INIMITABLE

noun: inimitable
adjective: so good or unusual as to be impossible to copy; unique.

Shaper Sense is a new line of lighting products that integrates 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.”

Richard S.
Principal
Denver, CO

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.

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 62 dynamic felt color selections, allow designers to choose and form countless looks, creating their own solutions for a space.
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 lowered 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 workplace.

The Shaper Sense family of products provides simple 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 bold visual statements that can help create visual collaboration cues, way finding purposes, or space delineation. The optional addition of Wavelinx wireless control platform, adds a third layer of flexible and desirable architectural space solutions.

The first series of products utilizes 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 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, provide the widest palette of colors available for acoustic lighting solutions. Using color can help address space 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.
Producing wool felt is an extensive and challenging process 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 changing needs of modern spaces.

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.

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 “setting” process, which involves matting, condensing and pressing the fibers. 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.

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**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**
- 2480 lumens
- 3000K @ 90 CRI
- 3084 lumens
- 3500K @ 80 CRI
- 3232 lumens
- 4000K @ 80 CRI

**Light Level 2 – 39W**
- 3172 lumens
- 3000K @ 80 CRI
- 3944 lumens
- 3500K @ 80 CRI
- 3075 lumens
- 4000K @ 80 CRI

**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 BP312 = 312 Lagune

**Example of Two-Tone**
Top Panel TP116 = 116 Orange
Bottom Panel BP713 = 713 Kiwi

**Driver Canopy**
**AC Cable Collector**

**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

**Light Level 1 – 30W**
- 2480 lumens @ 3000K
- 3084 lumens @ 3500K
- 3232 lumens @ 4000K

**Light Level 2 – 39W**
- 3172 lumens @ 3000K
- 3944 lumens @ 3500K
- 3075 lumens @ 4000K

**Color Vector Graphics - TM-30**

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

**Color Rendering Index CRi**
- 95: Excellent
- 80: Good
- 60: Moderate

**Luminance Luminance**
- 3500K @ 90 CRI
- 3500K @ 80 CRI

**Color Temperature**
- 3000K
- 3500K
- 4000K

**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.

**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 Monotone**

- Side AA = 713 Kiwi
- Side BB = 713 Kiwi

**Example of Two-Tone**

- Side AA = 116 Orange
- Side BB = 312 Lagune

**Test Method**

- LM-79-08
- Catalog Number: ShSe-TRAP-2-L35-80-UNV-STD
- Description: SHAPER SENSE TRAPEZOID LIGHT LEVEL 2

**Summary**

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

**Light Level 1 – 30W**

- 2467 lumens 3000K @ 90 CRI
- 3039 lumens 3500K @ 80 CRI
- 3036 lumens 4000K @ 80 CRI

**Light Level 2 – 39W**

- 3182 lumens 3000K @ 90 CRI
- 3555 lumens 3500K @ 80 CRI
- 3604 lumens 4000K @ 80 CRI

**AC Cable Collector**

**Driver Canopy**

See page 29 for color selection numbers.
SOUND VALUES

For the Shaper Sense Box and Trap anodized 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.

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

Testing Testing 1,2,3
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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.

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” knockout 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.

The LumaWatt Pro Tile mount sensor option is field installed to a single luminaire’s junction box or daisy chained to a group of luminaires, providing lighting control and sensing in an independent, fault-proof, resilient network 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.
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.

The sound absorbing substrate used in the Shaper Sense products are made from recycling plastics. The acoustic substrate from FilzFelt, contains a minimum of 60% recycled content and is 100% recyclable.

The unique use of recycled sound absorption materials, renewable felt that is 100% recyclable, and minimalist industrial design, contribute to a lower transportation costs, and even lower carbon footprint (less CO2 emissions affecting our planet). Shaper Sense products just feel good to use.

CASE STUDY: TRUCK LOAD COMPARISON

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

COMPETITOR X - 48 ACOUSTIC FIXTURES AT MAXIMUM CAPACITY

CASE STUDY: PALLET COMPARISON

SHAPER SENSE BOX fixtures – fits on 2 pallets

COMPETITOR X - 9 pallets

ASSUMPTIONS

53 ft Semi flat bed truck, 45”x48” pallet, 48 pallets fill full capacity in Semi flatbed truck

Shaper Sense Box - 15 light engines/pallet + 9 acoustic panels/pallet, Shaper Sense Trap - 15 light engines/pallet + 6 acoustic panels/pallet

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Shaper Sense Box - 15 light engines/pallet + 9 acoustic panels/pallet, Shaper Sense Trap - 15 light engines/pallet + 6 acoustic panels/pallet
Sound waves and light waves act the same way. In Lighting, when light waves reflect on hard surfaces, they create a pleasing ambient and diffuse lighting. When sound waves reflect on hard surfaces, it causes the overlapping echo-ness, of reverberation that is not pleasing and can make it hard to discern speech. When beautiful hard surface spaces are designed, sound absorption material became less. The concept of adding acoustic materials on a light fixture provides an aesthetically and pleasing way to provide sound absorption back into the space and 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 it will stop reflecting.

**EXAMPLE OF NRC IN MATERIALS**

**WHAT’S SO GREAT ABOUT SOUND ABSORBING LIGHT FIXTURES?**

When new open office and space designed 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, we can add back in sound absorption in increments of a lighting layout.

**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 pinpoint light reflection. In lighting, the reflectance through diffusion can create soft ambient lighting effects that are soothing.
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.

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.

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 illumination cast on a surface by a one-candela (12.57 lumen) omnidirectional source one foot away.

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.

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 light in the store renders 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 light’s 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 light reflections create diffuse lighting which creates soft inter-reflected light. This can be more comfortable than direct lighting which can be more intense and sometimes harsh.

FIDUCIAL SURFACE
DIFFUSE REFLECTION
SPECCULAR REFLECTION

The diagram shows the relationship between light emission, reflection, and human perception of light and color.
The work place 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. The work place 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. Technologies can help account for the different materials and acoustic design. Different materials and technologies can help account for the new functional vocabulary: reverberation, absorption, direct, characteristic absorption, octave bands, sound absorption coefficient, noise reduction coefficient, noise reduction, sound transmission class, noise control, noise absorption, and others. Here are just some of the new functional vocabulary:

- **Reverberation Time (RT)**: the time it takes for the sound level to drop by 60 dB after the source is turned off. It is a measure of how quickly the sound energy dissipates in a room. A shorter RT indicates a more reverberant space.

- **Absorption**: the ability of a material to absorb sound energy. Materials with higher absorption coefficients effectively reduce sound levels in a space.

- **Sound Absorption Coefficient (SAC)**: a measure of how much sound energy a material absorbs, typically expressed as a percentage. SAC values range from 0 (no absorption) to 1 (perfect absorption).

- **Noise Reduction Coefficient (NRC)**: a measure of the average sound absorption coefficient of a material across all frequency bands, indicating how well a material reduces sound transmission through a wall.

### Table of common reverberation times based on application space

<table>
<thead>
<tr>
<th>Application</th>
<th>Ideal RT Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal Office Space</td>
<td>0.6 to 1.0</td>
</tr>
<tr>
<td>Private Meeting Room</td>
<td>0.75 to 1.2</td>
</tr>
<tr>
<td>Open Workspace</td>
<td>0.6 to 0.8</td>
</tr>
<tr>
<td>Private Office</td>
<td>0.6 to 0.8</td>
</tr>
<tr>
<td>Café</td>
<td>0.4 to 0.8</td>
</tr>
</tbody>
</table>

### Examples of noise reduction properties within materials:

- **Marine**: 0
- **Brick - Painted**: 0.02
- **Concrete (block, painted)**: 0.04
- **Concrete (smooth, painted)**: 0.03
- **Sheet**: 0.1
- **Glass**: 0.1
- **Aluminum**: 0.16
- **Plywood**: 0.18
- **Concrete (smooth, unpainted)**: 0.2
- **Concrete, heavy on concrete**: 0.3
- **Concrete (block, unpainted)**: 0.25
- **Concrete, heavy on rubber**: 0.52
- **FilzFelt, 1” Semi- rigid**: 0.75
- **FilzFelt, 3/16” felt**: 0.05
- **Shaper Sense Trapezoid**: 1.4
- **Shaper Sense Box**: 1.2
- **FilzFelt Acoustic Baffles**: 1.2

### Noise Reduction Coefficient (NRC)

The Noise Reduction Coefficient (NRC) is a number indicating how much sound energy is absorbed upon striking a particular surface. It is the average of the absorption coefficients for the twelve one-third octave bands from 200 to 2500 Hz. The higher the NRC, the better the material absorbs sound. Shaper Sense products currently focus on most beneficial acoustic soundscapes.

### Sound Pressure Level (SPL)

Sound Pressure Level (SPL) is a unit used to measure the intensity of a sound.

### Frequency (Hz)

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), is usually measured per second.

### Decibels (dB)

The Decibel (dB) is a unit used to measure the intensity of a sound relative to a reference level. It is a logarithmic scale used to express the ratio of two sound levels.

### 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). A Sabin indicates the equivalent absorption of one square foot of a material, or one square inch of a material.

### Acoustic Absorption

The SI unit of frequency, equal to one cycle per second.

### Name that sound:

The SI unit of frequency, equal to one cycle per second.

- **Shaper Sense Luminaires**
- **SOUND**
- **ABC’s OF ACOUSTICS**
- **Absorb**
- **Block**
- **CoverUp**
- **RT - Reverberation**
- **RT60 – Reverberation Time**
- **Sound Absorption Coefficient**
- **Noise Reduction Coefficient**
- **Decibels**
- **Frequency**
- **Sabin**
- **Examples of frequency names of various sounds**: A commonly known sound, if those names of sound sources, the resulting sound that makes a specific combination can be assessed.

---

### Table of Sound Absorption Coefficients

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Absorption Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>0.52</td>
</tr>
<tr>
<td>400</td>
<td>0.52</td>
</tr>
<tr>
<td>630</td>
<td>0.52</td>
</tr>
<tr>
<td>800</td>
<td>0.52</td>
</tr>
<tr>
<td>1000</td>
<td>0.52</td>
</tr>
<tr>
<td>1250</td>
<td>0.52</td>
</tr>
<tr>
<td>1600</td>
<td>0.52</td>
</tr>
<tr>
<td>2000</td>
<td>0.52</td>
</tr>
<tr>
<td>2500</td>
<td>0.52</td>
</tr>
</tbody>
</table>

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.

---

### Courtesy of FilzFelt

The SI unit of frequency, equal to one cycle per second.
Shaper Sense Luminaires

Lights, Sound, Calc! Box

Lights, sound, calc

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.

**Example:** 58% reverberation decrease (RT60) using 6 Shaper Sense box fixtures at 8.5 ft spacing.

**Lighting Calculations**

<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 calc @ 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 calc @ fixture</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 calc @ 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>

**Reverberation Time (RT60)**

**FREQUENCY (Hz)**

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

The 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 Without Acoustic Sound Absorption**

**FREQUENCY (Hz)**

<table>
<thead>
<tr>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>250-2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.67</td>
<td>0.82</td>
<td>0.84</td>
<td>0.34</td>
<td>0.64</td>
<td>0.82</td>
<td>0.76</td>
</tr>
</tbody>
</table>

The 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)**

**FREQUENCY (Hz)**

<table>
<thead>
<tr>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>250-2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>12%</td>
<td>16%</td>
<td>27%</td>
<td>33%</td>
<td>36%</td>
<td>27%</td>
<td>27%</td>
</tr>
</tbody>
</table>

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.

**RT60 GOAL**

- No sound absorption
- RT60 Goal (technically) = 0.8

**NRC = 1.2**

**SAA = 1.19**

- 58% improvement in reverberation per octave band.
- 27% Reverberation Time goal for office settings.

**Light Fixtures With Acoustic Sound Absorption**

**FREQUENCY (Hz)**

<table>
<thead>
<tr>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>250-2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.20</td>
<td>1.15</td>
<td>1.11</td>
<td>0.91</td>
<td>0.85</td>
<td>1.04</td>
<td>1.04</td>
</tr>
</tbody>
</table>

The 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 engines include sound absorbers around the light engines in a box shape configuration and uniform layout.

**Reverberation Time (RT60)**

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>0.00</th>
<th>0.20</th>
<th>0.40</th>
<th>0.60</th>
<th>0.80</th>
<th>1.00</th>
<th>1.20</th>
<th>1.40</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>0.76</td>
<td>0.97</td>
<td>1.15</td>
<td>1.11</td>
<td>0.91</td>
<td>0.85</td>
<td>1.04</td>
<td>1.04</td>
</tr>
<tr>
<td>250</td>
<td>0.67</td>
<td>0.82</td>
<td>0.84</td>
<td>0.34</td>
<td>0.64</td>
<td>0.82</td>
<td>0.76</td>
<td>0.76</td>
</tr>
</tbody>
</table>

**Freq. Range**

The 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.

**Ambient lighting calculations performed on the floor and table (2.5 AFF). Ratios remain comfortable relative to task and ambient light levels.**

**Lighting Calculation Statistics**

**Reverberation (RT60)**

- RT60 (without acoustic treatment)
- RT60 (with acoustic treatment)
- Goal

**27% Reverberation Reduction**

**Reverberation Improvement (RT60)**

- 0.8

**Reverberation Goal**

- 0.8

**NRC = 1.2**

**SAA = 1.19**

- 58% improvement in reverberation per octave band.
- 27% Reverberation Time goal for office settings.
Lighting calculations and the effect on placement of the product relative to sound absorption are shown here. Sound testing labs produce a Sabine 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.

### Lighting Calculations

**Lighting Calculations**

<table>
<thead>
<tr>
<th>SQUARE CALCS @ TABLE</th>
<th>SYMBOL</th>
<th>AVG</th>
<th>MIN</th>
<th>MAX</th>
<th>MIN/MAX</th>
<th>AVG/MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td></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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SQUARE CALCS @ FLOOR</th>
<th>SYMBOL</th>
<th>AVG</th>
<th>MIN</th>
<th>MAX</th>
<th>MIN/MAX</th>
<th>AVG/MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td></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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRAP CALCS @ TABLE</th>
<th>SYMBOL</th>
<th>AVG</th>
<th>MIN</th>
<th>MAX</th>
<th>MIN/MAX</th>
<th>AVG/MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td></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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRAP CALCS @ FLOOR</th>
<th>SYMBOL</th>
<th>AVG</th>
<th>MIN</th>
<th>MAX</th>
<th>MIN/MAX</th>
<th>AVG/MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td></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>

The 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.

### RT60: Light Fixtures without Acoustic Sound Absorption

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

The 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

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<tr>
<th>FREQUENCY (Hz)</th>
<th>AVG</th>
<th>MIN</th>
<th>MAX</th>
<th>MIN/MAX</th>
<th>AVG/MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>0.64</td>
<td>0.75</td>
<td>0.68</td>
<td>0.68</td>
<td>0.53</td>
</tr>
<tr>
<td>250</td>
<td>0.64</td>
<td>0.75</td>
<td>0.68</td>
<td>0.68</td>
<td>0.52</td>
</tr>
<tr>
<td>500</td>
<td>0.64</td>
<td>0.75</td>
<td>0.68</td>
<td>0.68</td>
<td>0.52</td>
</tr>
<tr>
<td>1000</td>
<td>0.64</td>
<td>0.75</td>
<td>0.68</td>
<td>0.68</td>
<td>0.52</td>
</tr>
<tr>
<td>2000</td>
<td>0.64</td>
<td>0.75</td>
<td>0.68</td>
<td>0.68</td>
<td>0.52</td>
</tr>
<tr>
<td>4000</td>
<td>0.64</td>
<td>0.75</td>
<td>0.68</td>
<td>0.68</td>
<td>0.52</td>
</tr>
<tr>
<td>250-2k</td>
<td>0.64</td>
<td>0.75</td>
<td>0.68</td>
<td>0.68</td>
<td>0.52</td>
</tr>
</tbody>
</table>

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.
Felt Color Selections for Top and Bottom Panels

Box

Dimensions

Exploded View

Bottom Panel Selection (BP)

Notes:
- 1200 = Fixture 120V, 277V available in a 10' (3.0m) and 28' (8.5m) length (see page 3 for illustration)
- Explosion view is a partial view (see diagrams on pages 2 & 3 for illustration)
- Dimensions for 28' (8.5m) or larger can be customized. See diagram on page 3 for illustration
- Box Color Selections are available in a 28' (8.5m) or 10' (3.0m) length (see page 3 for illustration)
Felt Color Selections for Side AA and Side BB Panels

Scale

10’ [3.0m]

6’ [1.8m]

AC Cable

Canopy

Collector

Two-tone Side View

Mono-tone Side View

Bottom View

Shaper Sense Luminaires

Felt Color Selections for Side AA and Side BB Panels

Notes:

1. 3000K – only in 90 CRI, 3500K only available in 80 CRI, 4000K only available in 80 CRI.

Notes:

AA686 = AA Panel Enzian
AA626 = AA Panel Azur
AA613 = AA Panel Gletsher
AA534 = AA Panel Rose
AA503 = AA Panel Magnolie
AA448 = AA Panel Moos
AA437 = AA Panel Aubergine
AA385 = AA Panel Schlamm
AA331 = AA Panel Sahara
AA312 = AA Panel Lagune
AA300 = AA Panel Anthrazit
AA250 = AA Panel Truffelbraun
AA200 = AA Panel Natur
AA160 = AA Panel Beige
AA150 = AA Panel Weiss
AA110 = AA Panel Rohweiss
AA100 = AA Panel Wollweiss

Mono-tone Side Panel 2

UNV - 120 - 277V

Voltage

STD = 0-10V Dimming

Mounting

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

Notes:

All panels are designed for indoor use and are equipped with a self-cleaning function. Suitable for the TRAP two-tone color side panel. See diagram on page 3 for clarification.

Dimensions

Height:

Shaper Sense Luminaries

Scale