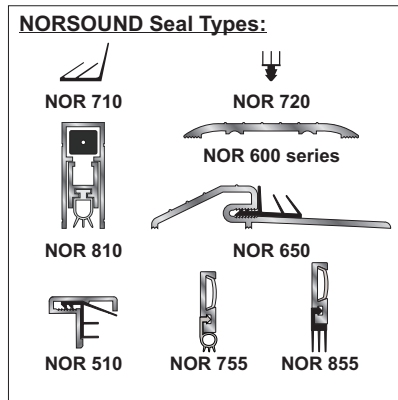
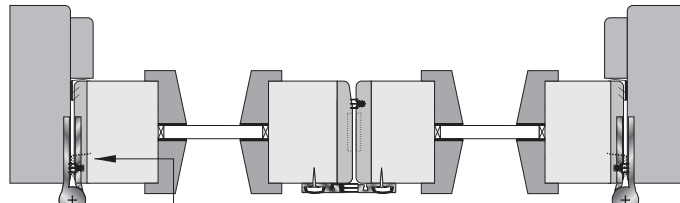
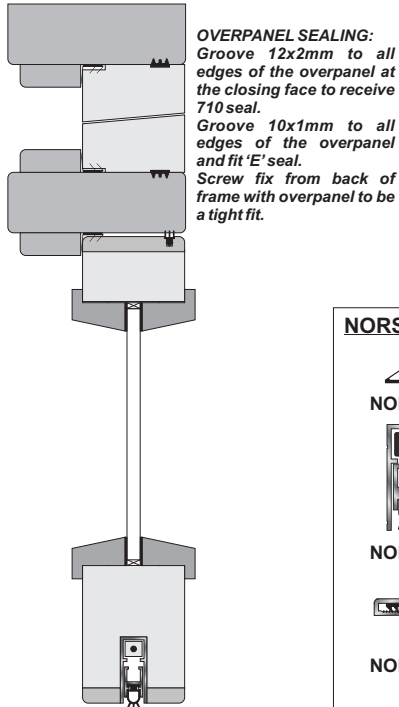


Rw.29dB ~ Rw.36dB

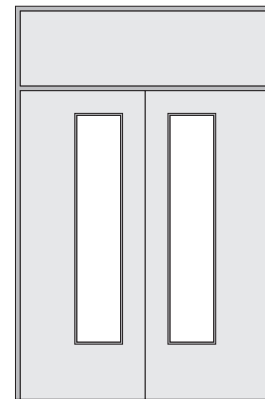
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660® 54mm - Double Leaf - Single Swing - Glazed Door - Storey Height - with Transom.

Fig.10a.22



54mm FLAMEBREAK 660® Double leaf - Single Swing - Glazed Storey Height Doorsets - with Transom



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on all edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to all edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs and underside of the transom rail.

FLAMEBREAK 660® 54mm - Glazed Door - Double Leaf - Single Action - 25% Glazing - Storey Height - with Transom.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 510	6mm Pyroshield	ASSESSED	Rw.33dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 510	6mm Pyroshield	ASSESSED	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 2x755	7mm Pyrobelite	ASSESSED	Rw.34dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 855 + 855 Carrier only + 720	10mm Pyrodur	ASSESSED	Rw.34dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 625	Norsound 710 + 720	12mm Pyrobelite	ASSESSED	Rw.35dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 625	Norsound 2x720	12mm Pyrobelite	ASSESSED	Rw.35dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 650	Norsound 710 + 720	15mm Pyrostop	ASSESSED	Rw.36dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

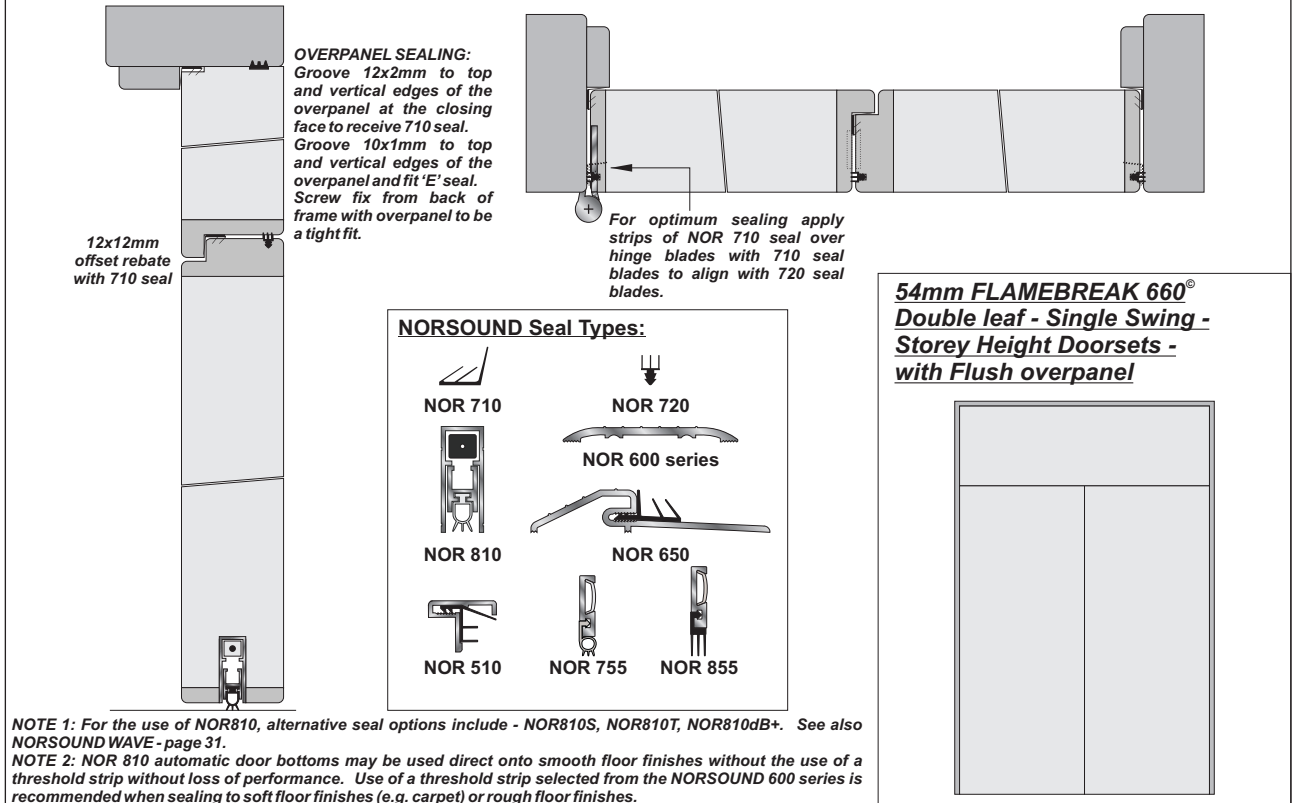


Rw.29dB ~ Rw.33dB

Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660[®] 54mm - Double Leaf - Single Swing - Flush Door - Storey Height - with Flush Overpanel.

Fig.10a.23



NOTE: Overpanel sealed on top and vertical edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to top and vertical edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs. NOR710 seal to jambs to extend full threshold to frame head height. Horizontal NOR710 seal applied to bottom edge of the overpanel to full width of frame shoulder.

FLAMEBREAK 660[®] 54mm - Flush Door - Double Leaf - Single Action - Storey Height - with Flush overpanel.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 510	N/A	ASSESSED	Rw.30dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 510	N/A	ASSESSED	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 2x755	N/A	ASSESSED	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 855 + 855 Carrier only + 720	N/A	ASSESSED	Rw.31dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 625	Norsound 710 + 720	N/A	ASSESSED	Rw.31dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 625	Norsound 710 + 720	N/A	ASSESSED	Rw.31dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 650	Norsound 710 + 720	N/A	ASSESSED	Rw.33dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

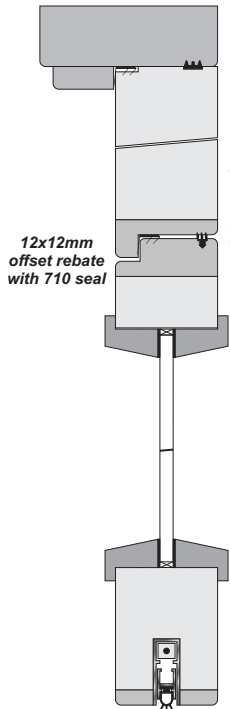


Rw.29dB ~ Rw.34dB

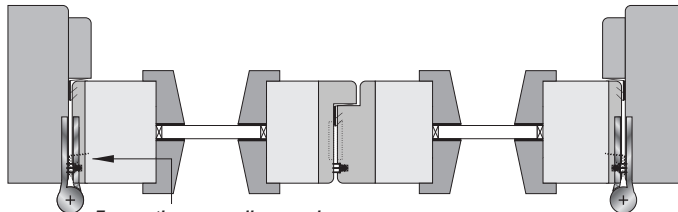
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660® 54mm - Double Leaf - Single Swing - Glazed Door - Storey Height - with Flush Overpanel.

Fig.10a.24

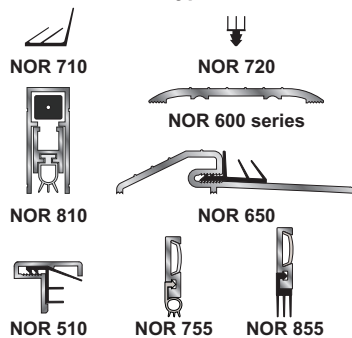


OVERPANEL SEALING:
Groove 12x2mm to top and vertical edges of the overpanel at the closing face to receive 710 seal.
Groove 10x1mm to top and vertical edges of the overpanel and fit 'E' seal.
Screw fix from back of frame with overpanel to be a tight fit.

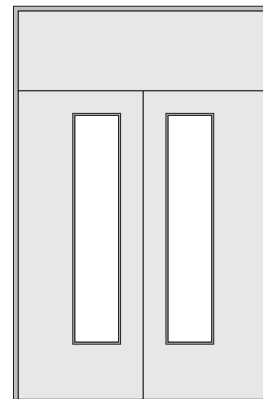


For optimum sealing apply strips of NOR 710 seal over hinge blades with 710 seal blades to align with 720 seal blades.

NORSOUND Seal Types:



54mm FLAMEBREAK 660® Double leaf - Single Swing - Glazed Storey Height Doorsets - with Flush overpanel



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.

NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

NOTE: Overpanel sealed on top and vertical edges with mastic or one row Norsound 710 seal positioned to align with door leaf seals. Norsound 'E' seal fitted to top and vertical edges of the overpanel towards the opening face. Overpanel fitted to provide for a tight fit and secured with screw fixings from the back of the frame head and jambs. NOR710 seal to jambs to extend full threshold to frame head height. Horizontal NOR710 seal applied to bottom edge of the overpanel to full width of frame shoulder.

FLAMEBREAK 660® 54mm - Glazed Door - Double Leaf - Single Action - 25% Glazing - Storey Height - with Flush overpanel.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 510	6mm Pyroshield	ASSESSED	Rw.31dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 510	6mm Pyroshield	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 720 + 2x755	7mm Pyrobelite	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 2x720	7mm Pyrobelite	ASSESSED	Rw.32dB
Norsound 710	Norsound 710	Norsound 710	Norsound 810 (each leaf)	Norsound 855 + 855 Carrier only + 720	10mm Pyrodur	ASSESSED	Rw.32dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 625	Norsound 710 + 720	12mm Pyrobelite	ASSESSED	Rw.33dB
Norsound 710 + 720	Norsound 710 + 720	Norsound 710 + 720	Norsound 810 + 650	Norsound 710 + 720	15mm Pyrostop	ASSESSED	Rw.34dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

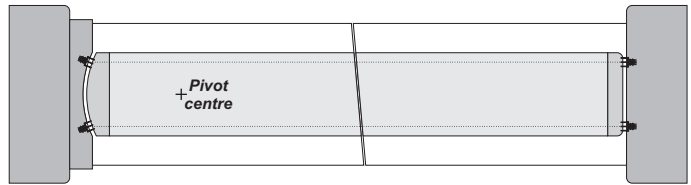
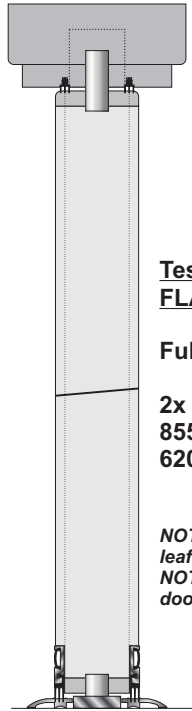


Rw.28dB

Diagrams for illustration purposes only.
See schedule below for further guidance.

FLAMEBREAK 430[®] 44mm - Single Leaf - Double Swing - Flush Door.

Fig.10a.25



Tested Detail:
FLAMEBREAK 430[®] 44mm flush door.

Fully Caulked = Rw. 29dB

2x Norsound 720 to head & Jambs with 2x Norsound 855 to threshold used in conjunction with Norsound 620 or 625 low level threshold.
= Rw.28dB.

NOTE 1: Norsound 720 seals can be transferred from the frame to door leaf edges.

NOTE 2: The ends of the 855 seal carrier must be profiled to suit the door leaf edge profiles.

**44mm FLAMEBREAK 430[®]
Single leaf - Double Swing**



NORSOUND Seal Types:



NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 430[®] 44mm - Flush Door - Single Leaf - Double Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 2x720	Norsound 2x720	Norsound 2x720	Norsound 2x855 used with 620 or 625 threshold.	N/A	N/A	C/08/5L/20184/R01 Test 113	Rw.28dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

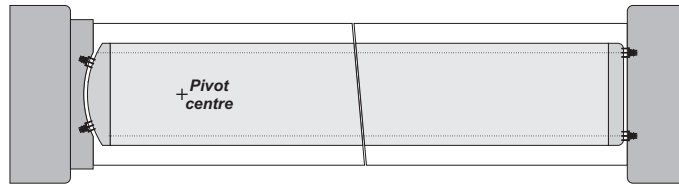
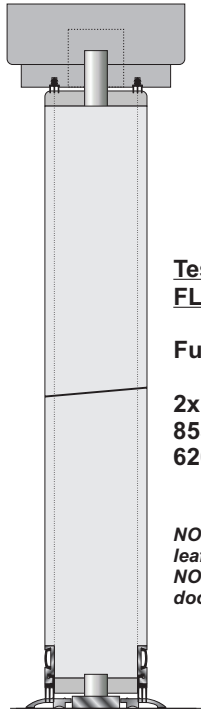


Rw.29dB ~ Rw.30dB

Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 660[®] 54mm - Single Leaf - Double Swing - Flush Door.

Fig.10a.26



Tested Detail:
FLAMEBREAK 660[®] 54mm flush door.

Fully Caulked = Rw. 33dB

2x Norsound 720 to head & Jambs with 2x Norsound 855 to threshold used in conjunction with Norsound 620 or 625 low level threshold.
 = Rw.30dB.

NOTE 1: Norsound 720 seals can be transferred from the frame to door leaf edges.

NOTE 2: The ends of the 855 seal carrier must be profiled to suit the door leaf edge profiles.

54mm FLAMEBREAK 660[®] Single leaf - Double Swing



NORSOUND Seal Types:



NOR 720



NOR 600 series



NOR 855

NOTE: The 'fully caulked' performance relates to a door of the same construction and size as tested under operational condition but with all operating gaps between the door and the frame completely sealed using a heavy duty sealant with the door in an inoperable condition to determine the maximum potential performance of the particular door construction.

FLAMEBREAK 660[®] 54mm - Flush Door - Single Leaf - Double Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 2x720	Norsound 2x720	Norsound 2x720	Norsound 2x855 used with 620 or 625 threshold.	N/A	N/A	C/08/5L/20184/R01 Test 105	Rw.30dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

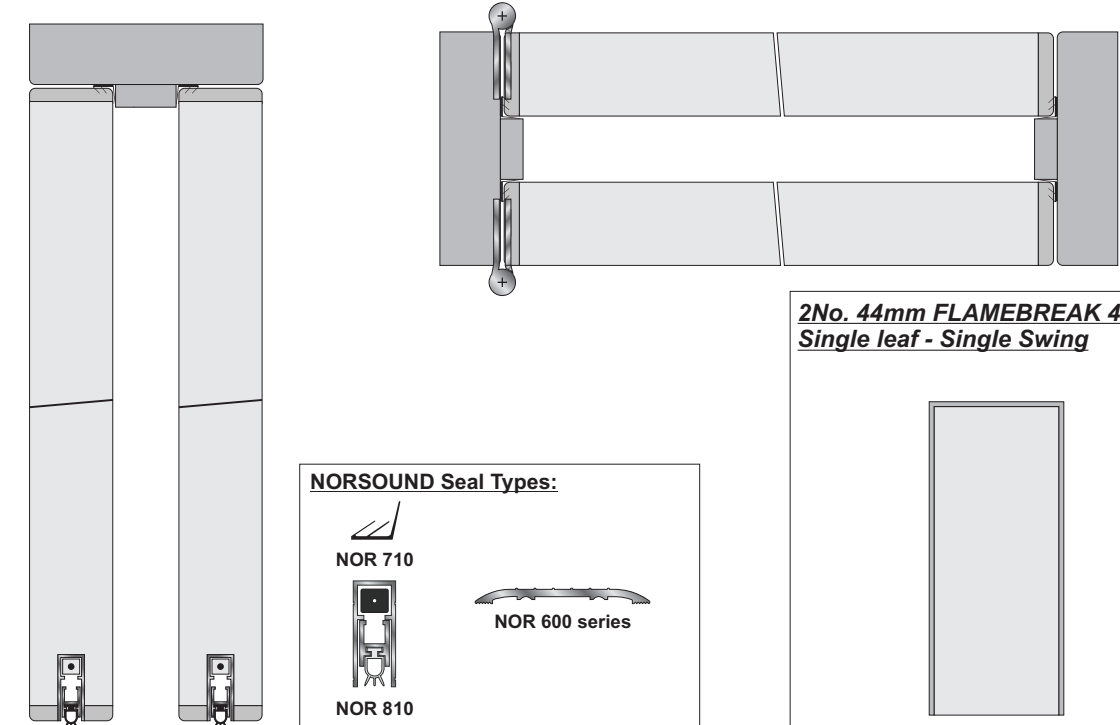


Rw.40dB+

Diagrams for illustration purposes only. See schedule below for further guidance.

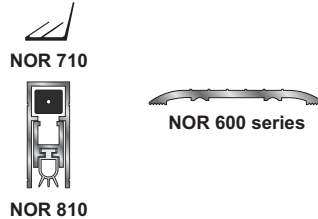
FLAMEBREAK 430[®] 44mm - Single Leaf - Single Swing - Flush Door.

Fig.10a.27



2No. 44mm FLAMEBREAK 430[®] Single leaf - Single Swing

NORSOUND Seal Types:



NOTE 1: For the use of NOR810, alternative seal options include - NOR810S, NOR810T, NOR810dB+. See also NORSOUND WAVE - page 31.
 NOTE 2: NOR 810 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

2No. FLAMEBREAK 430[®] 44mm - Flush Door - Single Leaf - Single Action (Back to Back).

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 710 (each leaf)	Norsound 710 (each leaf)	Norsound 710 (each leaf)	Norsound 810 (each leaf)	N/A	N/A	ASSESSED	Rw.40dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

High Performance - Sound Attenuating Doorsets:

For sound attenuating performance up to Rw.30dB using FLAMEBREAK[®] based door constructions a performance of Rw.30dB can be achieved using simple sealing systems which have a minimal influence on door operating forces.

Whereas performances in excess of Rw.35dB can be achieved using a single door it may be necessary to increase the sealing provisions with a possible effect on operating forces.

Where operating forces are a matter for concern, e.g. to satisfy the requirements of Building Regulations - (England & Wales) - Approved Document 'M', it is recommended that consideration is given to the creation of 'acoustic lobbies'. i.e. the use of two low operating force doorsets either fitted to the same frame or separated by a suitable space that might also be lined with sound absorbing materials.

The illustrated arrangement might also be suitable for (say) Plant Room doorsets where a high sound attenuating performance may be required.

NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.

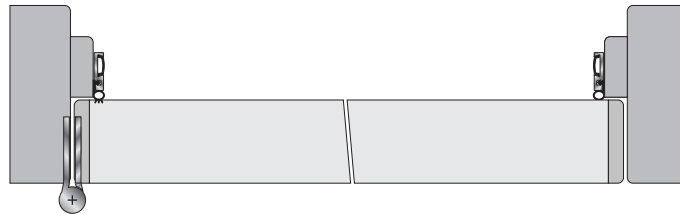
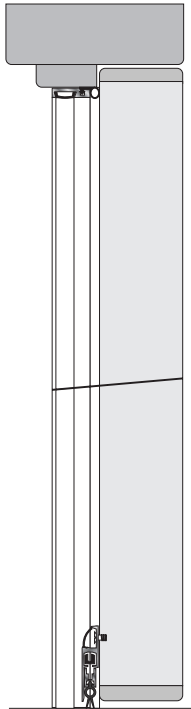


Rw.29dB - Upgrade

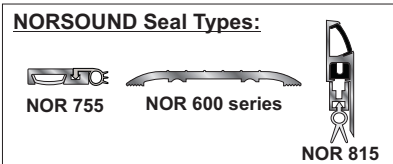
Diagrams for illustration purposes only. See schedule below for further guidance.

FLAMEBREAK 430[®] 44mm - Single Leaf - Single Swing - Flush Door.

Fig.10a.28



44mm FLAMEBREAK 430[®] Single leaf - Single Swing



NOTE: The NOR 815 automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

FLAMEBREAK 430[®] 44mm - Flush Door - Single Leaf - Single Action.

Hanging Jamb	Closing Jamb	Head	Threshold	Meeting Stiles	Glazing	Test Reference	Performance
Norsound 755	Norsound 755	Norsound 755	Norsound 815	N/A	N/A	ASSESSED	Rw.29dB

For further seal configuration options and guidance refer to Norsound Ltd. Tel: 01661 831311

Improved sound attenuation by upgrading existing installations:

Existing installations using FLAMEBREAK[®] 44mm or 54mm based doorsets can be up graded to provide for improved sound attenuating performance by the addition of perimeter and threshold seals.

The perimeter and threshold seals can be of a type that can be added to the doorset with a minimal risk of conflict with other doorset components e.g. hardware or intumescent seals etc.

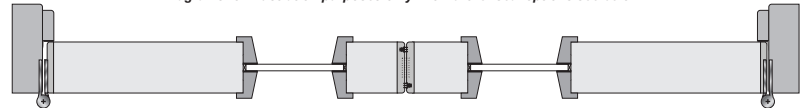
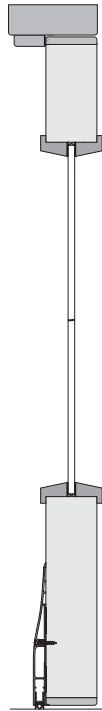
NOTE: Comparative 'fully caulked' and operational doorset testing demonstrates that the FLAMEBREAK FF630 construction may be used in lieu of the FLAMEBREAK 430 construction without loss of sound attenuating performances.



Norsound 'WAVE'

54mm - Double Leaf (pairs) - Single Swing - Glazed.

Fig.10a.29

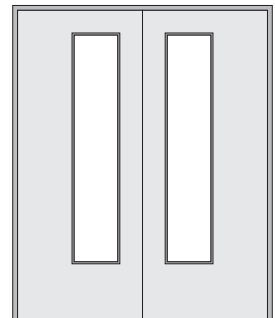


Diagrams for illustration purposes only. For further seal options see below.

Tested Detail:
54mm glazed door
Fully caulked performance = Rw.36dB.

Operational doors, face fitted perimeter NOR710 seals applied to face of doorstops. Single fin seal at meeting stiles, Norsound WAVE automatic door bottom to threshold = Rw.32dB.

54mm
Double leaf - Single Swing - Glazed



NOTE: Norsound WAVE automatic door bottoms may be used direct onto smooth floor finishes without the use of a threshold strip without loss of performance. Use of a threshold strip selected from the NORSOUND 600 series is recommended when sealing to soft floor finishes (e.g. carpet) or rough floor finishes.

Norsound 'WAVE' Automatic Door Bottom:

The Norsound 'WAVE' is a combined kick plate / automatic door bottom has been tested with a doorset design in a glazed equal pair configuration that provided for an Rw.36dB fully caulked performance. As an operational doorset using the WAVE surface mounted automatic door bottom the design achieved a performance of Rw.32dB. i.e. 89% efficiency.

The same doorset design was tested where the only variant was to substitute the WAVE with a Norsound 810S mortised automatic door bottom resulting in an Rw.31dB performance.

This base test data demonstrates that the Norsound WAVE combined kick plate / automatic door bottom may be substituted for a centre thickness mortised automatic door bottom (with all other seals being 'as tested') without detriment to performances, for doorset designs providing for fully caulked performances up to Rw.36dB.

Possible conflicts between threshold seals and edge fixed flush bolts can be avoided by the use of the Norsound WAVE product.

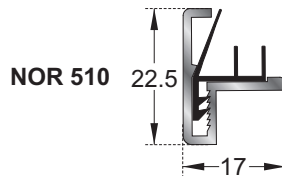


Norsound Ltd. Products tested with FLAMEBREAK® based doors.

Fig.10a.30

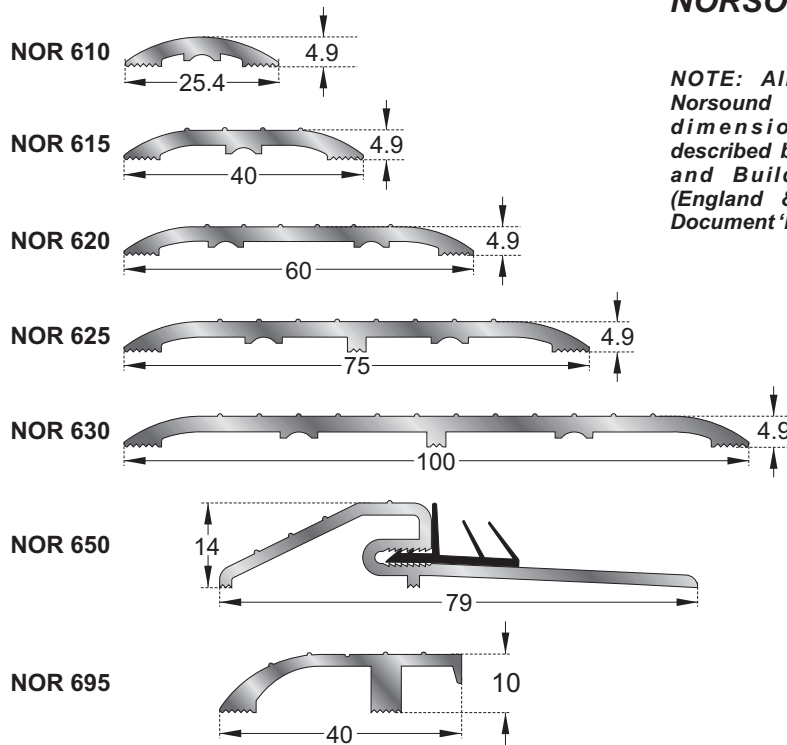
Meeting stile Astragal with seal

NORSOUND 500 Series



Thresholds

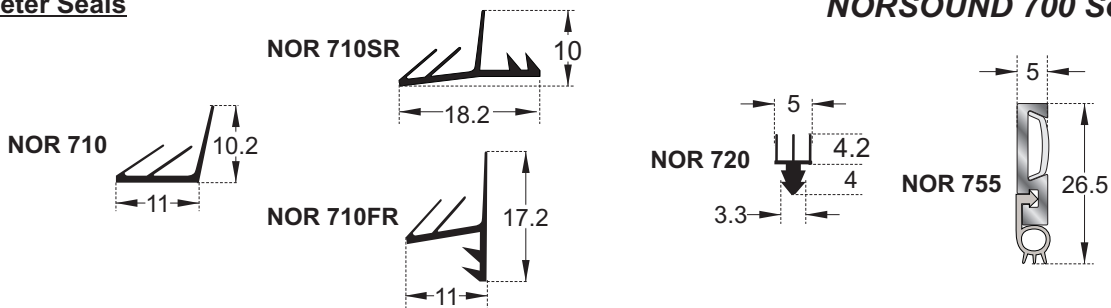
NORSOUND 600 Series



NOTE: All thresholds in the Norsound 600 range satisfy the dimensional requirements described by reference to BS8300 and Building Regulations - (England & Wales) - Approved Document 'M'.

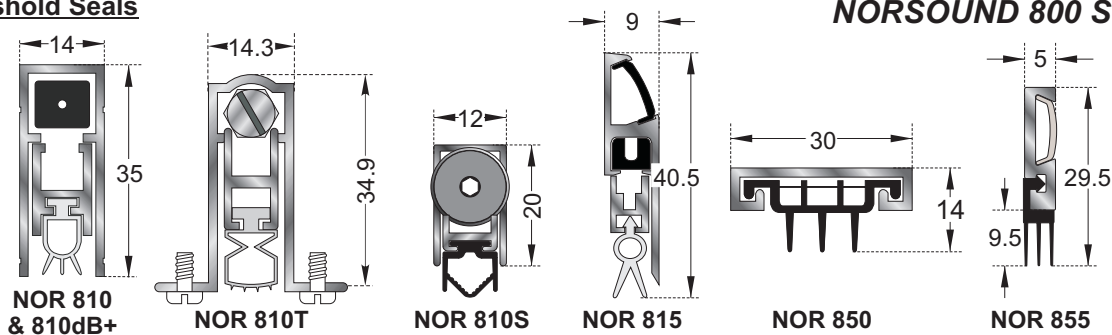
Perimeter Seals

NORSOUND 700 Series



Threshold Seals

NORSOUND 800 Series





Recommended locations for Norsound Seals:

For manufacturers recommendations see: www.norsound.co.uk

The sound attenuating performance of a doorset is directly related to the ability of the sealing system to prevent the flow of air (and consequently airborne sound) through the doorset.

Generally the maximum potential performance of a doorset design can be determined by 'fully caulked' testing. For this purpose the door is sealed in an inoperable condition using a heavy duty sealant to prevent airborne sound passing through any gaps around the door.

Doorsets require operating gaps around the door to permit the door to be operated. The sealing systems are required to fill these gaps to prevent (or significantly reduce) the flow of air through the doorset while still allowing the door to be operated. Consideration must also be given to the selection and location of hardware.

When developing the Norsound range of acoustic seals care was taken with regard to the location of seals to minimise the risk of conflicts between sealing systems and hardware, while providing for minimal influences on operating forces.

There are two methods for achieving a design performance requirements for a doorset:

Method 1: Use a door construction with a very high fully caulked performance in conjunction with minimal sealing efficiency.

Method 2: Use a door construction with a lower fully caulked performance with a more efficient sealing system.

Example: If (say) an *Rw.30dB* performance is required for a particular location:

A door construction providing for a (say) *Rw.38dB* fully caulked performance could be used in conjunction with seals providing for 79% efficiency (with the same door construction). i.e. allowing for 21% leakage.

Alternatively a lower rated door construction providing for a (say) *Rw.33dB* fully caulked performance with a sealing system providing for 91% sealing efficiency (when used with the same door construction). i.e. allowing for just 9% leakage.

General purpose door constructions can provide for performances up to *Rw.35dB*. as operational doorsets. For performances in excess of *Rw.35dB*. consideration should be given to the use of 'dedicated' acoustic door constructions or, to the construction of 'acoustic lobbies'.

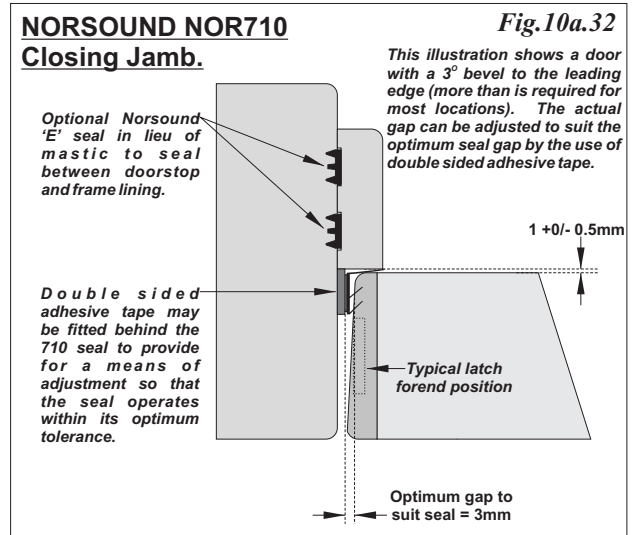
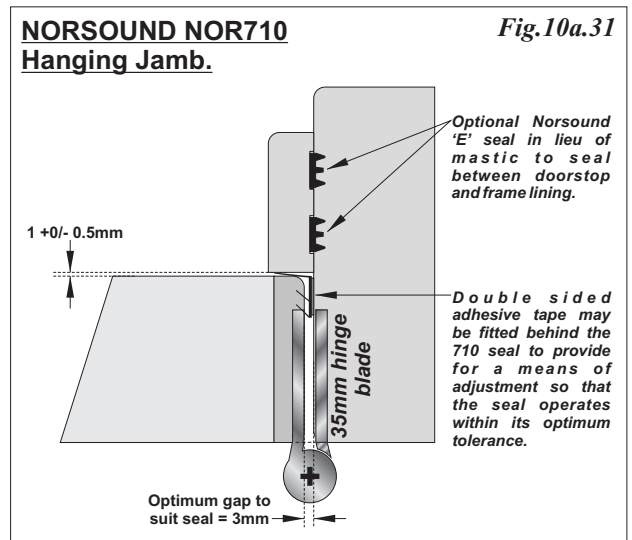
Some improvement to sound attenuating performances can be achieved by glazing using suitable glass types and methods of beading. The following details show recommended fitting positions for Norsound acoustic sealing systems based upon extensive testing with FLAMEBREAK® based doorsets. Sealing systems providing for similar performances are available from numerous sources.

Norsound 710 seal:

This flexible seal fits in the rebate of the frame in a position that is unlikely to result in conflicts with hardware or other sealing systems and in a position that results in minimal influence on operating forces.

Variants to the basic NOR 710 design to allow for alternative methods of fixing.

NOTE: The Norsound 710 seal together with other seals in the Norsound range are intended to provide for optimum performances when used with operating gaps as defined by reference to BS4787 Pt.1 : 1980.



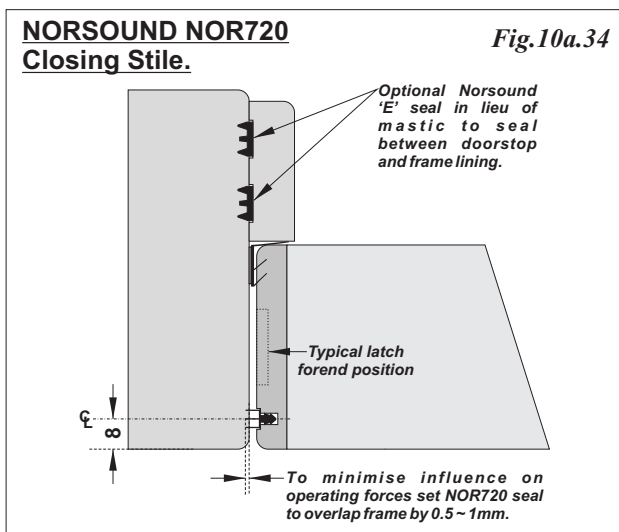
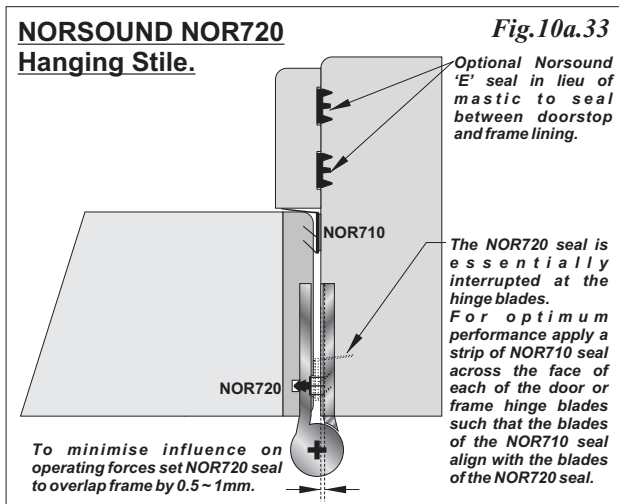


Norsound 720 seal:

This versatile small three bladed seal can be used for a number of applications including:

- Supplementary perimeter seal to improve sealing efficiency with minimal influence on operating forces.
- Meeting stile sealing option.
- Threshold sealing option.

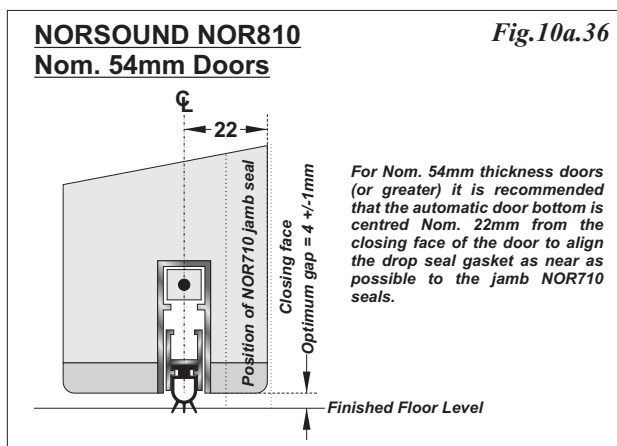
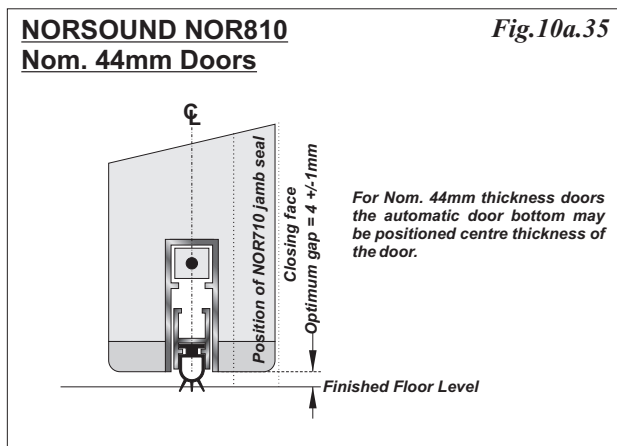
The NOR720 perimeter seal application is illustrated below:



Threshold sealing Norsound 810, 810T, 810S, 810dB+, 815, 850, 855, & 720:

Norsound provide for a number of threshold sealing options including five types of automatic door bottoms, door shoes, threshold strips and a stepped threshold plate with seal that has been successfully tested to provide for in excess of 95% sealing efficiency even when used with doorsets in the Rw.40dB+ class.

The following details illustrate various threshold sealing options:



NOTE: Comparisons testing demonstrates that Norsound 810, 810T, 810S and 810dB+ automatic door bottoms are interchangeable without detriment to tested performances.



Threshold sealing contd.

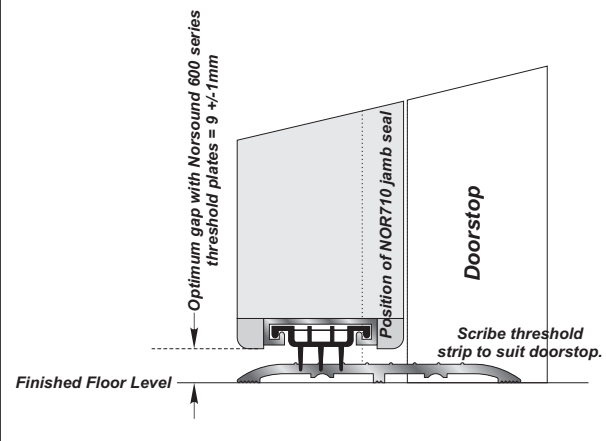
NORSOUND NOR850 Door Shoe Threshold Sealing. *Fig.10a.37*

The Norsound 850 triple bladed door shoe provides for a simple yet effective method for threshold sealing without the use of mechanically operated devices.

Fixed bottom of door seals must essentially be used with a threshold strip (NOR625 illustrated below) to ensure that the seal gasket clears the floor during the swing of the door.

It is recommended that the NOR850 carrier is recessed into the bottom edge of to a depth that is necessary to provide for the gasket blades to overlap the threshold strip by Nom.2 +/- 0.5mm.

Comparative base test data demonstrates that the NOR850 door shoe can be used as a direct substitute threshold sealing option to the NOR810 series without detriment to performances.



Threshold sealing can also be effectively achieved without the use of automatic door bottoms.

The Norsound 850 door shoe is fitted to the bottom edge of the door. This multi bladed seal provides for excellent sound attenuating performances.

A simpler low cost alternative can be achieved by using 2No. Norsound 720 seals at the threshold.

A threshold strip (or the Norsound 650 stepped threshold with seal) must be used with any fixed seals that are fitted to the bottom edge of the door to ensure that the seal blades will clear the floor during the swing of the door.

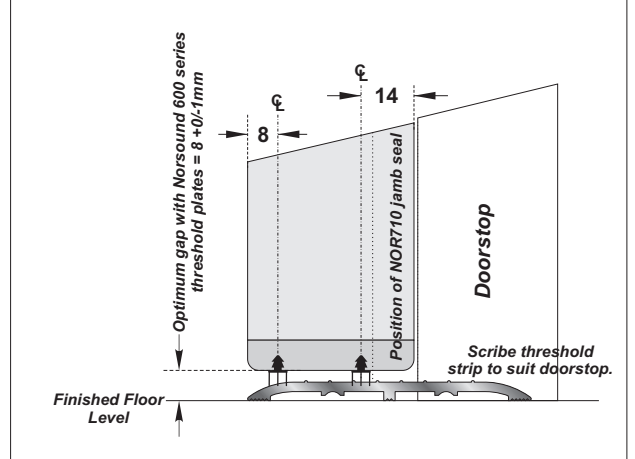
NORSOUND Twin NOR720 Threshold Sealing. *Fig.10a.38*

The versatile Norsound 720 triple bladed seal provides for a low cost yet effective threshold sealing system.

Fixed bottom of door seals must essentially be used with a threshold strip (NOR625 illustrated below) to ensure that the NOR720 seals clear the floor during the swing of the door.

More demanding tolerances apply when using the twin NOR720 threshold sealing system.

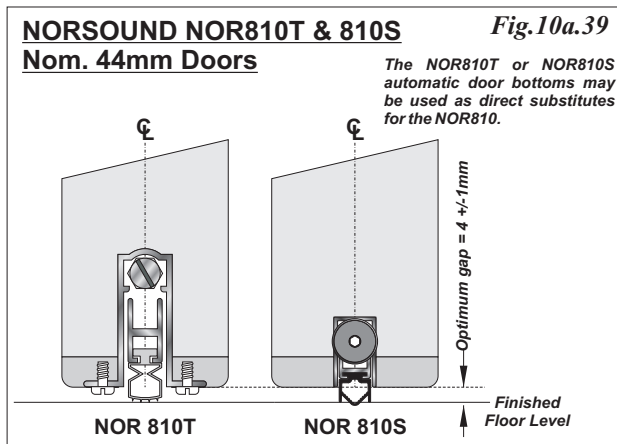
Comparative base test data demonstrates that the twin NOR720 option can be used as a direct substitute to the NOR810 series without detriment to performances.



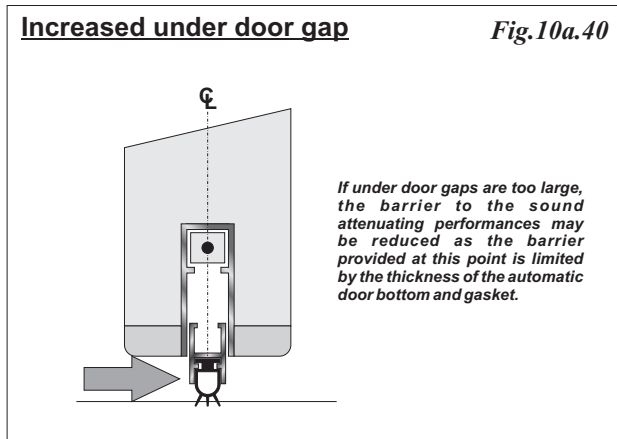


Threshold sealing contd.

The Norsound 810T, 810S & 810dB+ automatic door bottoms have matched the performance of the 810 under test and provides users with an alternative method of fixing and a smaller seal carrier.



NOTE: For sound attenuating applications it is necessary to keep the operating gaps to the minimum necessary to ensure correct operation. Particular care should be taken at the thresholds.



It is generally easier to control under door gaps where a threshold strip is used.

Whereas all of the Norsound 810 series automatic door bottoms will seal effectively onto carpet or hard floor finishes such as vinyl the use of a threshold strip is strongly recommended when using these devices with carpet or soft floor finishes.

NOTE: Use direct onto carpet may adversely effect durability.

When used with tiled floor finishes the grout between the tiles might provide a route for flanking.

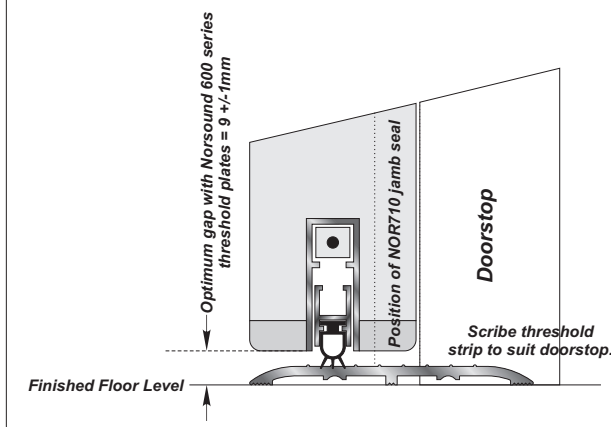
NORSOUND 600 series threshold strips.

NORSOUND NOR600 series *Fig.10a.41*
Threshold Strips.

Whereas Norsound 810 series automatic door bottoms may be used without a threshold strip for locations with both soft (carpeted) and hard floor (vinyl) finishes, the use of a threshold strip is recommended, particularly in conjunction with soft floor finishes, to improve seal gasket durability.

Tests have been carried out using a range of NOR600 series threshold strips with no variation to performances under test. The threshold should be aligned with the opening face of the door and carefully scribed to suit the doorstop on the closing face.

Threshold strips may be drilled / countersunk and screw fixed or secured with Norsound threshold adhesive.



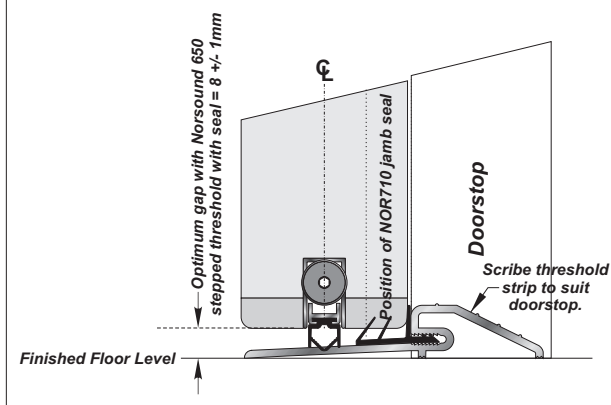
NORSOUND 650 stepped threshold with seal:

NORSOUND NOR650 stepped *Fig.10a.42*
Threshold with Seal.

The Norsound 650 stepped threshold with seal provides for optimum sound attenuating performances. The sealing gasket in the NOR650 aligns in section with the NOR710 perimeter seals to the head and the jambs thus considerably reducing flanking risks.

For doorsets required to provide for performances up to Rw.35dB, the NOR650 can be used without any additional threshold sealing. For doorsets in the Rw.35+dB class additional sealing may be required. Any of the bottom of door sealing options illustrated in this section may be used for this purpose. In this case use of the NOR810S is illustrated used with a nom. 44mm thickness door. For a Nom. 54mm thickness door the automatic door bottom can be centred Nom. 22mm from the closing face of the door.

The dimensions of the NOR650 stepped threshold with seal are within the requirements described by reference to Building Regulations - (England & Wales) - Approved Document 'M' and BS8300 requirements.





Meeting stile sealing:

Norsound provide for a number of meeting stile sealing options.

The fundamental problem with pairs of doors is that there is an additional gap to be sealed with a consequent increase of flanking risks. However, testing has demonstrated that performances achieved for single leaf doorsets can be maintained for pairs of doors.

Where possible, meeting stile seals should be positioned to align with jamb and head perimeter seals.

NORSOUND Twin NOR 720 Meeting stile seals.

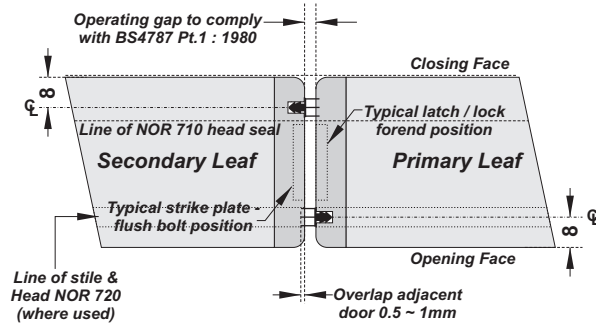
Fig.10a.43

Norsound 720 seals provide for an economic solution for sealing at the meeting stiles of pairs of doors.

One NOR720 seal located towards the opening face is generally sufficient for performances up to Rw.30dB. For performance in excess of Rw.30dB it is recommended that a second NOR720 seal is located towards the closing face of the secondary leaf.

NOTE: Locating the NOR720 seals as illustrated ensures that the seals provide for minimal resistance to the operation of the doors (door are in contact with the seals for approx. 9mm in the door thickness during swing). These positions also provide room for the fitting of hardware with the need to interrupt the sealing.

This meeting stile solution is suitable for use with both 44mm and 54mm thickness doors provided it is not necessary to bevel meeting stiles for operational purposes. (Use with Nom. 44mm thickness doors illustrated). For thicker, narrow doors where 'shooting' is required consideration should be given the Norsound 710 / 720 solution using off-set rebated meeting stiles.



NORSOUND 710 / 720 Twin seal with off-set Meeting stiles.

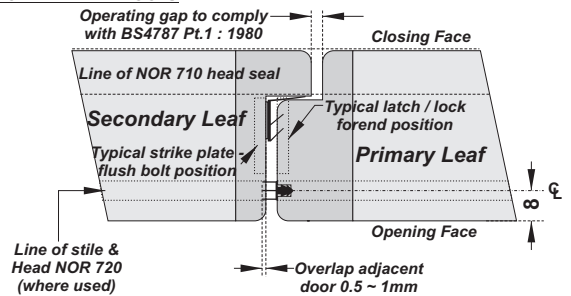
Fig.10a.44

The Norsound 710 / 720 seals used with a 12mm off-set rebate provides for effective meeting stile sealing for use with both Nom. 44mm and 54mm based doorsets. However, with Nom. 44mm thickness doors there is the risk of conflict with hardware items.

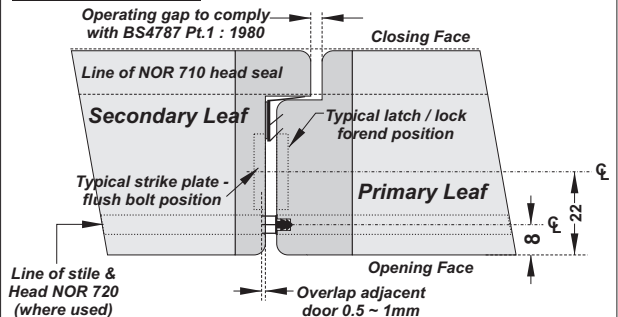
This meeting stile solution is better suited for use with Nom. 54mm doors but consideration still needs to be given to the location of securing hardware (locks / latches & flush bolts). Conflicts of this nature can generally be avoided where the securing hardware is centred Nom. 22mm from the opening face of the doors.

The off-set rebate option using NOR 710 / 720 seals is particularly useful where it is necessary to apply a leading edge to the primary leaf for operational reasons, the position of the NOR 710 seal can be adjusted to suit the gap at the seal position by the use of double sided adhesive backing tape.

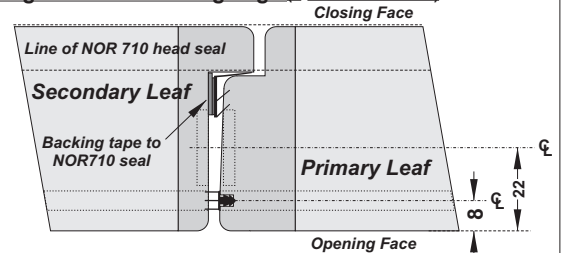
Nom. 44mm Doors



Nom. 54mm Doors



Meeting stiles with leading edge (2° bevel illustrated)





Meeting stile sealing contd:

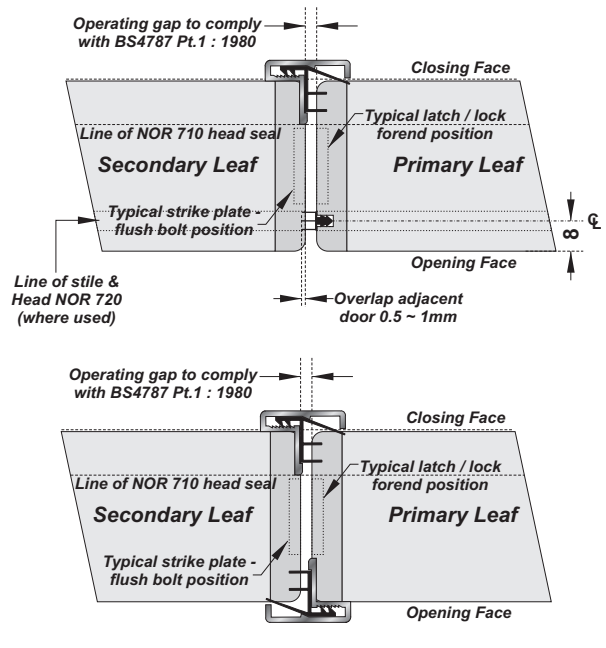
NORSOUND 510 Astragal with seal Meeting stiles. *Fig.10a.45*

The Norsound 510 astragal with seal provides for an alternative to the off-set rebate design.

The NOR510 can be used with the NOR720 seal as illustrated below. This can be a useful solution where it is necessary to apply a leading edge to a Nom. 44mm thickness door as the position of the NOR510 seal can be adjusted (by packing behind the carrier) to suit.

When fitted to the closing face of the secondary leaf the NOR510 carrier projects beyond the face of the door; the carrier and seal will therefore need to be scribed to suit the frame head doorstop.

The NOR510 astragal with seal can also be fitted to the opening face of the primary leaf as an alternative to the use of the NOR720 seal. In this case, the NOR510 carrier with seal is fitted to the full height of the door leaf.



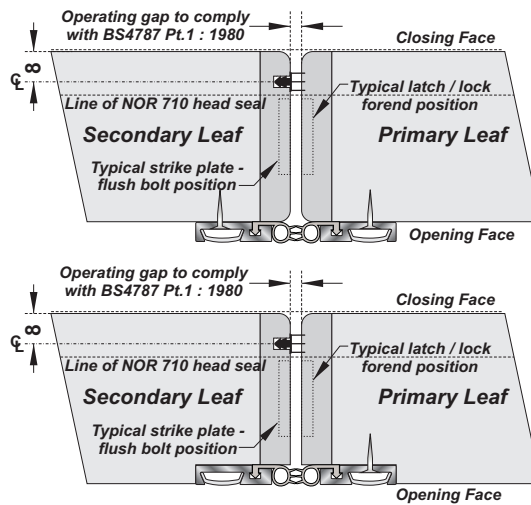
NORSOUND 755 Silicon Seal Meeting stiles. *Fig.10a.46*

The Norsound 755 consists of an aluminium carrier with a silicon gasket. The gasket is extremely soft and pliable and can be used to provide for excellent sound attenuating performances with minimal effect on operating forces.

For use with FLAMEBREAK® based doors, the NOR755 meeting stile sealing can be used for performances up to Rw.30dB without the need for the use of the additional NOR720 seal shown in this illustration.

For non fire rated applications, the NOR755 seals can be recessed into the face of the door without detriment to acoustic performances.

The NOR755 seal is screw fixed the fixings covered by a decorative strip to prevent casual access.



NORSOUND 855 Finger Seal Meeting stiles. *Fig.10a.47*

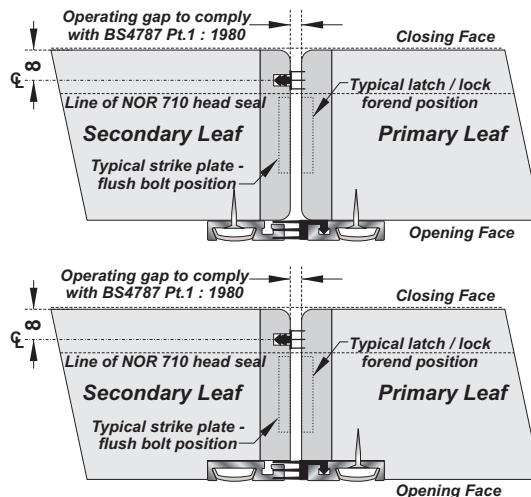
Although not designed to be a meeting stile seal, the Norsound 855 provides for an alternative to the NOR755 Silicon seal providing for identical results under test.

For meeting stile applications the seal gasket is fitted to one NOR855 carrier only with the other door fitted with the NOR855 carrier only.

For use with FLAMEBREAK® based doors, the NOR855 meeting stile sealing option can be used for performances up to Rw.30dB without the need for the use of the additional NOR720 seal shown in this illustration.

For non fire rated applications, the NOR855 carriers can be recessed into the face of the door without detriment to acoustic performances.

The NOR855 seal carrier is screw fixed the fixings covered by a decorative strip to prevent casual access.





Storey Height doorsets:

There is limited base test evidence with regard to the influence on sound attenuating performances resulting from the use of storey height doorsets. However, for storey height doorsets with transoms, the overpanel is a fixed (*non operable*) element that can be completely sealed to the surrounding frame.

For the purpose of assessments it is anticipated that a transomed overpanel will provide for 'fully caulked' performances and that the transom will act as the head of the frame thus providing for the same performances as door height assemblies.

As fixed elements, the overpanels can be completely sealed at all frame interface junctions using a suitable mastic. However, the same results can be achieved using a dry sealing option using Norsound seals. This latter option is illustrated in the following details:

For storey height doorsets with flush overpanels, the overpanel will still be a fixed (*non operable*) element with the junction between the door and the overpanel being effectively the same arrangement as applied to tested meeting stile details.

Overpanel with Transom.

Fig.10a.48

Storey height doorsets using over panels with transoms may be used without loss of performance provided that the sealing around the overpanel matches 'fully caulked' conditions. This can be achieved by using a mastic sealant around the over panel.

Sealing to match fully caulked performances can be achieved using Norsound 710 seals to all sides of the overpanel in conjunction with Norsound 'E' seal. The gap between the overpanel and the surrounding frame should not exceed 0.5mm.

To ease fixing soft beeswax can be applied to the edges of the overpanel and to the 'E' seal.

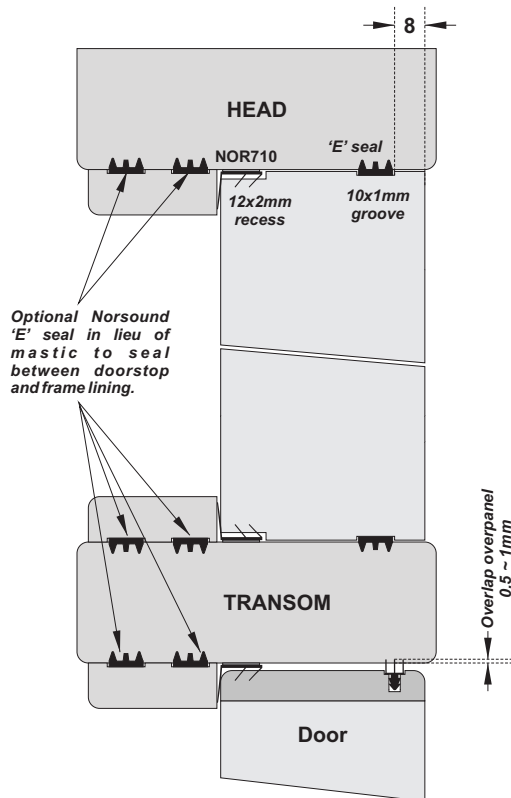
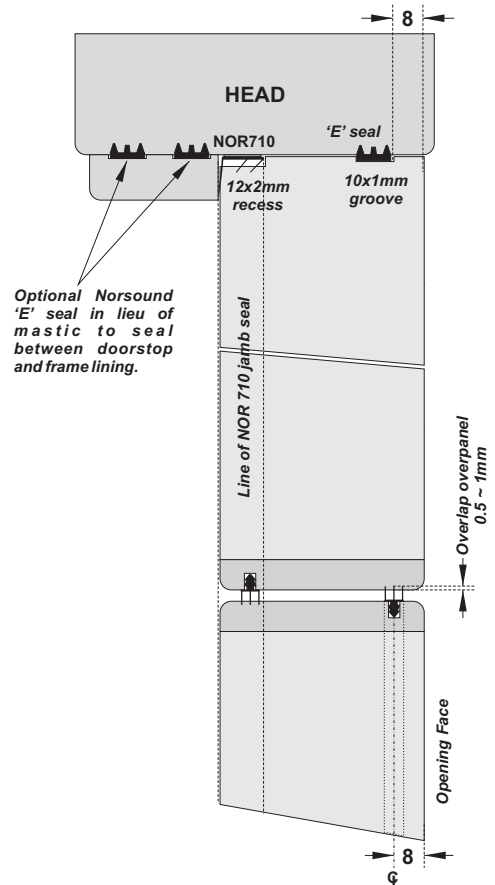


Fig.10a.49

Flush Overpanel with twin Norsound 720.

Various options are available for use with storey height doorsets with flush over panels.

The following detail using 2No. NOR 720 seals is suitable for use with single leaf doorsets where the jamb doorstops prevent swing through of the door leaves.





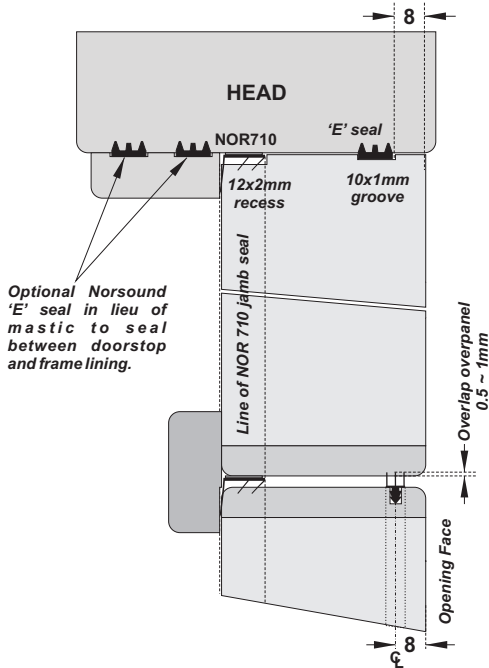
Storey Height doorsets: contd:

Flush Overpanel - with Astragal.

Fig.10a.50

This detail uses a Norsound 710 seal in conjunction with a hardwood astragal.

This detail overcomes the misalignment of the bottom of overpanel NOR 710 seal with the Jamb seals that otherwise occurs when rebates are used.



Optional Norsound 'E' seal in lieu of mastic to seal between doorstep and frame lining.

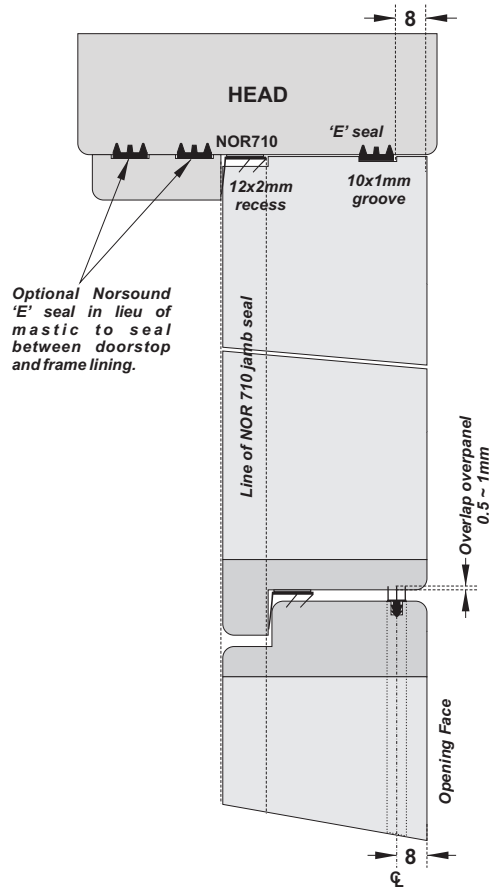
Flush Overpanel - Rebated.

Fig.10a.52

Various options are available for use with storey height doorsets with flush over panels.

This detail uses a Norsound 710 seal in a rebated junction between the door leaf and the overpanel.

This detail may be used with pairs of doors but some flanking may result from misalignment of the bottom of overpanel NOR710 seal with the Jamb seals.



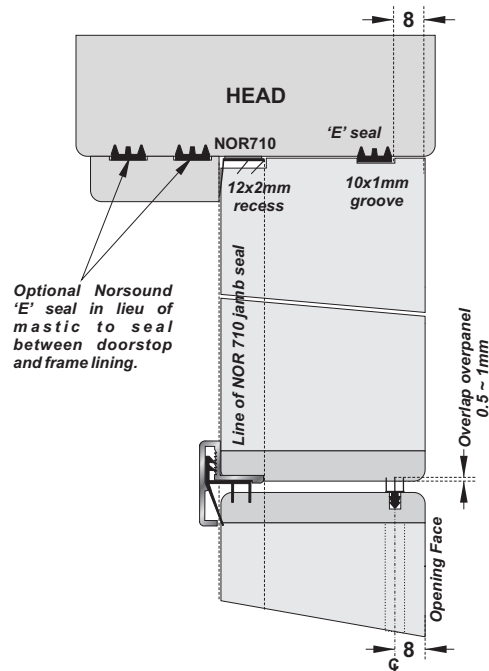
Optional Norsound 'E' seal in lieu of mastic to seal between doorstep and frame lining.

Flush Overpanel with Norsound 510 Astragal with seal.

Fig.10a.51

This detail uses a Norsound 510 astragal with seal.

This detail overcomes the misalignment of the bottom of overpanel NOR710 seal with the Jamb seals that otherwise occurs when rebates are used and provides for an alternative to the hardwood astragal detail. However, the NOR510 carrier needs to be scribed between the vertical doorstops.



Optional Norsound 'E' seal in lieu of mastic to seal between doorstep and frame lining.



The influence of glazing:

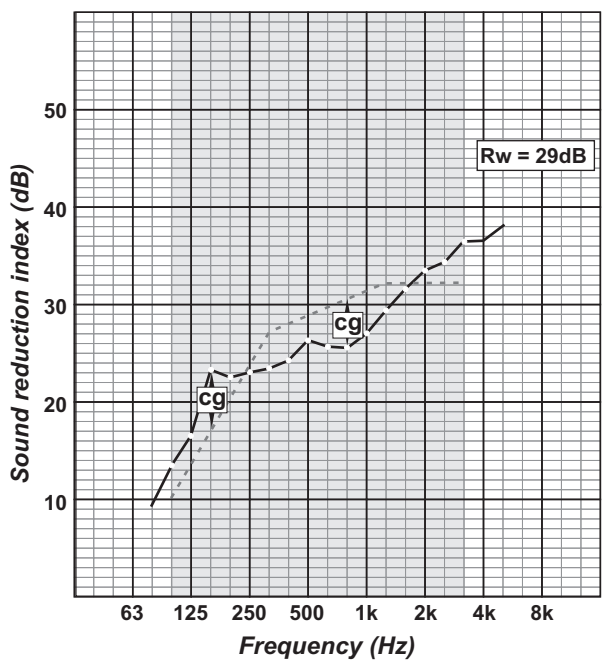
Most solid core 'general purpose' door constructions suffer from a 'coincidence gap' problem. The 'coincidence gap' is the difference between the plotted curve, measured by reference to BS EN ISO 140-3: 1995 and the reference curve that is calculated by reference to BS EN ISO 717-1 : 1997.

Where the plotted measurement falls above the reference curve, this indicates a surplus of performance at the particular frequencies relative to the weighted index (Rw.).

Where the plotted measurement falls below the reference curve, this indicates a deficiency in performance at the particular frequencies relative to the weighted index (Rw.).

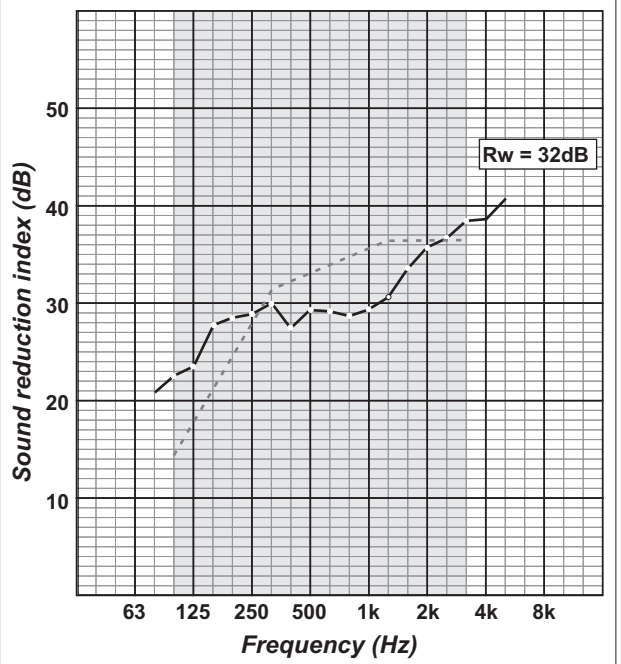
The test data for a Nom. 44mm FLAMEBREAK 430® door fitted with Norsound 710 perimeter seals and a Norsound 810 threshold seal is illustrated as follows:

44mm FLAMEBREAK 430® flush door with Norsound 710 & 810 seals *Fig.10a.53*
SRL Test Ref C/08/5L/20184/R01 Test 56



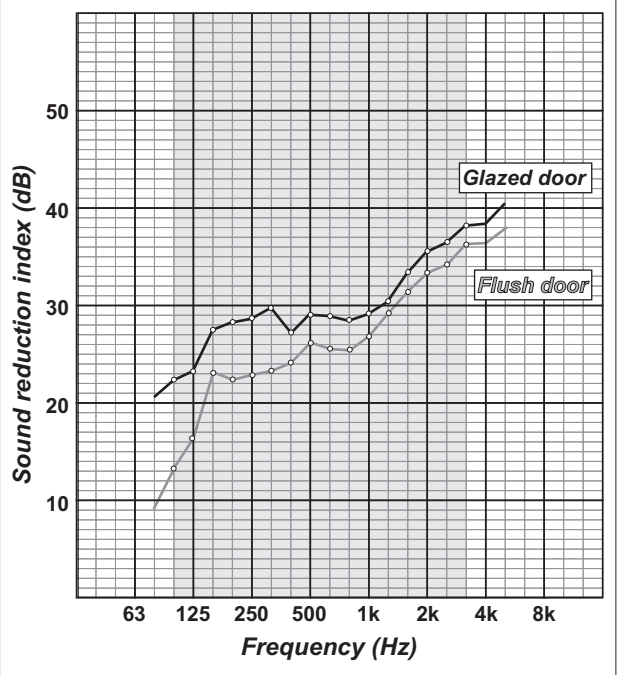
The maximum deviation for a FLAMEBREAK 430 based door occurred at about 800Hz. Tests were then carried out using the same arrangement but with the door glazed using various glass types.

44mm FLAMEBREAK 430® door glazed with 12mm Pyrobelite glass with Norsound 710 & 810 seals *Fig.10a.54*
SRL Test Ref C/08/5L/20184/R01 Test 48



Whereas glazing had some beneficial influence on coincidence gaps, the overall performance was improved by glazing. (This example illustrates the use of 12mm Pyrostop with a 25% clear glass area).

44mm FLAMEBREAK 430® Glazed door and flush door graphs overlaid. *Fig.10a.55*





The influence of glazing contd.

Glass type:

To measure the influence of glazing, a general purpose door construction was tested in a fully caulked condition with the first test being carried out using a reference panel, of the same construction as the door. This resulted in performance of $R_w.35dB$.

The reference panel was subsequently replaced with pre-glazed panels using various glass types. The reference panel and pre-glazed panels were dimensioned such that the dimensions provided for a clear glass area equal to 25% of the total door area. This dimension was chosen on the basis that the area would be sufficient to indicate the influence of glazing on the door leaf without the glass performance overwhelming the door leaf characteristics.

This test series and other base test data indicated that the glass thickness rather than the glass type influenced the sound attenuating performance of a doorset design.

Generally thicker glass types provided for improved performances. However, for any given door construction design and sealing arrangement a plateau performance was achieved after which further increases in glass thicknesses had little if any effect.

For a doorset providing for a fully caulked flush door performance of $R_w.32dB$, the following results have been achieved with operational doors with a 25% clear glass area using a simple Norsound 710 / 810 sealing system:

6mm Pyroshield = $R_w.32dB$
10mm Pyrodur = $R_w.34dB$.

For a doorset providing for a fully caulked flush door performance of $R_w.35dB$, the following results have been achieved with operational doors with a 25% clear glass area using a simple Norsound 710 / 810 sealing system:

6mm Pyroshield = $R_w.35dB$
10mm Pyrodur = $R_w.36dB$.
16.8 Optilam-Phon = $R_w.37dB$

For a doorset providing for a fully caulked flush door performance of $R_w.36dB$, the following results have been achieved with operational doors with a 25% clear glass area using a Norsound 710 +720/ 810 sealing system:

7.2mm Pyroguard = $R_w.36dB$
10mm Pyrodur = $R_w.36dB$.
15mm Pyrostop = $R_w.36dB$
23mm Pyrostop = $R_w.37dB$

Glass area:

Base test data relating to the influence of the clear glass area is more limited but the following can be advised for guidance:

For a doorset providing for a fully caulked flush door performance of $R_w.31dB$, the following results have been achieved with operational doors using a simple Norsound 710 / 850 sealing system:

7.2mm Pyroguard @ 8.9% = $R_w.32dB$
7.2mm Pyroguard @ 22.35% = $R_w.32dB$

For a doorset providing for a fully caulked flush door performance of $R_w.30dB$, the following results have been achieved with operational doors using a simple Norsound 710 / 850 sealing system:

7.2mm Pyroguard @ 27% = $R_w.32dB$
7.2mm Pyroguard @ 35% = $R_w.33dB$

Glazing acoustic doors - general advice:

The beading system in itself will change the characteristics of the door leaf with further influences resulting from the glass thickness and the clear glass area.

For doors providing for a fully caulked performance up to $R_w.32dB$ as a flush door construction: Test evidence indicates that this performance can be matched or bettered for an operational doorset (*otherwise to the same details*) using 6.5 ~ 10mm thickness glass types in conjunction with a simple acoustic sealing arrangement (*e.g. Norsound 710 / 810*).

For doors providing for a fully caulked performance up to $R_w.35dB$ as a flush door construction: Test evidence indicates that this performance can be matched or bettered for an operational doorset (*otherwise to the same details*) using 10mm (*or thicker*) glass types in conjunction with a more robust acoustic sealing arrangement (*e.g. Norsound 710 + 720/810*).

More limited base test data indicates that the area of glazing can have an influence and that, for use with general purpose door constructions, the clear glass area should not be less than 10% of the door leaf area.



The influence of hardware:

Provided that care is taken to select and position hardware to avoid the need to interrupt sealing systems, the choice of hardware will have little effect on sound attenuating performances.

Hardware items that require the removal of any of the door core should be kept as small as possible.

The main risk to the performance of a sound attenuating doorset results from the creation of flanking routes through the door that may be created by providing for hardware items that essentially pass through the thickness of the door. e.g. lever handles, cylinders / keyholes. The use of lever sets with back plates or roses will generally allow for the use of mastic (or other sealants) to prevent the passage of airborne sound. Similar action can be taken with cylinders. For key ways, the use of escutcheons with escutcheon plates will generally provide for a sufficient barrier.

NOTE: Letter plates passing through the door have been successfully tested for performances up to Rw.40dB.

Flanking:

Flanking is the leakage of airborne sound through or around the door leaf and / or the doorset.

The main causes of flanking are:

- Insufficient care and adjustment when fitting seals.
- Worn seals.
- Interruption of seals to receive hardware.
- Inadequate sealing around hardware items that pass through the door.
- Inadequate sealing around glazed apertures.
- Inadequate sealing between the frame and the surrounding structure.

When fitting seals, the main areas of weakness are at the junctions between horizontal and vertical seals i.e. at the four corners of a single leaf doorset. Seals should extend to the full shoulder height and width of the frame with the head seal carefully mitre jointed to the jamb seals where possible.

The operating gap at the seal position should suit the dimensions of the seal. In the case of the Norsound 710 seal, the operating gap at the seal position can be adjusted by the use of backing tape to provide for an optimum seal operating gap.

Seals such as the Norsound 720 should be positioned to provide for the optimum overlap with the frame or adjacent door. If sealing gaps are too small or seals are over compressed there is the risk of seal distortion with consequential failures.

NOTE: The optimum setting usually provides for seal gaskets to compress by about 40 ~ 50%.

The gaskets for automatic door bottoms should be cut to suit the full width of the door to provide for a close fit with the end plates. The automatic door bottoms should be carefully adjusted to ensure that they seal across the full width of the door onto the floor or threshold strip.

Carefully locating seals to suit the action of the door can ensure that the seals are in contact with the door / frame for the minimum amount of the swing of the door thus reducing the influence on operating forces and reducing wear resulting from friction.

Threshold strips or stepped thresholds with seals should be carefully scribed to the frame with mastic (or other suitable sealant) used to fill any gaps that might provide a route for flanking.

The use of frame and door leaf designs that provide for a pencil round at junctions where the seals meet the door leaf or the frame are recommended. This will act as a lead to the compression of the seal and improve seal durability.

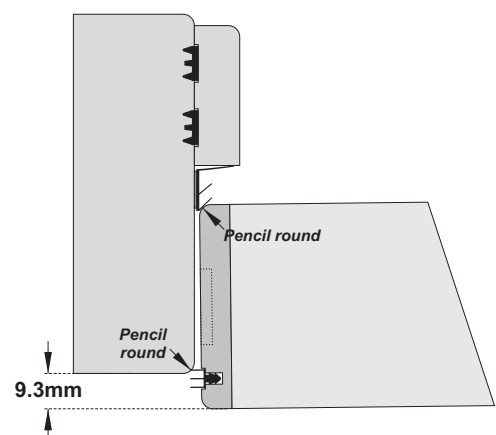
Frame Design & Positioning of Perimeter seals

Fig.10a.56

Frame designs that include a pencil round at junctions where seals meet the frame or the door leaf will provide for a lead for the compression of the seal blades in a manner that improves seal durability.

Seal positions should be carefully considered to ensure that the seals are in contact for the minimum amount of the travel of the door as it swings. This will reduce seal wear resulting from friction.

Both of these considerations will also assist in reducing the forces necessary to operate the door.





Flanking contd:

The doorset should be installed plumb and square. Any distortion may give rise to difficulties when fitting seals.

The gap between the frame and the surrounding structure should be carefully packed with mineral wool between fixings to prevent flanking around the frame. A mastic sealant should be applied to both sides of the frame before fixing architrave (if used).

Because doorsets are essentially operational products they must provide for ease of operation. This requires a careful balance when fitting (and adjusting) seals. The effect of the seals can usually be felt in the last part of closing but more particularly when opening. For well fitted seals there should be a 'bath plug' effect resistance to opening. (Air is trapped between seals as the door opens resulting in a lowering of air pressure). The pressure is equalised by the slow feed of air into the space. This effect will result in difficulty if an attempt is made to snatch open the doors. i.e. for normal operation the doors should be opened more gradually.

One part of the doorset that is difficult to seal is at the bottom of the doors at the hanging, closing and meeting stiles. This results from an essential gap between the end plates of automatic door bottoms.

When using the twin NOR720 seals (or other fixed bottom of door seals) with a threshold plate, it is possible to extend the 720 seal into the operating gap at the hanging jambs thus reducing flanking in this area.

For pairs of doors a flanking gap also occurs at the bottom of the meeting stiles. The NOR650 stepped threshold with seal (currently) provides for the only effective way for sealing this gap.

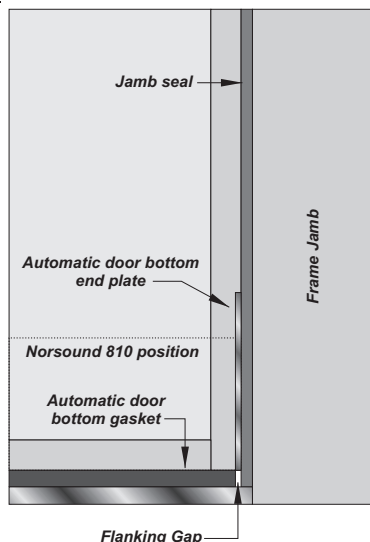
Flanking Gaps - Single leaf doorsets. Fig.10a.57

For single leaf doorsets there will generally be a flanking route at the threshold position caused by the essential need to provide for operating gaps.

Flanking can be minimised by ensuring that operating gaps, particularly at the threshold are kept as small as possible (4 +/- 1mm) and that threshold sealing gaskets extend as far as possible to the full width of the door. This is usually up to the automatic door bottom end plates.

For single leaf doorsets these flanking routes fall outside of the normal pedestrian used space. It is therefore possible to add small additional sealing devices to address this problem. See Flanking seals.

Elevation



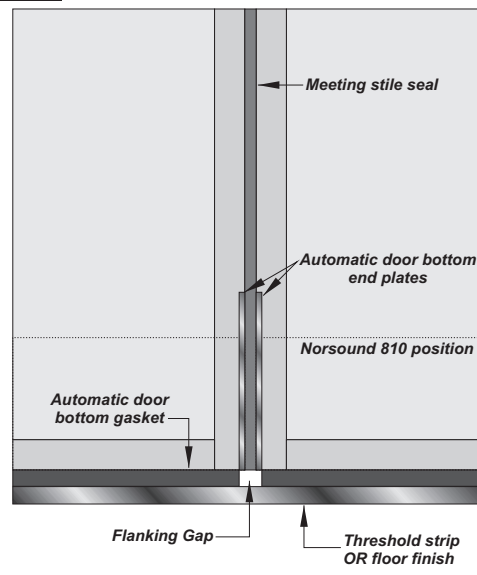
Flanking Gaps - Pairs. Fig.10a.58

When using automatic door bottoms or fixed bottom edge seals at the threshold there will be a gap at the bottom of the meeting stiles which will be exploited by airborne sound.

This leakage is unavoidable for an operational door but can be minimised by ensuring that under door gaps are kept as small as possible (4 +/- 1mm) and that threshold sealing gaskets extend as far as possible to the full width of the door. This is usually up to the automatic door bottom end plates.

Flanking at the bottom of meeting stiles can be significantly reduced by use of the Norsound 650 stepped threshold with seal where the NOR650 sealing gasket bridges this gap.

Elevation





Flanking contd:

To reduce flanking at the hanging and closing stiles of single leaf doorsets and the hanging stile for pairs of doors, flanking protectors can be added to the doorset sealing system.

These devices (*Norsound 'AcuPad'* and *Norsound DT1*) can form part of the original doorset design or added as upgrade items where they are needed.

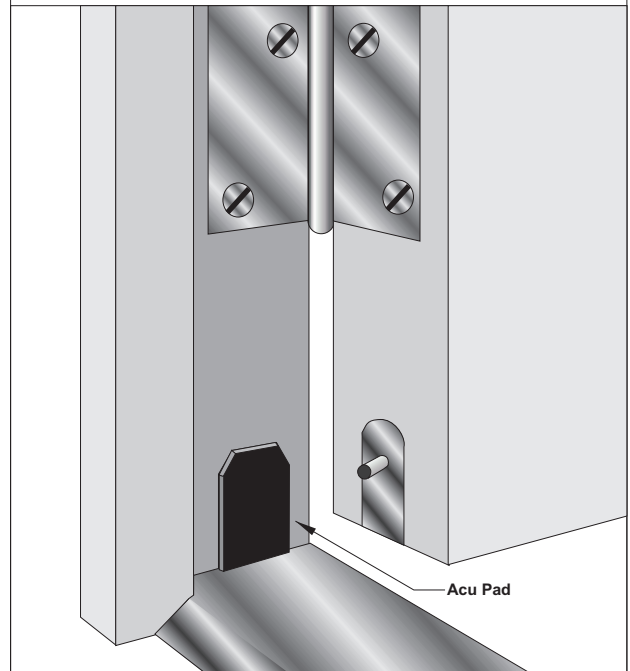
Norsound Flanking Seals.

Fig.10a.59

The Norsound 'AcuPad' is a small self adhesive device with a nylon brush seal that can be adhered to the frame jambs at the hanging and closing stiles of single action single leaf doors and at the hanging stiles for pairs. This device provides for a sealing function at a position where flanking is otherwise unavoidable.

The alternative Norsound DT1 provides for a similar function but this device is recessed into the bottom of the frame which is screw fixed into position.

Both devices provide for the same performance with the NOR DT1 being (perhaps) aesthetically more acceptable and less prone to casual removal.



Norsound 'AcuPad'



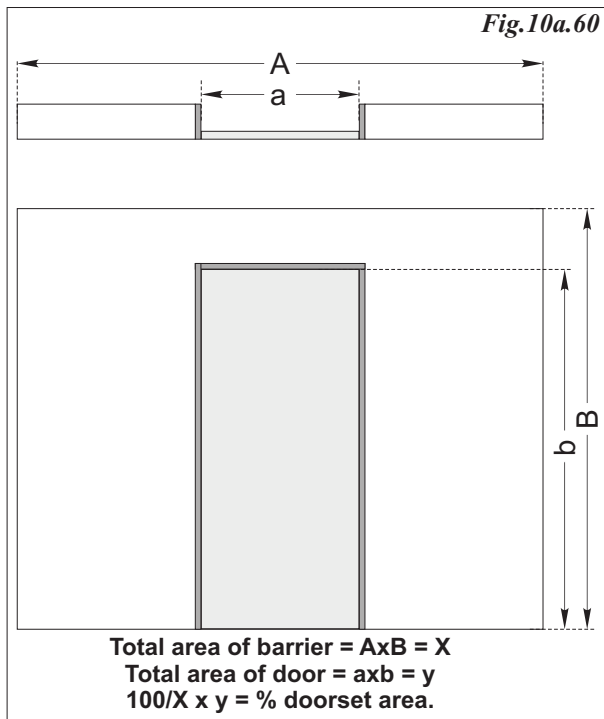
Norsound 'DT1'



Site Measurements:

When measuring sound attenuating performance on site, it is the performance of the complete barrier between the sound source and the protected area that is important. i.e. the combined performance of the wall, doorset, window etc. This performance is measured in accordance with BS EN ISO 140-4: 1998.

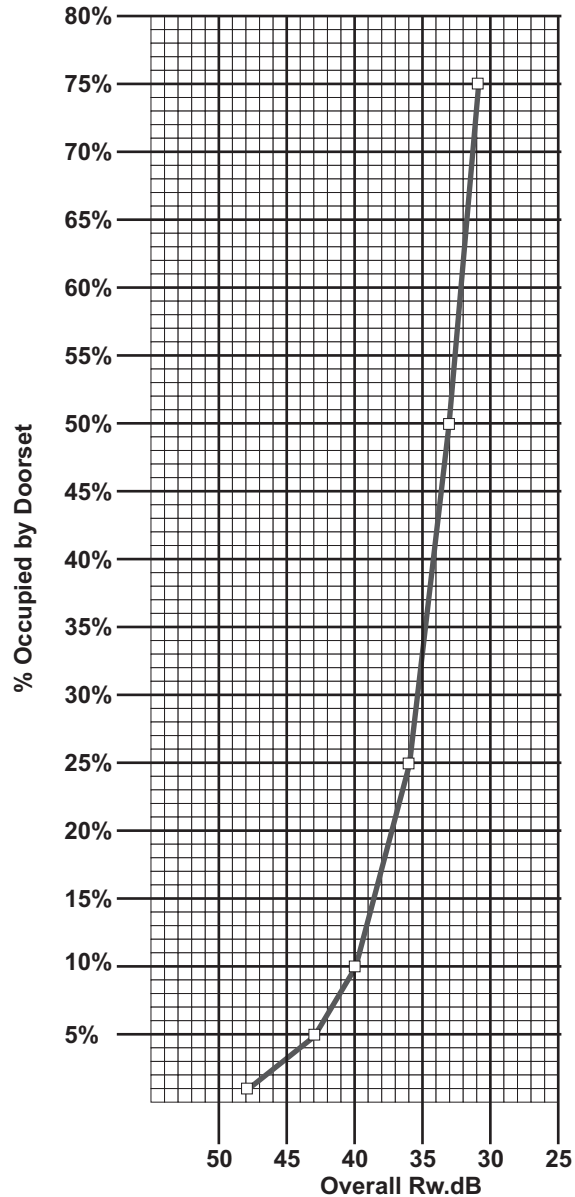
The performance of a doorset (*an operational product*) is likely to be less than the surrounding wall and the perceived performance of the total barrier (*wall & doorset*) will be less than the performance of the wall and better than the performance of the doorset. The total effect will vary, among other things, according to the percentage area that is occupied by the doorset.



Acoustic Engineers will need to know the sound attenuating performance of doorsets determined by laboratory testing to BS EN ISO 140-3 for the purpose of calculating acoustic designs for particular projects.

Pacific Rim Wood UK Ltd. will supply base test evidence to Architects and Acoustic Engineers for this purpose, on request.

Fig.10a.61



This graph illustrates the total sound attenuating performance when using an $R_w.30\text{dB}$ doorset in an $R_w.53\text{dB}$ wall.

Example: The overall sound attenuating performance of a barrier where an $R_w.30\text{dB}$ doorset occupies 25% of an $R_w.53\text{dB}$ wall, the overall performance would be about $R_w.36\text{dB}$.

Further assistance in the calculation of total barrier performances is provided by reference to www.norsound.co.uk 'Acoustic Calculator'