# ACCREDITATIONS

## Testing Organizations and Sound Standards

Acoustics testing is performed in accordance with strict guidelines which clearly define a specific sets of testing criteria to ensure uniform, accurate quality standards. These guidelines are typically authored by accredited independent testing organizations. Depending on the type of product and its application, testing may be government-mandated or strictly voluntary. Many manufacturers choose to undergo voluntary standards testing for their products, using the test data for a given item as quantifiable proof of its quality.

Pemko Manufacturing is completely committed to creating products that far exceed the highest expectations. We perform rigorous voluntary testing upon each new addition to our product family to ensure its unparalleled excellence and innovation. Simply put, specifying and installing Pemko's acoustics products on your structures dramatically reduces the transmission of unwanted noise through your entryway openings — and we have the test results to prove it.

While the actual criteria may differ depending upon the particular geographical area where a product is used, the purpose of structural acoustics testing is universal: To ensure that a product effectively contributes towards a safe, comfortable level of sound within an occupied building. The following independent organizations are instrumental in enforcing this goal, and their standards are the basis for the data found in the following pages:

**ASTM International (American Society for Testing and Materials, or ASTMI)**
Pemko's acoustics products surpass the following ASTMI (U.S.) standards:
ASTM E90-90 (see appendix for full description)
As one of the largest voluntary standards development organizations in the world, ASTMI is widely recognized as a trusted source for technical standards for materials, products, systems, and services. Known for their high technical quality and market relevancy, ASTM International standards have an important role in the information infrastructure that guides design, manufacturing and trade in the global economy.

**BSI (British Standards Institute)/NSB (UK National Standards Body)**
Pemko's acoustics products surpass the following BSI (British/European) standards:
BS EN ISO 140-4: 1995 (see appendix for full description)
BSI was the world's first national standards making body (NSB) and is number one in the world today. BSI British Standards, part of BSI Group, has a close working relationship with the British government, primarily through the Department of Trade and Industry (DTI). BSI's governmental role includes the development of standards for public use, the promulgation of standards, the voluntary nature of standards and their relationship with legislation.

BSI also operates independently of the government as a globally recognized impartial body which serves both the private and public sectors. BSI works with manufacturing and service industries, businesses, governments and consumers to facilitate the production of British, European and International standards.

Other independent organizations that figure prominently in acoustics testing are (Helen, do you want to add any of these? Do any of these apply?):

ANSI

ISO

BHMA

???

## The Sound Attenuation Testing Process

**What is Sound Attenuation Testing?**

Sound attenuation testing is the measurement of how effectively a barrier between two rooms (such as a door)  reduces the level of noise passed from room to room. Acoustings testing is non-destructive, meaning that the testing specimen is not harmed during the measurement process. (An example of destructive testing would be a fire test, where the door is completely burned to cinders as part of the process).

In the sound attenuation test, sound waves at a pre-determined decibel and frequency level are generated within a transmitting (source) room by a loudspeaker or other device. A full-size specimen door assembly is built into a standardized wall which separates the source room from a receiving room and equipped with hardware. The door is also equipped with any sealing systems or other devices if the sealing systems or devices themselves are the actual specimens that are being tested. The receiving room is equipped with sensitive microphones to collect the reduced sound signals after they travel through the specimen (door). The sound level data from each room is then compared to determine how effectively the testing specimen (door) blocked the transfer of sound between source room and the receiving room.

Because many different sound conditions (frequencies) may cause the specimen to perform differently, measurements are typically taken over a range of varied frequencies in order to obtain an accurate picture of the specimen's overall sound reduction performance. This data can then be applied to standardized rating systems as established by organizations such as ASTM, BHI and others.

## Sound Transmission Loss (TL)

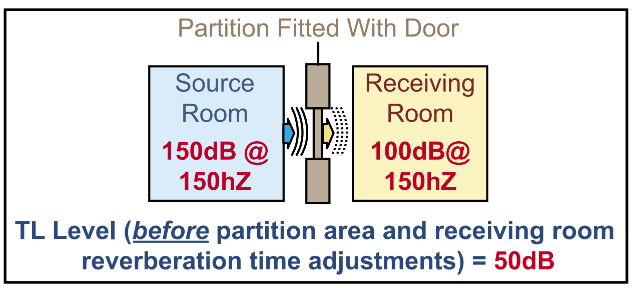



**Fig. XX: Sound Transmission Loss (TL) Level Testing**

As shown by the simplified illustration above, the TL level is the net sound loss between the source room and receiving room that is caused by the barrier (door) being tested at a certain frequency. The higher the TL, the more effective the noise reduction provided by the barrier. *(Note: This illustration does not take into consideration any adjustments for partition area or receiving room reverberation time).*

In the case of a door, **Sound Transmission loss (TL)** refers to its effectiveness in stopping sound transfer at a given frequency. Sound pressure levels are measured in decibels in both the source room and the receiving room at the test frequency; adjustment calculations are applied which factor in the overall area of the room's shared divider (wall or other partition) and the receiving room's reverberation time. The resulting difference between the sound levels inside the two rooms is the barrier (door)'s TL level; the higher the TL number, the better the door's ability to block unwanted sound (Figure XX).

TL measurements in the United States are performed in laboratories which comply with the **ASTM E90** *"Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions"*.

## STC Ratings Explained

The **STC (Sound Transmission Class**) rating system was developed in order to effectively provide a single-figure comparison standard which applies to any range of different doors. As with the Sound Transmission Loss (TL) number, the higher a specimen's STC rating number, the better its sound attenuation performance.

An STC rating is essentially a weighted compilation of sound transmission loss (TL) values taken over a set range of sixteen different frequencies. These sixteen measurements are plotted on a graph and compared to a standard reference curve which has been defined in the U.S. by **ASTM E413** *Classification Standard for Rating Sound Insulation*. This reference curve approximates the sound perception of the human ear under the same conditions as the test. Comparing these curves will determine the test specimen's STC rating number

STC testing can be conducted in two ways, and it's of utmost importance to be aware of the difference when choosing a rated door assembly for field installation. A non-operational door can be sealed into a test wall where the entire partition (door and wall together) is rated as a single panel. In this instance, the sound attenuation performance is often very different from that of of the same assembly if installed as a functioning door. A door assembly can also be tested in its fully operable state, which in most circumstances gives a more accurate representation of how the door will perform in a practical application. While not required, many manufacturers voluntarily test their doors under both sets of circumstances. It's vital to be aware of the type of published STC rating on your chosen door and how it may affect your installation.

# STC Ratings Explained (Continued)

**Typical Sound Attenuating Test Report:**

ASTM E90-90 Test

| Frequency Hz. | Sound Reduction Index dB 1/3 Octave | 1/1 Octave |
|---|---|---|
| 50+ | 21.3 | |
| 63+ | 25.7 | 22.9 |
| 80+ | 22.8 | |
| 100 | 17.9 | |
| **125** | 21.5 | 20.6 |
| **160** | 25.1 | |
| **200** | 26.5 | |
| **250** | 27.5 | 27.2 |
| **315** | 27.8 | |
| **400** | 25.2 | |
| **500** | 24 | 25.1 |
| **630** | 26.4 | |
| **800** | 27.3 | |
| **1000** | 29.6 | 29 |
| **1250** | 30.9 | |
| **1600** | 32.2 | |
| **2000** | 34 | 33.8 |
| **2500** | 36 | |
| **3150** | 37.9 | |
| **4000** | 39.3 | 39.2 |
| 5000 | 40.9 | |
| 6300+ | 41.4 | |
| 8000+ | 39.9 | 40.6 |
| 10000+ | 40.7 | |

**Average sound reduction over Frequency range 125 ~ 4000Hz = 29.45dB**

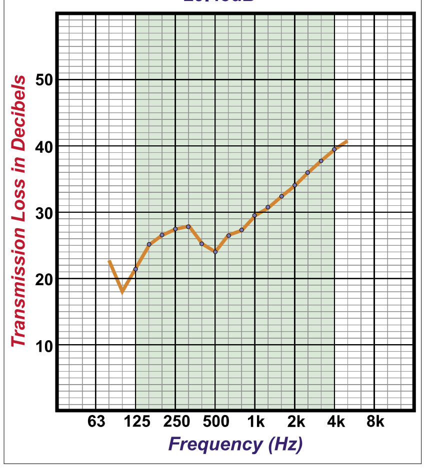



**Fig. XX: STC Test Data**
By averaging the sixteen dB reduction ratings for the frequencies of 125Hz to 400kHz, we arrive at an overall reduction level of 29.45dB.

**Application of the Standard Reference Curve:**

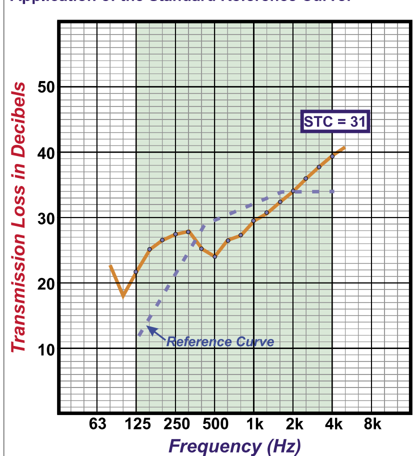



**Fig. XY: Standard Reference Curve**
The Standard Reference Curve represents the range of actual human hearing perception.

STC ratings are used to demonstrate a test specimen's actual sound attenuation rating. This data is also used to help determine which additional measures must be taken in order to achieve a desired STC rating (for instance, if a door without acoustical gasketing rates only 35dB and the minimun required sound attenuation rating for the opening is 45dB, this will help the installer determine which type and material of acoustical gasketing needs to be added in order to bring the door assembly up to the required 45dB rating).

It is critical to keep in mind that acoustical testing occurs in an optimal setting which excludes the many variables which can affect the door's performance in a real-world situation. Therefore, the door's sound blocking performance in the field will most likely be less than its lab-tested STC rating. The installation of proper acoustical gasketing is instrumental in making up for this performance deficit.

### Interpreting STC Test Data

Figure XX at left illustrates the typical method of sound attenuation measurement, with results plotted onto a graph. In the chart, "Octave" and "1/3 Octave" are simple ways to group frequencies together into reasonable gradations (100Hz, 125Hz, etc.), as opposed to exhaustively measuring each separate frequency (101Hz, 102Hz, 103Hz, etc).

Several steps are taken in order to calculate a test specimen's STC rating. We begin by averaging a specimen's sound attenuation performance over a specified range of frequencies (in this case, 125Hz to 400kHz) as shown by the chart and graph at left. In this example, if we take the average of the sixteen "1/3 Octave" results for the frequencies of 125Hz up to 4kHz (as specified by the **ASTM E90-90** Test), we arrive at the number 29.45 dB. This range of frequencies is also shown by the solid orange line in the graph of Figure XX.

Next, we apply a **Standard Reference Curve**, shown by the dashed blue line in Figure XY, which plots the range of actual human hearing perception.  We may now refer to this set of measurements by using the term **STC (Sound Transmission Class)**. As shown by the illustration, the two lines follow markedly different paths, intersecting occasionally. The areas where the lines do not intersect are referred to as c**oincidence gaps**. In a completely ideal acoustical situation, the lines would follow identical paths with no coincidence caps. This, however, is almost never the case in most commonly used building materials.

These lines allow us to chart where the test specimen (door) is able to satisfactorily block unwanted noise at certain decibel levels and frequencies, and where it fails to do so. Where the orange line is above the blue line, the product is performing above the minimum requirements for the particular STC; where the orange line falls below the blue line, it is performing below the desired performance level at those particular frequencies. Using this information, we can see that this particular specimen (door) performs well at low frequencies, but that as the frequencies increase, the sound attenuation decreases sharply before improving again at the highest frequencies. This mid-range decrease reduces the door's overall performance rating by lowering its net average score. This performance would be fairly typical in, for example, a solid wood or chipboard-core door.

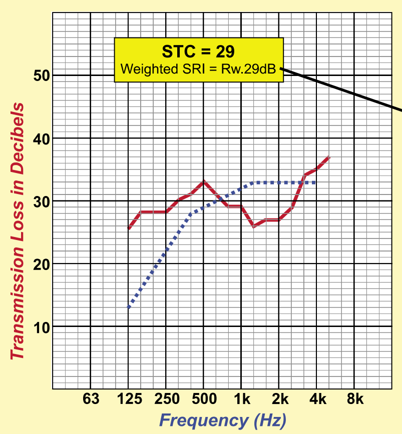
## Fig. XX vs. Fig. XY: Interpretation

In Figure XX, we consider the performance of what is possibly a solid wood core door of 1-¾ inches (44.5mm) thickness with a density of 8.45 lb/ft² (41.3 Kg/M²). This structure is reliant on crude mass law principles. In Figure XY, we examine a “dedicated” sound attenuating door construction. The door thickness is also 1-¾ inches (44.5mm), but in this case the door density is only 5.55 lb/ft² (27.1 Kg/M²).

By comparing Figures XX and XY, we are able to see that although we are getting good low frequency peformances from the STC29dB door (Fig. XX), the overall performance is dragged down by the coincidence gap in the 1kHz ~ 2 kHz frequency range. For the dedicated acoustic door (Fig. XY), the plotted performance follows the reference curve very closely, demonstrating an impressive STC40 performance.

However, overall decibel loss is not the only factor in deciding which of the two door applications to install. Each specimen performed quite differently at each frequency level; the STC29 door, for instance, had a higher sound attenuating performance (25.5db) at 125Hz than the STC40 door at the same frequency (20dB). Because of this, in a situation where, for example, we are only concerned about a noisy transformer turning out high sound pressure within the 125Hz range, the 29dB product may be preferable.

### Fig. XX




Specifications for sound attenuating doorsets will generally be related to “weighted” performances (STC). Some specifications, however, will actually define sound attenuating performance requirements at specific frequencies (i.e. **dB@defined frequency**).

**BASE TEST DATA**

TEST No. TL92-141 = STC29dB

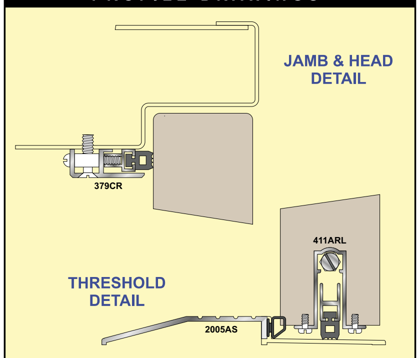
**SPECIMEN DETAILS**

| | |
|---|---|
| Frame | 6x2 in (146x50.8mm) 14g mild steel frame with integral door stop to head and jambs. Frame backfilled. |
| Door Leaf | 1-¾ “ (44.5mm) thickness wood door; density: 8.45 lb/ft² (41.3 Kg/M²) |

**SEALING SYSTEM**

| | |
|---|---|
| Threshold | Pemko 2005AS Threshold |
| Door Bottom | Pemko 411ARL Automatic Door Bottom to bottom edge of door leaf |
| Jambs & Head | Pemko 379CR Perimeter Seal |

**PROFILE DRAWINGS**




E90-90 average = 29dB

**STC 29**

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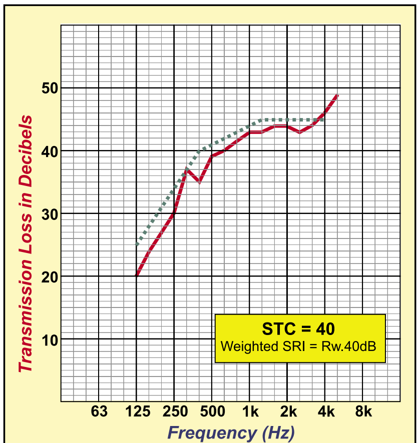
### Fig. XY




**BASE TEST DATA**

TEST No. TL92-143 = STC40dB

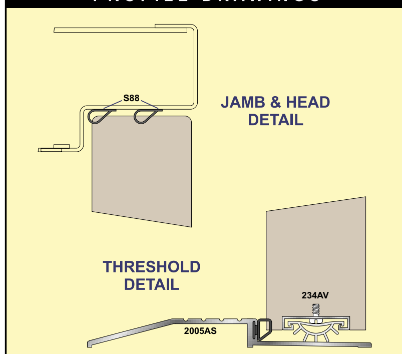
**SPECIMEN DETAILS**

| | |
|---|---|
| Frame | 6x2 in (146x50.8mm) 14g mild steel frame with integral door stop to head and jambs. Frame backfilled. |
| Door Leaf | 1-¾ “ (44.5mm) thickness wood door; density: 5.55 lb/ft² (27.1 Kg/M²) |

**SEALING SYSTEM**

| | |
|---|---|
| Threshold | Pemko 2005AS Threshold |
| Door Shoe | Pemko 234AV Door Shoe to bottom edge of door leaf |
| Jambs & Head | 2 strips Pemko S88 “Tear Drop” Seal in a parallel configuration |

**PROFILE DRAWINGS**




E90-90 average = 36dB

**STC 40**

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## Doorsets: Defining Usage and Purpose

A doorset's primary purpose is to provide a means for traffic to pass from one side of a wall to the other. In order to be fully functional, doors must be easy to use in consideration of its particular set of circumstances. Any number of factors can affect a doorset's ease of operation, including:

- **Location** - Will the door be installed in a noisy area, such as a manufacturing floor, or will this door be used in a quiet corridor? Is this an interior or exterior door?
- **Capabilities of Users** - Does the door need to be accessible to persons with disabilities? Does the door need to be easily opened by people of widely varying physical capabilities, or will it be accessed only by able-bodied persons?
- **Traffic Patterns** - Will the door be opened only occasionally for a specific purpose, or will this be used for access by the general public?
- **Any Additional Specialized Purpose**s - Is the door a fire door? Must the door fulfill any additional requirements, such as shielding against extreme temperatures or radiation? Will the doorset be installed as free-swinging "pass-through" doors (such as used in a restaurant kitchen)?

A doorset can not be completely sealed against sound or other environmental factors without becoming inoperable. Therefore, the doorset is always a potential weakness in any sound attenuating barrier — and the same factors which affect a doorset's ease of use can also greatly impact its ability to stop the transmission of unwanted noise. This is where acoustical gasketing comes into play.

## How Acoustical Gasketing Works

Sound waves move through the air with very little resistance (and therefore very little loss in strength). This means that any gap in a barrier through which air can flow also has the inherent ability to transfer virtually undiminished sound.

Because of the unimpeded way in which sound waves travel, the existence of any gap at all, regardless of size, drastically reduces a barrier's ability to block sound. If air can escape, noise will escape right along with it. Acoustical gasketing serves to stop unwanted noise in its tracks by stopping the passage of air around the door — and, in some cases, using air that has been trapped between gasketing seals as an extra sound absorber (since trapped air does not move, it provides an extra amount of "dead space" between the source of the sound and the recipient without allowing sound waves to penetrate).

- **Composition** - Gasketing is commonly composed of several different materials (such as vinyl, silicone, neoprene, and others), either singly or in combination. Each material has its own properties and purposes, and it may be advantageous to use a combination of different products to achieve your desired results. It is important to correctly match your door's intended usage to the proper gasketing materials; this is easily done by contacting Pemko or consulting an experienced installer.
- **Installation** - In order for acoustical gasketing to properly block unwanted sound, a door's entire perimeter (head, jambs and sill) must be equipped with a continuous, air-tight seal. Gasketing is applied along the door's perimeter on the same side of the door to establish the proper seal. The gasketing must also keep good surface contact with both the edges of the opening and the door itself, often having to compensate for imperfect door alignment or other door installation flaws.
- **Quality** - Installing top-quality acoustical gasketing not only assures optimal sound-blocking performance, it ensures that the seal will continue to withstand wear and tear and require fewer re-applications over the lifespan of the door opening.

  The quality of your perimeter gasketing is often not just a matter of stopping nuisance noise — it can also be a matter of liability, and even of life and death. Many modern installations require perimeter door seals to satisfy multiple requirements, often demanding that gasketing plays a vital role in stopping the spread of fire and/or blocking the infiltration of hazardous smoke in addition to arresting sound. To this end, Pemko has engineered a full line of industry-leading sealing products which surpass the building industry's most stringent safety and noise regulations.