[SHAPER SENSE]
ACOUSTIC LIGHTING
Shaper Sense is a new line of lighting products that integrate lighting and acoustic sound absorption materials together. Partnering with FilzFelt, a natural materials and acoustics leader, has led to innovative, award winning, yet simple product designs that meet the needs of open spaces where unwanted noise has become an issue. The solution based strategy of high performance lighting along with the industries highest level of sound absorbing materials and the widest array of color selections, within simple forms, give maximum freedom in design.

Introducing Shaper Sense:
A new line of award winning acoustic lighting products.

“Great design, great acoustics, and great finish options all in one. Finally, lighting and acoustic solutions integrated into one seamless design with performance for the workplace. A win for our clients. A win for design.”
What is Shaper? And does it make sense?

Shaper
The ethos of decorative products that solve customer problems through differentiated design and integrated technology.

Introducing Shaper Sense
An ensemble of products that coalesce the physical senses of sight, sound, and touch, to produce outputs of illuminance, sound absorption, and texture with controls, from one platform.

Sense
A sense is a physiological capacity of organisms that provide data for perception.

The decorative collection of Shaper Sense fixtures are designed to invoke the human senses of sight, hearing, and touch. In partnership with industry leading acoustic and natural materials company, FilzFelt™, the edgelit luminaires are an ensemble of integrated LED lighting and acoustic products with 100% Wool Design Felt.

This combination provides a collection of products of high aesthetic appeal, visual performance, and quality acoustic surrounds. The simple shapes (Box and Trapezoid) combined with 60 dynamic felt color selections, allow designers to choose and form countless looks, creating their own solutions for a space.
A CONFLUENCE OF
LIGHT + SOUND

Workspace office design has gone through a revolution from high wall cubicles to flexible-modular open office plans that promote collaboration and communication. A byproduct of this design has resulted in some unwanted noise causing disruption and distractions that can lead to lower productivity and dissatisfaction of the workspace environment.

By addressing the physiological components of lighting and noise from Maslow’s Hierarchy of Needs applied to workplace strategy, the development of integrating lighting and sound absorption materials from one platform becomes an ideal solution to help combat increasing noise and disruption in the work place.

The Shaper Sense family of products provides simplistic shapes, with dynamic color selections that can match other materials in the space or become a highlight on their own. In spaces that use FilzFelt sound absorbing products, Shaper Sense products are a natural complement to the environment. The natural material colors can be used in these large-scale voluminous fixtures to be calming, as well as using the vibrant color selections to make loud visual statements that can help create visual collaboration cues, way finding purpose, or space delineation. The optional addition of Wavelinx wireless controls platform, adds a third layer of flexible and desirable architectural space solutions.

The first series of products utilize a square light engine that is surrounded by acoustic materials in a box shape and trapezoid shape. Each shape has different color elements that can be selectable. The Shaper Sense Box fixture has a top and bottom panel that can have different felt colors, or can simply have the same felt color. The trapezoid has opposing pairs of panels for different felt color selection, or can be the same.

Color is a strong design element. Shaper Sense products partnered with Filzfelt, provides the widest palette of colors available for acoustic lighting solutions. Using color can help distinguish spacial design and can be highly impactful. In this scenario - color helps to distinguish collaborative spaces vs. work stations. The same product is used, but color helps define visual insight.
FilzFelt is an industry leading natural textile and acoustic products company that provides industry leading material performance. The color palette offering of 60+ 100% Wool Design Felt colors choices are used in the Shaper Sense products, creating thousands of dynamic color variable options. This lets the design teams add value and design choices that work for their spaces. FilzFelt’s 100% Wool Design Felt, is moisture resistant, self-extinguishing and known for its thermal and acoustic insulation properties and its highly saturated and lightfast colors. Wool felt is a nonwoven textile that has warmed, sheltered, protected and comforted human beings for centuries. This natural material has inherent durability and beauty that cannot be achieved with synthetic fibers. The 100% Wool Design Felt brings this ancient fabric into the 21st century where it balances beauty, utility and sustainability while meeting the challenging needs of modern spaces. Warranty on FilzFelt acoustic materials are 5 years.

Wool is a natural fiber harvested from sheep. Sheep’s wool is highly regarded for its crimped, elastic fibers that are easily felted to form a fabric that cannot be pulled apart. This translates into durability, excellent dye ability, resistance to flame and compression, and thermal and sound insulation. Plus, this natural fiber is a rapidly renewable resource (it grows back!) and is 100% biodegradable.

FilzFelt’s felts are manufactured from Merino wool that is typically sourced primarily from Australia, New Zealand, and South Africa. Merino sheep are prized for their fine hair and considered to be the highest quality sheep’s wool. Most sheep are sheared once a year (in spring or early summer) as it takes a full year to grow back.
100% Wool Design Felt - Over 60 color choices.

Wool felt is one of the oldest man-made textiles and to produce felt, raw wool undergoes a wet “felting” process, which involves matting, condensing and pressing the fibers. 100% Wool Design Felt is a high quality natural material, comes in highly saturated colors, and is perfect for demanding design applications. The proprietary process for developing the widest range of various felt colors is what propels FilzFelt to be an industry leader. 100% Wool Design Felt is 100% biodegradable, contains no formaldehyde, 100% VOC free, no chemical irritants, free of harmful substances.

100% Wool Design Felt contributes to LEED® v4

WHY IT WORKS

Our definition of “Substrate” is a recycled PET plastic made from items like plastic bottles. These are broken down and made into sound absorbing materials that are industry leading. These substrates contain a minimum of 60% recycled content, and are 100% recyclable in themselves. The “Shaper Sense” products use sound absorbing substrates in combination with sound absorbing colorful felt to bring a richness and depth to the aesthetic value of the product, that sets itself apart.

CHOICES...OVER 60+ OF THEM!
**PICK ME!**

The Shaper Sense Box has a top panel from which over 60+ of the 100% Wool Design Felt choices can be selected. The bottom panel also allows for the same number of selections of colors. These can then be the same for a uniform look, or very different... creating contrast and depth.

### Light Level 1 – 30W

<table>
<thead>
<tr>
<th>Lumens</th>
<th>Color Temperature</th>
<th>CRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2480</td>
<td>3000K @ 90 CRI</td>
<td>90</td>
</tr>
<tr>
<td>3084</td>
<td>3500K @ 80 CRI</td>
<td>80</td>
</tr>
<tr>
<td>3028</td>
<td>4000K @ 80 CRI</td>
<td>80</td>
</tr>
</tbody>
</table>

### Light Level 2 – 39W

<table>
<thead>
<tr>
<th>Lumens</th>
<th>Color Temperature</th>
<th>CRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>3172</td>
<td>3000K @ 90 CRI</td>
<td>90</td>
</tr>
<tr>
<td>3944</td>
<td>3500K @ 80 CRI</td>
<td>80</td>
</tr>
<tr>
<td>3873</td>
<td>4000K @ 80 CRI</td>
<td>80</td>
</tr>
</tbody>
</table>

---

**Test Method:** LM-79-08

**Catalog Number:** ShSe-BOX-2-L35-80-UNV-STD

**Description:** SHAPER SENSE BOX LIGHT LEVEL 2

**Light Source:** 3500K CCT, 80 CRI LEDS

**Summary**

- Luminaire Lumens: 3955 lumens
- Efficacy: 101.7 lumens/watt
- Input Watts (W): 38.8

**Color Vector Graphics - TM-30**

- Fidelity - Rf: 81
- Gamut - Rg: 95.9
HOW TO PICK  SHAPER SENSE BOX COLORS

For contrasting colors, choose different colors for the top panel and the bottom panel. For a monochromatic effect, select the same color for both top and bottom panels.

Select Top Panel + Color Selection from chart on page 28. Select Bottom Panel + Color Selection from chart on page 28.

EXAMPLE OF MONO-TONE
Top Panel TP713 = 713 Kiwi
Bottom Panel BP713 = 713 Kiwi

EXAMPLE OF TWO-TONE
Top Panel TP116 = 116 Orange
Bottom Panel BP312 = 312 Lagune

See page 28 for color selection numbers
The Shaper Sense Trapezoid has opposing pairs of panel from which over 60+ of the 100% Wool Design Felt choices can be selected. From one side, a solid panel look is created. Turn the corner, and a contrast of color can be achieved. Or, select all panels to be the same for a uniform look.

**Light Level 1 – 30W**

- 2487 lumens 3000K @ 90 CRI
- 3092 lumens 3500K @ 80 CRI
- 3036 lumens 4000K @ 80 CRI

**Light Level 2 – 39W**

- 3182 lumens 3000K @ 90 CRI
- 3955 lumens 3500K @ 80 CRI
- 3884 lumens 4000K @ 80 CRI

**Test Method:** LM-79-08

**Catalog Number:** ShSe-TRAP-2-L35-80-UNV-STD

**Description:** SHAPER SENSE TRAPEZOID LIGHT LEVEL 2

**Light Source:** 3500K CCT, 80 CRI LEDS

**Summary**

- **Luminaire Lumens:** 3955 lumens
- **Efficacy:** 101.9 lumens/watt
- **Input Watts (W):** 38.8

**Color Vector Graphics - TM-30**

- **Fidelity - Rf:** 81
- **Gamut - Rg:** 95.9

**Reference Illuminant**

**Test Source**
HOW TO PICK  SHAPER SENSE TRAPEZOID COLORS

For contrasting colors, choose different colors for the top panel and the bottom panel.
For a monochromatic effect, select the same color for both top and bottom panels.

Select side AA Panels + Color Selection from chart page 29.
Select side BB Panels + Color Selection from chart page 29.

EXAMPLE OF MONO-TONE
Side AA = 713 Kiwi
Side BB = 713 Kiwi

EXAMPLE OF TWO-TONE
Side AA116 = 116 Orange
Side BB312 = 312 Lagune

See page 29 for color selection numbers
For the Shaper Sense Box and Trapezoid fixtures the Noise Reduction Coefficient and Sound Absorption Average are calculated based on a range of frequency bands pertinent to human speech.

**Testing Testing 1,2,3**
Acoustic testing performed at industry leading NVLAP accredited labs.

### Shaper Sense Box
- Apparent Noise Reduction Coefficient (NRC): 1.2
- Apparent Sound Absorption Average (SAA): 1.19

<table>
<thead>
<tr>
<th>Hz</th>
<th>Sabins/ Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>5.7</td>
</tr>
<tr>
<td>250</td>
<td>8.05</td>
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<tr>
<td>500</td>
<td>11.44</td>
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<tr>
<td>1000</td>
<td>15.97</td>
</tr>
<tr>
<td>2000</td>
<td>16.79</td>
</tr>
<tr>
<td>4000</td>
<td>15.87</td>
</tr>
</tbody>
</table>

### Shaper Sense Trap
- Apparent Noise Reduction Coefficient (NRC): 1.4
- Apparent Sound Absorption Average (SAA): 1.38

<table>
<thead>
<tr>
<th>Hz</th>
<th>Sabins/ Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>10.97</td>
</tr>
<tr>
<td>250</td>
<td>13.65</td>
</tr>
<tr>
<td>500</td>
<td>23.39</td>
</tr>
<tr>
<td>1000</td>
<td>29.91</td>
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<tr>
<td>2000</td>
<td>30.93</td>
</tr>
<tr>
<td>4000</td>
<td>29.16</td>
</tr>
</tbody>
</table>
In spaces that use FilzFelt sound absorbing products, Shaper Sense products are a natural complement to the space. The calm natural material colors can be used in these large-scale voluminous fixtures to be calming, as well as using the vibrant color selections to make loud visual statements that can help create visual collaboration cues, or way finding purpose, or space delineation. Used in conjunction together these products help reduce unwanted reverberation.
The concept of OPEN design takes a step further in the development of a translucent light engine that is edge lit using high powered LEDs. The Shaper Sense Box and Trapezoid fixtures allow natural daylight to pass through preventing a dark and ominous feel from these large scale products. When the fixtures are on, they provide uplight and downlight for ambient task lighting. And when using the daylight harvesting feature from the wireless sensor platforms, can maintain illuminance as day turns to night.

85% translucent lens

A window…Natural Light can pass through. the light engine “OFF”

Illuminated light fully “ON”

• Conference Room
• Collaboration Space
Shaper Sense Trapezoid

EXAMPLE OF FIXTURE “OFF” (CENTER)

A great use for the Shaper Sense products are in conference rooms that tend to be open and airy. Reverberation in these spaces can be high, and when the main agenda for this application is to communicate, Shaper Sense acoustic lighting products are a natural fit.

EXAMPLE OF FIXTURE “ON” (ALL)
WIRELESS SENSING SENSORS

Shaper Sense acoustic lighting products are able to use Cooper Lighting's wireless controls platforms of WaveLinx and LumaWatt Pro.

WAVELINX
The WaveLinx tile mount sensor option is an integral part of the WaveLinx Wireless Connected Lighting System and offers 3 amp relay control and continuous 0-10V dimming of Shaper Sense luminaires. The tile mount sensor provides daylight dimming and control for a single luminaire or can be daisy chained for group luminaire control. The sensor’s control module allows simple electrical Junction Box mounting via ½” knock out or direct connection to the junction box attached to the Shaper luminaire. The WaveLinx Tile mount daylight sensor operates on a wireless mesh network based on IEEE 802.15.4 standards and is controlled by a WaveLinx Wireless Area Controller.

LUMAWATT PRO
The LumaWatt Pro Tile mount sensor option is field installed to a single luminaires junction box or daisy chained to a group of luminaires, providing lighting control and sensing in an independent, fault-proof, resilient networks of powerful end-points. Sensors have profiles stored internally containing all of the variables for the application once a configuration is set and is able to manage the fixture without connectivity to the system. The sensors gather data from four on-board inputs: Passive infrared occupancy detection, daylight, temperature, and electrical current use. Wireless gateways communicate with the sensors and transmit the data using industry-standard wired technology to the Energy Manager, for powerful, familiar dashboards of information tailored for access on a connected computer. Energy Managers connect to optional cloud-based applications, maximizing the dense, data-rich sensing within the footprint of the luminaire for management of the building environment, and much more.
The unique use of recycled sound absorption materials, renewable felt that is 100% recyclable, and minimalistic industrial design, contribute to lower transportation costs, and even lower carbon footprint (less CO2 emissions affecting our planet.). Shaper Sense products just feel good to use.

Part of the ingenious and patented design is how the product assembles and ultimately ships. Each acoustic light fixture consists of one translucent light engine and four acoustic panels. They arrive to the job site in two separate boxes. By having individual acoustic panels, they can be laid flat, and be “flat packed” to minimize transportation costs as well as less impact on the environment.
CASE STUDY: PALLET COMPARISON

The Shaper Sense products stack up well against the competition. The flat pack design allows more fixtures on to a pallet, and thus less pallets and environmental impacts for a project. The Shaper Sense Box, fixture for instance, can fit 9 complete products on to two pallets. The competition (assuming one large fixture per pallet), would need nine individual pallets.

9 Shaper Sense Box fixtures – fits on 2 pallets

VS.

9 large scale acoustic lighting fixtures – fits on 9 pallets

CASE STUDY: TRUCK LOAD COMPARISON

SHAPER SENSE PRODUCTS - 270 BOX / 200 TRAP FIXTURES AT MAXIMUM CAPACITY

COMPETITOR X - 48 ACOUSTIC FIXTURES AT MAXIMUM CAPACITY

SHAPER SENSE (1) FULL TRUCK LOAD

1/6

COMPETITOR X (6) FULL TRUCK LOADS

ASSUMPTIONS

53 ft Semi-flat bed truck, 45”x48” pallet, 48 pallets fill full capacity in Semi-flatbed truck
Competitors X - 1 large fixture / pallet
Shaper Sense Box - 15 light engines/ pallet + 9 acoustic panels/ pallet, Shaper Sense Trap - 15 light engines/ pallet + 6 acoustic panels/ pallet
Shaper Sense Luminaires

LIGHT WAVES + SOUND WAVES... A REFLECTION

Sound waves and light waves act similarly. In LIGHTING, when light waves reflect on hard surfaces, like gypsum for example, they create a pleasing and diffused light. In SOUND, “When sound reflects on hard surfaces, it causes overlapping reflections that are either experienced as echoes (distinct reflections that reduce intelligible speech), or build up as reverberation, which makes communication generally more difficult. When beautiful hard surface spaces are designed, sound absorption materials become difficult to incorporate.” - Scott Pfeiffer, Partner at Threshold Acoustics

The concept of adding acoustic materials on a light fixture provides an aesthetically pleasing way to provide sound absorption back into the space in increments that are beneficial to the spacing of lighting fixtures.

HOW SOUND REFLECTS...

- 100% sound absorption yields an NRC = 1.0
- 0% sound absorption yields an NRC = 0

This example shows a ceiling tile that has an NRC equal to 0.75, which means it stops 75% of the sound from going through. In the same way, when sound hits a hardwood floor, only 15% of the sound is absorbed, thus allowing 85% to reflect. This can cause multiple echoes of reflected sound, called reverberation, which can be uncomfortable. Using more sound absorption materials in a space can reduce reverberation.

Sound hits a surface, gets absorbed, then reflects the excess. If a surface does not absorb sound well, then sound continues to reflect, though eventually becoming 100% absorbed.
HOW LIGHT REFLECTS...

When light reflects, it either gets absorbed or reflects depending on the reflectance value of the surface it hits. In lighting, there is specular reflectance and diffuse reflectance. Specular reflectance takes the incident light and reflects back the same amount as a specular reflection. Diffuse reflectance sends the light uniformly in all directions regardless of the incident direction. This can create soft light, rather than poignant light reflection. In lighting, the reflectance through diffusion can create soft ambient lighting effects that are soothing.

WHAT'S SO GREAT ABOUT SOUND ABSORBING LIGHT FIXTURES?

When new open office and space design evolved in taking down the cubicle walls and opening up the ceiling plane, the sound absorbing materials, often the acoustic ceiling tiles, went out the window as well. By adding sound absorption materials onto the light fixture, sound absorption materials can be added back into spaces in increments of a lighting layout.
LIGHTING 101

LIGHT:
Visible light is the portion of the electro-magnetic spectrum that is perceived by the human eye, and is responsible for the sense of sight.

FOOTCANDLE (fc):
Noun: footcandle; plural noun: footcandles is the imperial unit of illumination, or lumen density incident on a surface. One footcandle is equal to 10.764 lux (SI units), and represents the illuminance cast on a surface by a one-candela (12.57 lumen) omnidirectional source one foot away.

LUMEN (lm):
The SI unit of luminous flux. One lumen is the amount of flux emitted into a unit solid angle (1 steradian) by a one-candela omnidirectional point source. Luminous flux (lumens) is radiant power (watts) multiplied by the luminous efficacy curve of the human eye. This accounts for our eyes perceiving different wavelengths with different sensitivities across the visible spectrum.

CCT: CORRELATED COLOR TEMPERATURE:
The correlated color temperature (CCT) of a light source is the temperature, in kelvin, to which an ideal blackbody radiator must be heated in order to emit light that resembles the chromaticity of the light source in question. As a blackbody radiator is heated, the chromaticity of the “white” light emitted changes from red-orange towards blue. The continuous curved line defining the color change over temperature is referred to as the Planckian locus.

The CIE 1931 x,y chromaticity space, also showing the chromaticities of black-body light sources of various temperatures (Planckian locus), and lines of constant correlated color temperature.
LIGHTING 101

CRI: COLOR RENDERING INDEX:
Color rendering index (CRI) is a quantitative measure of the ability of a light source to reveal the colors of objects faithfully in comparison with daylight or incandescent reference illuminant. For example, imagine going to a grocery store and having apples look grayish-red, that would indicate that the lights in the store render some colors poorly and may have a low CRI. If you took that same apple outside it would look more natural.

Rf: Fidelity Index:
The fidelity index expands on the concepts of the CRI by introducing 99 new color samples for consideration across a more broad range of hues and saturations than CRI. This is a better overall indication of the lights ability to render colors accurately.

Rg: Gamut Index:
The gamut index indicates the change in saturation of colors. A gamut index of 100 indicates that, on average, the light source does not change the saturation of colors relative to the reference illuminant. If the Rg is less than 100, the light source renders colors as less saturated, and if it is higher than 100, then it renders colors more saturated. This value is averaging the effect of all colors considered, so the detailed TM-30 data should be referenced to understand the change in chroma across hues.

DIFFUSE LIGHTING AND REFLECTION:
Light reflects off of diffuse and specular surfaces. White surfaces are good for reflection as well as hard surfaces. When light reflects off of these, it continues and it dissipates. These multiple lighting reflections create diffuse lighting which creates soft inter-reflect ed light. This can be more comfortable than direct lighting which can be more intense and sometimes harsh.
SOUND  -  THE NEW LANGUAGE

The workplace landscape and culture has shifted over the past number of years to adjust to changing demographics, technologies, and work styles that combine focused work as well as team work setting. This has lead to investigation of noise in the work place and productivity and better solutions to help with this problem. To understand the integrated lighting and acoustic products from Shaper Sense, a new language and terminology is being introduced and learned as well. Here are just some of the new functional vocabulary:

ABC'S OF ACOUSTICS

These 3 techniques are the base line on acoustic design. Different materials and technologies can help account for the most beneficial acoustic soundscapes. Shaper Sense products currently focus on “A” – absorption – which directly affects Reverberation and RT.

REVERBERATION  -  sound that lingers due to reflection in an interior space

RT60 – REVERBERATION TIME  -  is the number of seconds required for the intensity of the sound to drop from the starting level, by an amount of 60 Db.

Table of common reverberation times based on application space. Ideal office space setting is between 0.6 and 0.8

<table>
<thead>
<tr>
<th>Application</th>
<th>Ideal Reverberation Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cafe</td>
<td>0.8 to 1.2</td>
</tr>
<tr>
<td>Open Workspace</td>
<td>0.75 to 1.2</td>
</tr>
<tr>
<td>Private Meeting Room</td>
<td>0.6 to 1.0</td>
</tr>
<tr>
<td>Private Office</td>
<td>0.6 to 0.8</td>
</tr>
</tbody>
</table>

NRC  -  NOISE REDUCTION COEFFICIENT

Is a scalar representation of the amount of sound energy absorbed upon striking a particular surface.

SAA  -  SOUND ABSORPTION AVERAGE

This is the average of the absorption coefficients for the twelve one-third octave bands from 200 to 2500 Hz...

The higher the SAA or the NRC value, the better the material absorbs sound

Examples of noise reduction properties within materials:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>NRC VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marble</td>
<td>0</td>
</tr>
<tr>
<td>Brick - Painted</td>
<td>0.02</td>
</tr>
<tr>
<td>Concrete (block), painted</td>
<td>0.05</td>
</tr>
<tr>
<td>Brick, unpainted</td>
<td>0.05</td>
</tr>
<tr>
<td>Concrete (smooth), painted</td>
<td>0.05</td>
</tr>
<tr>
<td>Steel</td>
<td>0.1</td>
</tr>
<tr>
<td>Glass</td>
<td>0.1</td>
</tr>
<tr>
<td>Wood</td>
<td>0.15</td>
</tr>
<tr>
<td>Plywood</td>
<td>0.15</td>
</tr>
<tr>
<td>Concrete (smooth), unpainted</td>
<td>0.2</td>
</tr>
<tr>
<td>Carpet, indoor-outdoor</td>
<td>0.2</td>
</tr>
<tr>
<td>Carpet, heavy on concrete</td>
<td>0.3</td>
</tr>
<tr>
<td>Concrete (block), unpainted</td>
<td>0.35</td>
</tr>
<tr>
<td>Carpet, heavy on foam rubber</td>
<td>0.55</td>
</tr>
<tr>
<td>Fiberglass, 1” Semi-rigid</td>
<td>0.75</td>
</tr>
<tr>
<td>Fiberglass, 3-1/2” batt</td>
<td>0.95</td>
</tr>
<tr>
<td>FilzFelt Acoustic Baffles</td>
<td>1.2</td>
</tr>
<tr>
<td>Shaper Sense Box</td>
<td>1.2</td>
</tr>
<tr>
<td>Shaper Sense Trapezoid</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Courtesy of FilzFelt
The Noise Reduction Coefficient (NRC) is the amount of sound absorbed when a sound wave strikes a surface. An NRC of zero indicates perfect reflection; and NRC of one indicates 100% sound absorption. Lighting Acoustic fixtures have taken on new shapes and geometries that the testing labs are not familiar with. Traditionally, NRC is calculated for flat materials. Because of this paradigm, and the request by the industry to state NRC, test labs have performed these tests on these geometries, which are yielding results higher than 1.0. Currently the test method is following ASTM 423C-17. NRC is the term most recognized and used by the architectural and building industry, but not recognized by ASTM. ASTM has moved to Sound Absorption Average, SAA, that covers more frequency bands within the framework of sound. The conversation around sound is really about reducing Reverberation Time in a space – to improve speech intelligibility.

**NAME THAT SOUND: OTHER COMMONLY USED TERMS AND EXAMPLES:**

**dB - DECIBEL** A unit used to measure the intensity of a sound.

Examples of decibels in everyday life:

<table>
<thead>
<tr>
<th>DECIBEL, dB</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>a mosquito 10 ft away</td>
</tr>
<tr>
<td>13</td>
<td>ordinary light bulb hum</td>
</tr>
<tr>
<td>40</td>
<td>whisper</td>
</tr>
<tr>
<td>50</td>
<td>typical office noise level</td>
</tr>
<tr>
<td>40-60</td>
<td>normal conversation</td>
</tr>
<tr>
<td>80</td>
<td>heavy traffic at 10am</td>
</tr>
<tr>
<td>85</td>
<td>beginning of hearing damage, earplugs should be worn</td>
</tr>
<tr>
<td>110</td>
<td>night club - dance floor</td>
</tr>
<tr>
<td>116</td>
<td>human body perceiving low vibration</td>
</tr>
<tr>
<td>130-135</td>
<td>large train horn</td>
</tr>
<tr>
<td>150</td>
<td>rock concert</td>
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<tr>
<td>165</td>
<td>727 taking off</td>
</tr>
<tr>
<td>198-202</td>
<td>human death from sound</td>
</tr>
<tr>
<td>220</td>
<td>space shuttle landing</td>
</tr>
<tr>
<td>235</td>
<td>5.0 Richter scale earthquake</td>
</tr>
<tr>
<td>320</td>
<td>volcanic eruption</td>
</tr>
</tbody>
</table>

**Fr - FREQUENCY** The rate at which a vibration occurs that constitutes a wave, either in a material (as in sound waves), or in an electromagnetic field (as in radio waves and light), usually measured per second.

**Hz - Hertz** The SI unit of frequency, equal to one cycle per second.

**Sb - SABIN** Unit of sound absorption (the process by which a material, structure or object takes in sound energy, as opposed to reflecting or transmitting the energy). One sabin indicates the equivalent absorption of one square foot (or square meter in SI units) of a perfect 100% sound absorber.

**EX. TEST REPORT: SPECIMEN ABSORPTION**

<table>
<thead>
<tr>
<th>FREQUENCY [HZ]</th>
<th>SABINS</th>
<th>SABIN/UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>315</td>
<td>45.89</td>
<td>15.30</td>
</tr>
<tr>
<td>400</td>
<td>52.77</td>
<td>17.59</td>
</tr>
<tr>
<td>500</td>
<td>70.77</td>
<td>23.59</td>
</tr>
<tr>
<td>630</td>
<td>78.65</td>
<td>26.22</td>
</tr>
<tr>
<td>800</td>
<td>86.33</td>
<td>28.78</td>
</tr>
<tr>
<td>1000</td>
<td>91.79</td>
<td>30.60</td>
</tr>
<tr>
<td>1250</td>
<td>95.97</td>
<td>31.99</td>
</tr>
<tr>
<td>1600</td>
<td>97.55</td>
<td>32.52</td>
</tr>
<tr>
<td>2000</td>
<td>95.34</td>
<td>31.78</td>
</tr>
<tr>
<td>2500</td>
<td>94.56</td>
<td>31.52</td>
</tr>
<tr>
<td>3150</td>
<td>91.80</td>
<td>30.60</td>
</tr>
</tbody>
</table>

**Examples of frequency bands of human speech. As a common sound source, if these bands of can be absorbed, the reflected sound that makes a space uncomfortable can be reduced.**
Ambient lighting calculations performed on the floor and table (2.5 AFF). Ratios remain comfortable relative to task and ambient light levels.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>SYMBOL</th>
<th>AVG</th>
<th>MAX</th>
<th>MIN</th>
<th>MAX/MIN</th>
<th>AVG/MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQUARE CALCS @ TABLE</td>
<td>+</td>
<td>40 fc</td>
<td>43 fc</td>
<td>35 fc</td>
<td>1.2 : 1</td>
<td>1.1 : 1</td>
</tr>
<tr>
<td>SQUARE CALCS @ FLOOR</td>
<td>+</td>
<td>25 fc</td>
<td>29 fc</td>
<td>17 fc</td>
<td>1.7 : 1</td>
<td>1.5 : 1</td>
</tr>
<tr>
<td>BOX CALCS @ TABLE</td>
<td>+</td>
<td>41 fc</td>
<td>45 fc</td>
<td>37 fc</td>
<td>1.2 : 1</td>
<td>1.1 : 1</td>
</tr>
<tr>
<td>BOX CALCS @ FLOOR</td>
<td>+</td>
<td>23 fc</td>
<td>28 fc</td>
<td>18 fc</td>
<td>1.6 : 1</td>
<td>1.3 : 1</td>
</tr>
</tbody>
</table>

LIGHTING CALCULATION STATISTICS

SQUARE CALCS @ TABLE:
- Symbol: +
- AVG: 40 fc
- MAX: 43 fc
- MIN: 35 fc
- MAX/MIN: 1.2 : 1
- AVG/MIN: 1.1 : 1

SQUARE CALCS @ FLOOR:
- Symbol: +
- AVG: 25 fc
- MAX: 29 fc
- MIN: 17 fc
- MAX/MIN: 1.7 : 1
- AVG/MIN: 1.5 : 1

BOX CALCS @ TABLE:
- Symbol: +
- AVG: 41 fc
- MAX: 45 fc
- MIN: 37 fc
- MAX/MIN: 1.2 : 1
- AVG/MIN: 1.1 : 1

BOX CALCS @ FLOOR:
- Symbol: +
- AVG: 23 fc
- MAX: 28 fc
- MIN: 18 fc
- MAX/MIN: 1.6 : 1
- AVG/MIN: 1.3 : 1
**Lights, Sound, Calc!**

**Box**

Lighting calculations and the effect on placement of the product relative to sound absorption are shown here. Sound testing labs compute a Sabin/ unit report that produces a value corresponding to a frequency band. This frequency range is put into the perspective of human speech octave, and how we measure reverberation. Here we show those values in a typical conference room, with and without acoustic substrate surrounds. The layout can be similar to how we lay out lighting to get uniform distributions as well as effective sound absorption, or lower reverberation.

**RT60: Light Fixtures Without Acoustic Sound Absorption**

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>AVG</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>0.76</td>
</tr>
<tr>
<td>250</td>
<td>0.97</td>
</tr>
<tr>
<td>500</td>
<td>1.15</td>
</tr>
<tr>
<td>1000</td>
<td>1.11</td>
</tr>
<tr>
<td>2000</td>
<td>0.91</td>
</tr>
<tr>
<td>4000</td>
<td>0.85</td>
</tr>
<tr>
<td>250-2k</td>
<td>1.04</td>
</tr>
</tbody>
</table>

These frequencies are represented in octave bands that are related to human speech. The results are the RT60 for each frequency in seconds. In this calculation, it is without sound absorbers around the light engines.

**RT60: Light Fixtures With Acoustic Sound Absorption**

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>AVG</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>0.67</td>
</tr>
<tr>
<td>250</td>
<td>0.82</td>
</tr>
<tr>
<td>500</td>
<td>0.84</td>
</tr>
<tr>
<td>1000</td>
<td>0.74</td>
</tr>
<tr>
<td>2000</td>
<td>0.64</td>
</tr>
<tr>
<td>4000</td>
<td>0.62</td>
</tr>
<tr>
<td>250-2k</td>
<td>0.76</td>
</tr>
</tbody>
</table>

These frequencies are represented in octave bands that are related to human speech. The results are the RT60 for each frequency in seconds. In this calculation, the light fixtures include sound absorbers around the light engines in a box shape configuration and uniform layout.

**% Improvement in Reverberation (RT60)**

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>AVG</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>12%</td>
</tr>
<tr>
<td>250</td>
<td>16%</td>
</tr>
<tr>
<td>500</td>
<td>27%</td>
</tr>
<tr>
<td>1000</td>
<td>33%</td>
</tr>
<tr>
<td>2000</td>
<td>30%</td>
</tr>
<tr>
<td>4000</td>
<td>27%</td>
</tr>
<tr>
<td>250-2k</td>
<td>27%</td>
</tr>
</tbody>
</table>

Ex. 58% reverberation decrease (RT60) using 6 Shaper Sense Box fixtures at 8.5 ft spacing.

The percentages represent the % improvement in reverberation per octave band, and then an average value over the entire range. It is recommended to use between 0.6 to 0.8 as an Reverberation Time goal for office settings.
Ambient lighting calculations performed on the floor and table (2.5 AFF). Ratios remain comfortable relative to task and ambient light levels.

<table>
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<tr>
<th>DESCRIPTION</th>
<th>SYMBOL</th>
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<th>MIN</th>
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<tbody>
<tr>
<td>SQUARE CALCS @ TABLE</td>
<td>+</td>
<td>40 fc</td>
<td>43 fc</td>
<td>35 fc</td>
<td>1.2 : 1</td>
<td>1.1 : 1</td>
</tr>
<tr>
<td>SQUARE CALCS @ FLOOR</td>
<td>+</td>
<td>25 fc</td>
<td>29 fc</td>
<td>17 fc</td>
<td>1.7 : 1</td>
<td>1.5 : 1</td>
</tr>
<tr>
<td>TRAP CALCS @ TABLE</td>
<td>+</td>
<td>43 fc</td>
<td>46 fc</td>
<td>37 fc</td>
<td>1.2 : 1</td>
<td>1.2 : 1</td>
</tr>
<tr>
<td>TRAP CALCS @ FLOOR</td>
<td>+</td>
<td>26 fc</td>
<td>32 fc</td>
<td>21 fc</td>
<td>1.5 : 1</td>
<td>1.2 : 1</td>
</tr>
</tbody>
</table>
**Lights, Sound, Calc!**

**Trapezoid**

Lighting calculations and the effect on placement of the product relative to sound absorption are shown here. Sound testing labs produce a Sabin/ unit report that produces a value corresponding to a frequency band. This frequency range is put into the perspective of human speech octave, and we measure reverberation. Here we show those values in a typical conference room, with and without acoustic substrate surrounds. The layout can be similar to how we lay out lighting to get uniform distributions as well as effective sound absorption, or lower reverberation.

### Reverberation Time (RT60)

![Reverberation Time (RT60)](image)

### RT60: Light Fixtures Without Acoustic Sound Absorption

<table>
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<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>0.76</td>
</tr>
<tr>
<td>250</td>
<td>0.97</td>
</tr>
<tr>
<td>500</td>
<td>1.15</td>
</tr>
<tr>
<td>1000</td>
<td>1.11</td>
</tr>
<tr>
<td>2000</td>
<td>0.91</td>
</tr>
<tr>
<td>4000</td>
<td>0.85</td>
</tr>
<tr>
<td>250-2k</td>
<td>1.04</td>
</tr>
</tbody>
</table>

These frequencies are represented in octave bands that are related to human speech. The results are the RT60 for each frequency in seconds. In this calculation, it is without sound absorbers around the light engines.

### RT60: Light Fixtures With Acoustic Sound Absorption

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>0.64</td>
</tr>
<tr>
<td>250</td>
<td>0.75</td>
</tr>
<tr>
<td>500</td>
<td>0.68</td>
</tr>
<tr>
<td>1000</td>
<td>0.60</td>
</tr>
<tr>
<td>2000</td>
<td>0.53</td>
</tr>
<tr>
<td>4000</td>
<td>0.52</td>
</tr>
<tr>
<td>250-2k</td>
<td>0.64</td>
</tr>
</tbody>
</table>

These frequencies are represented in octave bands that are related to human speech. The results are the RT60 for each frequency in seconds. In this calculation, the light fixtures include sound absorbers around the light engines in a Trapezoid shape.

### % Improvement in Reverberation (RT60)

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>16%</td>
</tr>
<tr>
<td>250</td>
<td>23%</td>
</tr>
<tr>
<td>500</td>
<td>41%</td>
</tr>
<tr>
<td>1000</td>
<td>46%</td>
</tr>
<tr>
<td>2000</td>
<td>42%</td>
</tr>
<tr>
<td>4000</td>
<td>39%</td>
</tr>
<tr>
<td>250-2k</td>
<td>38%</td>
</tr>
</tbody>
</table>

Ex. 38% reverberation decrease (RT60) using 6 Shaper Sense Trapezoid fixtures.

The percentages represent the % improvement in reverberation per octave band, and then an average value over the entire range. It is recommended to use between 0.6 to 0.8 as an Reverberation Time goal for office settings.
TECHNICAL SPECIFICATIONS

BOX

Felt Color Selections for Top and Bottom Panels

Shaper Sense Luminaires
**Dimensions**

**Series**
ShSh = Shaper Sense

**Shape/Family**
BOX=Box

**Light Level 1**
1-L30-90=2480 lumens, 30W, 3000K, 90 CRI
1-L35-80=3084 lumens, 30W, 3500K, 80 CRI
1-L40-80=3028 lumens, 30W, 4000K, 80 CRI
2-L30-90=3172 lumens, 39W, 3000K, 90 CRI
2-L35-80=3944 lumens, 39W, 3500K, 80 CRI
2-L40-80=3873 lumens, 39W, 4000K, 80 CRI

**Voltage**
UNV = Universal Voltage (120-277)

**Mounting**
CNPY = Canopy mount (works for surface, open structure, and gypsum ceilings)

**Dimming**
STD = 0-10V

**Controls**
SWTPD1 = Wavelinx Wireless Tile
LWTPD1 = LumaWatt Pro Wireless Tile

**Top Panel Selection (TP)**
- TP100 = TP Panel Wollweiss
- TP110 = TP Panel Rohweiss
- TP150 = TP Panel Tomate
- TP160 = TP Panel Weiß
- TP170 = TP Panel Graphit
- TP175 = TP Panel Graphit
- TP200 = TP Panel Natur
- TP220 = TP Panel Natural
- TP250 = TP Panel Truffelbraun
- TP300 = TP Panel Anthrazit
- TP308 = TP Panel Anthrazit
- TP331 = TP Panel Sahara
- TP385 = TP Panel Schlam
- TP408 = TP Panel Tanne
- TP415 = TP Panel Schlief
- TP437 = TP Panel Aubergine
- TP448 = TP Panel Moos
- TP503 = TP Panel Magnicie
- TP534 = TP Panel Rose
- TP540 = TP Panel Ozsan
- TP613 = TP Panel Gletscher
- TP626 = TP Panel Azur
- TP686 = TP Panel Enzian

**Bottom Panel Selection (BP)**
- BP100 = BP Panel Wollweiss
- BP110 = BP Panel Rohweiss
- BP150 = BP Panel Tomate
- BP160 = BP Panel Weiß
- BP170 = BP Panel Graphit
- BP175 = BP Panel Graphit
- BP200 = BP Panel Natur
- BP220 = BP Panel Natural
- BP250 = BP Panel Trufellbraun
- BP300 = BP Panel Anthrazit
- BP308 = BP Panel Anthrazit
- BP331 = BP Panel Sahara
- BP385 = BP Panel Schlam
- BP408 = BP Panel Tanne
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- BP534 = BP Panel Rose
- BP540 = BP Panel Ozsan
- BP613 = BP Panel Gletscher
- BP626 = BP Panel Azur
- BP686 = BP Panel Enzian

**Notes:**
1. 3000K – only in 90 CRI, 3500K only available in 80 CRI, 4000K only available in 80 CRI.
2. Selection for BOX top panel color. See diagram on page 3 for clarification.
3. Selection for BOX bottom panel color. See diagram on page 3 for clarification.
# TECHNICAL SPECIFICATIONS

## TRAPEZOID

<table>
<thead>
<tr>
<th>Color Code</th>
<th>Color Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>021</td>
<td>Grün</td>
</tr>
<tr>
<td>023</td>
<td>Blau</td>
</tr>
<tr>
<td>025</td>
<td>Violett</td>
</tr>
<tr>
<td>027</td>
<td>Kirsch</td>
</tr>
<tr>
<td>029</td>
<td>Terrakotta</td>
</tr>
<tr>
<td>031</td>
<td>Schoko</td>
</tr>
<tr>
<td>033</td>
<td>Beige</td>
</tr>
<tr>
<td>035</td>
<td>Anthrazit</td>
</tr>
</tbody>
</table>

Felt Color Selections for Side AA and Side BB Panels

<table>
<thead>
<tr>
<th>Color Code</th>
<th>Color Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>Anthrazit</td>
</tr>
<tr>
<td>122</td>
<td>Braun</td>
</tr>
<tr>
<td>124</td>
<td>Gelb</td>
</tr>
<tr>
<td>126</td>
<td>Beige</td>
</tr>
<tr>
<td>128</td>
<td>Anthrazit</td>
</tr>
<tr>
<td>130</td>
<td>Anthrazit</td>
</tr>
<tr>
<td>132</td>
<td>Anthrazit</td>
</tr>
<tr>
<td>134</td>
<td>Anthrazit</td>
</tr>
</tbody>
</table>

---

Shaper Sense Luminaires
Series
ShSh = Shaper Sense
Shape/Family
TRAP = Trapezoid

Light Level
1-L30-90=2487 lumens, 30W, 3000K, 90 CRI
1-L35-80=3092 lumens, 30W, 3500K, 80 CRI
1-L40-80=3036 lumens, 30W, 4000K, 80 CRI
2-L30-90=3181 lumens, 39W, 3000K, 90 CRI
2-L35-80=3955 lumens, 39W, 3500K, 80 CRI
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Voltage
UNV = Universal Voltage (120-277)

Mounting
CNPY = Canopy mount (works for surface, open structure, and gypsum ceilings)

Dimming
STD = 0-10V

Controls
SWTPD1 = Wavelinx Wireless Tile
LWTPD1 = LumaWatt Pro Wireless Tile

Finish
Mono-tone Side Panel
AA100 = AA Panel Wollweiss
AA110 = AA Panel Rohweiss
AA150 = AA Panel Weiss
AA160 = AA Panel Beige
AA170 = AA Panel Asche
AA175 = AA Panel Graphit
AA200 = AA Panel Natur
AA220 = AA Panel Rehbraun
AA250 = AA Panel Truffelbraun
AA300 = AA Panel Anthrazit
AA331 = AA Panel Sahara
AA343 = AA Panel Schlamm
AA408 = AA Panel Tawpe
AA415 = AA Panel Schilf
AA437 = AA Panel Aubergine
AA448 = AA Panel Moos
AA503 = AA Panel Magnolie
AA534 = AA Panel Rose
AA540 = AA Panel Ocean
AA613 = AA Panel Gletscher
AA626 = AA Panel Azur
AA686 = AA Panel Enzian

Two-tone Side Panel
BB100 = BB Panel Wollweiss
BB110 = BB Panel Rohweiss
BB150 = BB Panel Weiss
BB160 = BB Panel Beige
BB170 = BB Panel Asche
BB175 = BB Panel Graphit
BB200 = BB Panel Natur
BB220 = BB Panel Rehbraun
BB250 = BB Panel Truffelbraun
BB300 = BB Panel Anthrazit
BB331 = BB Panel Sahara
BB343 = BB Panel Schlamm
BB408 = BB Panel Tawpe
BB415 = BB Panel Schilf
BB437 = BB Panel Aubergine
BB448 = BB Panel Moos
BB503 = BB Panel Magnolie
BB534 = BB Panel Rose
BB540 = BB Panel Ocean
BB613 = BB Panel Gletscher
BB626 = BB Panel Azur
BB686 = BB Panel Enzian

Notes:
1. 3000K - only in 90 CRI, 3500K only available in 80 CRI, 4000K only available in 80 CRI.
2. Selection for TRAP Mono-Tone color side panel. See diagram on page 3 for clarification.
3. Selection for TRAP Two-Tone color side panel. See diagram on page 3 for clarification.

Dimensions
Canopy
AC Cable Collector

Scale
10' [3.0m] 6' [1.8m]