ARD

QuietStuf® is a registered trademark of Autex Ind Ltd
This guide has been produced to provide guidance in the selection of Insulation Products for Mechanical Services. All information is given in good faith but without warranty. All products are subject to constant development and we reserve the right to change specification without warranty.
1. Welcome

Autex Pty is an Australian company. You will find Autex products almost everywhere. Our acoustic wall linings are in schools across Australasia, helping children to hear better in the classroom. Our bedware is found in the hotel rooms of a five star hotel chain in Portugal and Spain. You’ll find our marine carpets on pleasure boats in Dubai and our carpets brighten Hong Kong Disneyland.

We use the same innovation and technology to produce our range of mechanical service insulation that are presented in this brochure.

Autex has been manufacturing polyester insulation for over fifteen years and is now the largest polyester insulation manufacturer in Australasia. Autex also exports insulation materials around the world and has been specified and used in projects in the UK, the Middle East, SE Asia, Japan, China, South Africa, and throughout the Pacific region.

Our various thermal and acoustic insulations are used in a wide range of applications from domestic and commercial buildings to automotive and marine, as well as air conditioning and industrial functions.

All of our products are based on 100% user friendly polyester fibres. We utilise recycled fibre in our insulation and have a zero waste ethos. All of our insulation products are 100% recyclable. We can even take back insulation, offcuts and surplus, and reuse this material allowing for endless product life cycles.

Our plants in Melbourne, Sydney, Perth and Queensland operate using an integrated ISO 9001 quality and ISO 14001 Environmental management control system.

www.autex.com.au
2. Mechanical Service Insulation Products

The Autex Mechanical Services Insulation Guide provides a ready reference to products engineered to satisfy the minimum requirement levels set by the Building Code of Australia (BCA).

Autex ARD (Autex Rigid Duct) insulation Products are thermally bonded using 100% Polyester fibre. Our products are manufactured with up to 85% recycled fibre.

Autex Polyester products are durability warranted and they are also fully recyclable. They do not contain nor produce any ozone depleting substances or gases. Our products are rated as low VOC and no VOCs are used during the manufacturing process.

Autex Insulation contains no fibres of a respirable size. The manufacturing process is a very clean, low noise, low energy use production process. The manufacturing process also embraces a zero waste policy; where by any excess production of polyester goods are re-used in the process. Our products have a low embodied energy.

Introducing;

External Duct Lining Products;

ARD-ER
(Autex Rigid Ducting-External R(R VALUE))

Available with facings;
- Plain Foil (PF)

Internal Duct Lining Products;

ARD-IR
(Autex Rigid Ducting-Internal R(R VALUE))

Available with facings;
- Black Polyester Non Woven (BNW)
- Plain Foil (PF)
- Perforated foil (HWPF)-(Heavy Weight Perforated Foil)

Ultimate Internal Duct Lining Products;

ARD-IR MAX
(Autex Rigid Ducting-Internal R(R VALUE) MAXimum Acoustics)

Available with facings;
- Plain Foil (PF)
- Perforated foil (HWPF)-(Heavy Weight Perforated Foil)

The R Values of QuietStuf ARD – ER, IR & IR Max are material R Values. The Building Code of Australia lists the total R value required for insulated ductwork.

FOR AVAILABLE SIZES AND TECHNICAL INFORMATION SEE SECTION 8.
Autex also manufactures insulation material for Flexible duct, please consult with your Autex sales consultant for data sheets.

Autex also manufactures insulation material for the manufacture of Filtration products, such as return air vents, filtration bags etc.

Please consult with your Autex sales consultant for filtration data sheets.

**WARNING - SUBSTITUTION**

Products in this manual have specific design characteristics. Substituting them for other products may invalidate performance. No warranty for the performance of any system will be given where substituted product is used.

All Autex products have undergone extensive testing. When tested in accordance with AS1530.3 “Early Fire Hazard Properties of Materials” the range of Autex ARD products exhibit the following characteristics which comply with the requirements of AS4254 “Ductwork for air Handling and the Building Code of Australia”.

- Ignitability Index 0
- Spread of Flame 0
- Heat Evolved 0
- Smoke developed 0 to 3
3. Why Polyester?

Performance / Compliance and Safety

- breathe easy
- non-irritant
- non-toxic
- non-allergenic
- odourless

Polyester is the name of the fibre extruded from PET plastic. Most of the polyester we use has been recycled from various sources, such as plastic bags and other packaging.

Polyester does not “leach” any chemicals and is food safe. The polyester we use is the same as found in milk bottles, clothing and bedding. Polyester is also used extensively in medical applications due to its safe nature.

Polyester fibres do not contain nor produce any Ozone depleting substances or gases. They are also odourless.

Polyester fibres have been used in bedding and clothing for many years.

Polyester’s thermal insulation performance has been proven in Polar Fleece® and similar clothing during expeditions to the coldest places on earth.

All of our insulation is thermally bonded and will continue to loft over time unlike other forms of insulation that use chemical binders that can break down over time resulting in a loss of performance.

Autex polyester insulation is incredibly easy to install. No protective clothing or equipment is required.

Finally, polyester is resistant to attack by insects, vermin and other pests, and is unaffected by moisture.
There are no health concerns associated with polyester fibres. Autex Polyester insulation contains no formaldehyde based chemical binders, as may be found in some other insulation materials.

As well as being a known carcinogen, formaldehyde is also a major asthma trigger and can be a contributing factor to many other known health concerns.

Our insulation has no airborne fibres of a respirable size. Absolutely no precautions or protective equipment are needed during installation.

Polyester fibres are non-irritant, non-toxic and non-allergenic. There is no need to use protective clothing during installation and occupants ongoing health will not be compromised.
Autex Polyester Insulation goes beyond the environmental benefits gained from the performance of its thermal insulation.

The most obvious contribution to the environment of Autex Insulation is the improvement in the thermal efficiencies of buildings, which in turn greatly aids in the reduction of energy use and greenhouse gas production.

It is largely accepted that insulating buildings and associated mechanical services is one of the most cost effective ways of combating greenhouse gas emissions. The energy saved via insulation outweighs the energy used in the production of the insulation by hundreds of times over the life time of a typical building.

To this end Autex could be classified as better than carbon neutral.

But Autex goes much further than this: we ensure that Ecological Sustainable Design applies to both our product and its use.

Unlike many other forms of insulation which may be classified as hazardous waste, Autex polyester insulation’s make-up, production, and its performance, have been engineered to ensure the best possible environmental outcome.

Autex Polyester Insulation is manufactured using up to 85% recycled content and our manufacturing plants have a zero waste policy. All off-cuts and waste are immediately recycled back into the process or recycled into anything from plastic pallets to fence posts, which may also be recycled in the future.

We ensure every excess item used in our production plants is recycled, including packaging, straps and any other forms of material.

Unfaced Autex polyester insulation is fully recyclable, unlike many other types of insulation which must be treated as hazardous waste. Autex insulation does not need to add to landfill.

The embodied energy of our insulation is one of the lowest available due to the high level of recycled material used, and the low energy production process. Being fully recyclable allows for a continued reduction in our products embodied energy.
Our gas-fired ovens are the most efficient available and no chemicals are used during the manufacturing process of our polyester insulation. Our insulation will not off-gas, providing for safer and better indoor air quality, as well as ensuring that no Ozone depleting substances are used or produced.

Autex is also a signatory to the National Packaging Covenant and has committed to programs to reduce all impacts of pre and post consumer packaging use and disposal.

Autex Insulation is the ideal choice for projects requiring GreenStar or ESD accreditation.

Autex insulation has been fully assessed by Ecospecifier Australia as well as being manufactured under ISO 9001 quality and ISO14001 environmental management systems.

Taking into account the above information Autex polyester insulation can provide the best support for your GreenStar rated project providing the maximum credit available.
5. Australian Building Code Ducting Requirements

Energy consumption is the dominant source of greenhouse gas emissions in Australia, contributing 68% of the nation’s total emissions (Commonwealth of Australia, 2004).

Commercial buildings are responsible for about 9% of the national greenhouse emissions, with electricity use, representing the dominant source of these emissions (89% of all commercial building emissions).

Building energy-efficient commercial buildings and improving the energy efficiency of existing buildings is the most important action the commercial building sector can take in its contribution to reducing greenhouse impacts.

Commercial building energy use is dominated by air-conditioning (HVAC - Heating, Ventilation and Air Conditioning) and lighting systems, which together account for, on average, 84% of the total energy use (Australian Greenhouse Office, 1999). Ensuring that highly efficient systems are installed, commissioned and operated in new buildings is vitally important. This importance is now reflected in the Building Code of Australia as deemed to satisfy provisions.

This manual provides information on:
- The new building code provisions for ductwork insulation.
- How to meet the BCA requirements with Autex Insulation.
6. BCA Deemed to Satisfy Provisions
Step 1.
The first step to determining the insulation requirements for a specific project is to find the appropriate climate zone from the map below.

Step 2.
The second step having determined the climate zone is to find the total R-value required from the table below.

As found within the BCA 2007 Section J5.2 table 3a and 3b.

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# Ductwork - Minimum Insulation

## For systems of no more than 65kWr and 65kW heating capacity

<table>
<thead>
<tr>
<th>Location and element</th>
<th>Minimum Total R-Value for ductwork</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Evaporative cooling</td>
</tr>
<tr>
<td></td>
<td>Heating system or refrigerated cooling</td>
</tr>
<tr>
<td>Climate Zones</td>
<td>All</td>
</tr>
<tr>
<td>In a roof space with insulation installed beneath the roof</td>
<td>R0.6</td>
</tr>
<tr>
<td>Under an enclosed suspended floor</td>
<td>R0.6</td>
</tr>
<tr>
<td>In a plant room</td>
<td>R0.6</td>
</tr>
<tr>
<td>All other buildings</td>
<td>R0.6</td>
</tr>
<tr>
<td>External to the building</td>
<td>R0.6</td>
</tr>
<tr>
<td>Under an unenclosed suspended floor</td>
<td>R0.6</td>
</tr>
<tr>
<td>In a roof space with insulation installed on the ceiling</td>
<td>R0.6</td>
</tr>
</tbody>
</table>

## For systems greater than 65kWr and 65kW heating capacity

<table>
<thead>
<tr>
<th>Location and element</th>
<th>Minimum Total R-Value for ductwork</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Evaporative cooling</td>
</tr>
<tr>
<td></td>
<td>Heating system or refrigerated cooling</td>
</tr>
<tr>
<td>Climate Zones</td>
<td>All</td>
</tr>
<tr>
<td>Within a conditioned space other than the last space served</td>
<td>Nil</td>
</tr>
<tr>
<td>In a roof space with insulation installed beneath the roof</td>
<td>R0.6</td>
</tr>
<tr>
<td>Under an enclosed suspended floor</td>
<td>R0.6</td>
</tr>
<tr>
<td>In a plant room</td>
<td>R0.6</td>
</tr>
<tr>
<td>All other buildings</td>
<td>R0.6</td>
</tr>
<tr>
<td>External to the building</td>
<td>R0.6</td>
</tr>
<tr>
<td>Under an unenclosed suspended floor</td>
<td>R0.6</td>
</tr>
<tr>
<td>In a roof space with insulation installed on the ceiling</td>
<td>R0.6</td>
</tr>
</tbody>
</table>

The total insulated ducted system with aluminium foil delivers R0.23 to R 0.8 above the bulk or material R-value depending on the orientation of the foil. Even with some reduction in the emissivity of the foil this R-value is still an added 0.19 to 0.48 (ASHRAE Fundamentals) On this basis the recommended insulation materials are detailed on the following page.

In some cases the minimum insulation level may be insufficient for condensation control and may require an engineering calculation to confirm the appropriate level.
7. Application

Step 3.
The final step is to determine the recommended Autex insulation product from the table below.

<table>
<thead>
<tr>
<th>Required Total - R values as deemed by the BCA</th>
<th>Recommended Autex Products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Internal Insulation</td>
</tr>
<tr>
<td>ARD-IR .4</td>
<td>14</td>
</tr>
<tr>
<td>R 0.6</td>
<td>ARD-IR .7</td>
</tr>
<tr>
<td>R 1.0</td>
<td>ARD-IR 1.1</td>
</tr>
<tr>
<td>R 1.3</td>
<td>ARD-IR 1.4</td>
</tr>
<tr>
<td>R 1.5</td>
<td>ARD-IR 1.4</td>
</tr>
<tr>
<td>R 1.8</td>
<td>ARD-IR 2.1</td>
</tr>
</tbody>
</table>

The R values of ARD products displayed in the above table and presented in coming pages of this manual, state (material R values). The Building Code of Australia list the total R value required for insulated ductwork. To calculate the total R value of external sheet metal ductwork insulated with foil faced ARD-ER, add 0.15 m² k/w to the material R value of the insulation.

On the following pages (Section 8), you will find general and technical information that is specific to ARD products.
8. Product Information
**Product Description:**
QuiteStuf® ARD – ER (Autex Rigid Ducting - External R(R value)) is a thermally bonded polyester insulation designed principally for the external lagging/lining of ductwork to meet building code requirements. It is designed to provide excellent acoustic absorption and thermal resistance properties.

QuietStuf® ARD – ER can be laminated with Plain, Medium or Heavy Weight foils.

QuietStuf® ARD – ER products are manufactured under a ISO 9001 quality management system.

**Applications:**
QuiteStuf® ARD – ER, is used for external lining of Air-conditioning ductwork, piping and tanks.

QuietStuf® ARD – ER material thermal values provided are based on testing in accordance with AS 4859.1 at a mean temperature of 23 degrees Celsius. QuietStuf® ARD ER products have a total R value arising from contributions of the bulk insulation material (Material R Value) and contributions from adjacent airspaces that the face products bound.

**Product Specifications:**

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Material R Value</th>
<th>Nominal Thickness (mm)</th>
<th>Length (m)</th>
<th>Width (mm)</th>
<th>Quantity per Pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>QuietStuf ARD-ER 0.6</td>
<td>0.6</td>
<td>25</td>
<td>20</td>
<td>1200</td>
<td>2</td>
</tr>
<tr>
<td>QuietStuf ARD-ER 1.0</td>
<td>1.0</td>
<td>38</td>
<td>15</td>
<td>1200</td>
<td>2</td>
</tr>
<tr>
<td>QuietStuf ARD-ER 1.3</td>
<td>1.3</td>
<td>50</td>
<td>15</td>
<td>1200</td>
<td>2</td>
</tr>
<tr>
<td>QuietStuf ARD-ER 1.4</td>
<td>1.4</td>
<td>55</td>
<td>15</td>
<td>1200</td>
<td>2</td>
</tr>
<tr>
<td>QuietStuf ARD-ER 1.9</td>
<td>1.9</td>
<td>75</td>
<td>10</td>
<td>1200</td>
<td>2</td>
</tr>
</tbody>
</table>

Other configurations are available on request subject to minimum order quantities.

**Facings**
QuiteStuf® ARD – ER; standard available facing are:

- Plain Foil (PF)
- Medium Foil (MWF)
- Heavy Weight Foil (HWF)

Other facings are available on request, subject to minimum order quantities.

**Acoustic Performance:**
Sound Absorption Coefficients results (Plain Product tested to AS1045 “Acoustics Measurement of Sound Absorption in a Reverberation room”)

<table>
<thead>
<tr>
<th>ARD-ER Sound Absorption Coefficient Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
</tr>
<tr>
<td>ARD-ER 0.6</td>
</tr>
<tr>
<td>ARD-ER 1.3</td>
</tr>
</tbody>
</table>

Acoustic tests were conducted at RMIT and the University of Auckland. Acoustic Measurement of Sound Absorption in Reverberation Room in accordance with AS 1045.
Handling:
There are no known hazards with the use or handling of Autex polyester insulation materials. QuietStuf® is non-toxic, non-irritant and non-allergenic. No precautions or personal protective equipment is required for handling or installation. Autex insulation is odour free.

Fire Resistance:
When tested in accordance with AS1530.3 “Early Fire Hazard Properties of Materials” the range of Autex ARD-ER products exhibits the following characteristics which comply with the requirements of AS4254 “Ductwork for air Handling.”

| Ignitability Index | 0 |
| Spread of Flame     | 0 |
| Heat Evolved        | 0 |
| Smoke developed     | 0-1 to 3 |

Moisture:
QuietStuf® ARD-ER is not affected by moisture. Exposure to an atmosphere of 50°C at 90% relativity humidity for four days showed moisture absorption by weight of less than 0.03%. Should QuietStuf® ever get wet full thermal performance will be restored on drying out.

Corrosiveness:
When tested in accordance with NZS4222, QuietStuf® insulation is classified as non-corrosive. The pH of QuietStuf® is 7.8 (a pH of 7 is neutral).

Recommended Maximum Service Temperature;
160 degrees Celsius for Plain/nude product, withfacings and adhesives max of 70 degrees Celsius.

Composition: - Polyester

Durability:
QuietStuf® insulation will not sag or lose its loft or bulk over time. Time design characteristic ensures full performance in maintained (50+ years durability). Autex provides a 50 year durability warranty against product failure in normal use situations.

Vermin:
QuietStuf® is naturally resistant to insect and vermin attack and does not contain chemical deterrents.

Environmental:
All unfaced Polyester insulation Products as manufactured by Autex Pty Ltd and marketed under the names; GreenStuf®, QuietStuf®, are produced using 100% Polyester fibre without the need for any binders or adhesives. Our products are manufactured with up to 85% recycled fibre.

These products do not contain nor produce any ozone depleting substances or gases. Our products are rated as low VOC and no VOCs are used during the manufacturing process.

Autex Polyester Insulation Products are manufactured under ISO 9001 quality and ISO14001 environmental managed systems that include zero waste policies as well as extended producer responsibility policies.

All of our products are fully recyclable and have low embodied energy.

Autex Polyester has been awarded Good Environmental Choice Australia status and have been fully verified by Ecospecifier. They provide maximum credit for GreenStar® rated projects.

How to Specify:
The Insulation material shall be Autex QuietStuf® ARD ER ___ (Material R Value required as indicated in Product Specifications) as Manufactured by Autex Pty Ltd.

Please also nominate the facing material if required; eg HWF (Plain Heavy Weight Foil)

Installation Advice:
Polyester Insulation can be cut with a sharp industrial Stanley knife, a serrated knife such as a bread knife or the use of an electric power reciprocating or circular action knives. Blankets/Sheets can be mechanically fastened with Capacitor Discharge (CD) weld pins, just place the insulation over the pins and tap with rubber mallet to pierce before using speed clips.

General:
ARD - ER is manufactured in Australia by Autex Pty Ltd an ISO9001 quality and ISO14001 environmental certified company. Autex retains the right to change products and specifications without prior notice. If a specification is critical to end use situation please discuss your requirements with your Autex representative.

MSDS:
Material Safety Data Sheets (MSDS) are available on request.
Product Description;
QuietStuf® ARD – IR (Autex Rigid Ducting – Internal R(Rvalue)) is a thermally bonded insulation designed for the internal lining of ductwork to meet the Building Code of Australia requirements. It is designed to provide excellent acoustic absorption and thermal resistance properties.

QuietStuf® ARD – IR can be laminated with perforated or plain foils or a black non woven textile face. Pressure Sensitive Adhesive (PSA) can also be laminated for original equipment manufacturers (OEM).

QuietStuf® ARD – IR products are manufactured under a ISO 9001 Quality management system.

Applications:
QuietStuf ARD – IR is used for the internal lining of air-conditioning ductwork and OEM equipment such as VAV boxes and air handling units. Absorption results with suitable factory bonded facings films (of your choice) make it easier to choose products that provide an acoustic absorption over a particular frequency range to absorb mechanical noise from fans, motors and other equipment.

Lining ductwork internally will also provide a thermal performance benefit. The R values provided for our QuiteStuf ARD - IR products are material R values and are based on testing in accordance with AS 4859.1 at the mean temperature of 23 degrees Celsius. QuietStuf ARD - IR products have a total R value arising from contributors to the bulk insulation material (Material R Value) and contributors from adjacent airspaces that the faced products bound.

Product Specifications;

<table>
<thead>
<tr>
<th>Product description</th>
<th>Material R Value</th>
<th>Nominal Thickness (mm)</th>
<th>Length (m)</th>
<th>Width (mm)</th>
<th>Quantity per Pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>QuietStuf ARD – IR 0.4</td>
<td>0.4</td>
<td>14</td>
<td>15</td>
<td>1200</td>
<td>2</td>
</tr>
<tr>
<td>QuietStuf ARD – IR 0.7</td>
<td>0.7</td>
<td>25</td>
<td>15</td>
<td>1200</td>
<td>2</td>
</tr>
<tr>
<td>QuietStuf ARD – IR 1.1</td>
<td>1.1</td>
<td>38</td>
<td>7.5</td>
<td>1200</td>
<td>2</td>
</tr>
<tr>
<td>QuietStuf ARD – IR 1.4</td>
<td>1.4</td>
<td>50</td>
<td>7.5</td>
<td>1200</td>
<td>2</td>
</tr>
<tr>
<td>QuietStuf ARD – IR 2.1</td>
<td>2.1</td>
<td>75</td>
<td>2.4</td>
<td>1200</td>
<td>3</td>
</tr>
</tbody>
</table>

Other size configurations are available on request, subject to minimum order quantities.

Facings
QuietStuf® ARD – IR ; standard available facings are:
- Black Non Woven Polyester (BNW)
- Plain Foil (PF)
- Perforated Heavy Weight Foil (HWPF)

Other Facings are available on request, subject to minimum order quantities.

Acoustic Performance;
Sound Absorption Coefficients results (Products tested to AS1045 “Acoustics Measurement of Sound Absorption in a Reverberation room”)

<table>
<thead>
<tr>
<th>Product Facing material Frequency (Hz)</th>
<th>ARD-IR 0.7 NUDE</th>
<th>ARD-IR 1.4 NUDE</th>
<th>ARD-IR 0.7 (BNW) BLACK NON WOVEN</th>
<th>ARD-IR 1.4 (BNW) BLACK NON WOVEN</th>
<th>ARD-IR 0.7 (PF) PLAIN FOIL</th>
<th>ARD-IR 1.4 (PF) PLAIN FOIL</th>
<th>ARD-IR 0.7 (HWPF) PERFORATED HEAVY WEIGHT FOIL</th>
<th>ARD-IR 1.4 (HWPF) PERFORATED HEAVY WEIGHT FOIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>0.09</td>
<td>0.34</td>
<td>0.65</td>
<td>0.85</td>
<td>0.95</td>
<td>0.7</td>
<td>0.33</td>
<td>0.59</td>
</tr>
<tr>
<td>250</td>
<td>0.10</td>
<td>0.36</td>
<td>0.68</td>
<td>0.87</td>
<td>0.95</td>
<td>0.9</td>
<td>0.34</td>
<td>0.60</td>
</tr>
<tr>
<td>500</td>
<td>0.08</td>
<td>0.32</td>
<td>0.61</td>
<td>0.81</td>
<td>0.91</td>
<td>0.7</td>
<td>0.36</td>
<td>0.63</td>
</tr>
<tr>
<td>1000</td>
<td>0.07</td>
<td>0.30</td>
<td>0.58</td>
<td>0.79</td>
<td>0.89</td>
<td>0.7</td>
<td>0.37</td>
<td>0.64</td>
</tr>
<tr>
<td>2000</td>
<td>0.06</td>
<td>0.28</td>
<td>0.55</td>
<td>0.76</td>
<td>0.86</td>
<td>0.7</td>
<td>0.38</td>
<td>0.66</td>
</tr>
<tr>
<td>0</td>
<td>0.05</td>
<td>0.26</td>
<td>0.52</td>
<td>0.73</td>
<td>0.84</td>
<td>0.7</td>
<td>0.39</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Acoustic tests were conducted at RMIT and the University of Auckland. Acoustic Measurement of Sound Absorption in Reverberation Room in accordance with AS 1045.
Handling:
There are no known hazards with the use or handling of Autex polyester insulation materials. QuietStuf® is non-toxic, non-irritant and non-allergenic. No precautions or personal protective equipment is required for handling or installation. Autex insulation is odour free.

Fire Resistance:
When tested in accordance with AS1530.3 “Early Fire Hazard Properties of Materials” the range of Autex ARD-IR products exhibits the following characteristics which comply with the requirements of AS4254 “Ductwork for Air Handling.”

<table>
<thead>
<tr>
<th>Product</th>
<th>Facing</th>
<th>Ignitability Index</th>
<th>Spread of Flame</th>
<th>Heat Evolved</th>
<th>Smoke developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARD-IR</td>
<td>NUDE</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0-1 to 3</td>
</tr>
<tr>
<td>ARD-IR</td>
<td>BNW</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ARD-IR</td>
<td>PF</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ARD-IR</td>
<td>HWPF</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Moisture:
QuietStuf® ARD-IR is not affected by moisture. Exposure to an atmosphere of 50°C at 90% relativity humidity for four days showed moisture absorption by weight of less than 0.03%. Should QuietStuf® ever get wet full thermal performance will be restored on drying out.

Corrosiveness:
When tested in accordance with NZS4222, QuietStuf® insulation is classified as non-corrosive. The pH of QuietStuf® is 7.8 (a pH of 7 is neutral).

Recommended Maximum Service Temperature:
160 degrees Celsius for Plain/nude product, with facings and adhesives max of 70 degrees Celsius.

Composition: - Polyester

Durability:
QuietStuf® insulation will not sag or lose its loft or bulk over time. Time design characteristic ensures full performance in maintained (50+ years durability).

Vermin:
QuietStuf® is naturally resistant to insect and vermin attack and does not contain chemical deterrents.

Environmental:
All unfaced Polyester insulation Products as manufactured by Autex Pty Ltd and marketed under the names; GreenStuf®, QuietStuf®, are produced using 100% Polyester fibre without the need for any binders or adhesives. Our products are manufactured with up to 85% recycled fibre.

These products do not contain nor produce any ozone depleting substances or gases. Our products are rated as low VOC and no VOCs are used during the manufacturing process.

Autex Polyester Insulation Products are manufactured under ISO 9001 quality and ISO14001 environmental managed systems that include zero waste policies as well as extended producer responsibility policies.

All of our products are fully recyclable and have low embodied energy.

Autex Polyester has been awarded Good Environmental Choice Australia status and have been fully verified by Ecospecifier. They provide maximum credit for GreenStar rated projects.

How to Specify:
The Insulation material shall be Autex QuietStuf® ARD IR ___ (Material R Value required as indicated in Product Specifications) as Manufactured by Autex Pty Ltd.

Please also nominate the facing material if required; eg HWF (Plain Heavy Weight Foil)

Installation Advice
Polyester Insulation can be cut with a sharp industrial Stanley knife, a serrated knife such as a bread knife or the use of an electric power reciprocating or circular action knives. Blankets/Sheets can be mechanically fastened with Capacitor Discharge (CD) weld pins, just place the insulation over the pins and tap with rubber mallet to pierce before using speed clips or fixed with Pressure sensitive adhesive backing (PSA).

General:
ARD - IR is manufactured in Australia by Autex Pty Ltd an ISO9001 quality and ISO14001 environmental certified company. Autex retains the right to change products and specifications without prior notice. If a specification is critical to end use situation please discuss your requirements with your Autex representative.

MSDS:
Material Safety Data Sheets (MSDS) are available on request.
Product Description:
QuietStuf® ARD – IR MAX (Autex Rigid Ducting - Internal R(Rvalue) MAXimum Acoustics) is a thermally bonded insulation designed to provide MAXIMUM Acoustic absorption for the internal lining of ductwork.

QuietStuf® ARD – IR MAX can be laminated with perforated or plain foils or a black non woven textile face. Pressure Sensitive Adhesive (PSA) can also be laminated for original equipment manufacturers (OEM).

QuietStuf® ARD – IR MAX products are manufactured under a ISO 9001 Quality management system.

Applications:
QuietStuf® ARD – IR MAX is used for the internal lining of air-conditioning ductwork and OEM equipment such as VAV boxes and air handling units. Absorption results with suitable factory bonded facings films (of your choice) make it easier to choose products that provide a acoustic absorption over a particular frequency range to absorb mechanical noise from fans, motors and other equipment.

Lining ductwork internally will also provide a thermal performance benefit. The R values provided for our QuietStuf® ARD – IR MAX products are material R values and are based on testing in accordance with AS 4859.1 at the mean temperature of 23 degrees Celsius. QuietStuf® ARD – IR MAX products have a total R value arising from contributions of the bulk insulation material (Material R Value) and contributions from adjacent airspaces that the faced products bound.

Product Specifications;

<table>
<thead>
<tr>
<th>Product description</th>
<th>Material R Value</th>
<th>Nominal Thickness (mm)</th>
<th>Length (m)</th>
<th>Width (mm)</th>
<th>Quantity per Pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>QuietStuf ARD – IR MAX 0.6</td>
<td>0.6</td>
<td>25</td>
<td>10</td>
<td>1200</td>
<td>2</td>
</tr>
<tr>
<td>QuietStuf ARD – IR MAX 1.0</td>
<td>1.0</td>
<td>30</td>
<td>7.5</td>
<td>1200</td>
<td>1</td>
</tr>
<tr>
<td>QuietStuf ARD – IR MAX 1.5</td>
<td>1.5</td>
<td>50</td>
<td>7.5</td>
<td>1200</td>
<td>1</td>
</tr>
<tr>
<td>QuietStuf ARD – IR MAX 2.2</td>
<td>2.2</td>
<td>75</td>
<td>1.5</td>
<td>1200</td>
<td>3</td>
</tr>
</tbody>
</table>

Facings
QuietStuf® ARD – IR MAX; available facings are;
- Plain Foil (PF)
- Perforated Heavy Weight Foil (HWPF)

Other Facings are available on request, subject to minimum order quantities.

Acoustic Performance:
Sound Absorption Coefficients results (Products tested to AS1045 “Acoustics Measurement of Sound Absorption in a Reverberation Room”)

<table>
<thead>
<tr>
<th>ARD-IR MAX Sound Absorption Coefficient Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Facing material</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>ARD IR MAX 1.5 (PF) PLAIN FOIL</td>
</tr>
<tr>
<td>ARD IR MAX 0.6 (HWPF) PERFORATED HEAVY WEIGHT FOIL</td>
</tr>
<tr>
<td>ARD IR MAX 1.5 (HWPF) PERFORATED HEAVY WEIGHT FOIL</td>
</tr>
</tbody>
</table>

Acoustic results were conducted at RMIT and the University of Auckland. Acoustic Measurement of Sound Absorption in Reverberation Room in accordance with AS 1045.
Handling:
There are no known hazards with the use or handling of Autex polyester insulation materials. QuietStuf® is non-toxic, non-irritant and non-allergenic. No precautions or personal protective equipment is required for handling or installation. Autex insulation is odour free.

Fire Resistance:
When tested in accordance with AS1530.3 “Early Fire Hazard Properties of Materials” the range of Autex ARD-IR MAX products exhibits the following characteristics which comply with the requirements of AS4254 “Ductwork for air Handling.”

<table>
<thead>
<tr>
<th>Material</th>
<th>Frequency (Hz)</th>
<th>NRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARD-IR MAX 1.5 (PF)</td>
<td>125</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>1.09</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>4000</td>
<td>0.46</td>
</tr>
</tbody>
</table>

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MSDS:
Material Safety Data Sheets (MSDS) are available on request.
9. Sound Attenuation

The best guide to sound attenuation in internally insulated ductwork, is by measurement of insertion loss.

These tests were conducted in accordance with AS1277 Acoustics-Measurement Procedure for Ducted Silencers. Test data is detailed below.

Importantly the attenuation matches or exceeds that of fibreglass insulated ductwork, detailed in ASHRAE Applications Guide and therefore Autex ARD-IR can be used across all duct sizes.

<table>
<thead>
<tr>
<th>Duct Size</th>
<th>Lined Length</th>
<th>Lining Thickness</th>
<th>Insertion Loss - Frequency (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>63</td>
</tr>
<tr>
<td><strong>510 x 380</strong></td>
<td></td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>1.2</td>
<td>2.4</td>
<td>3.6</td>
<td>4.7</td>
</tr>
<tr>
<td>1.2</td>
<td>2.4</td>
<td>3.6</td>
<td>4.7</td>
</tr>
<tr>
<td>1.2</td>
<td>2.4</td>
<td>3.6</td>
<td>4.7</td>
</tr>
<tr>
<td>1.2</td>
<td>2.4</td>
<td>3.6</td>
<td>4.7</td>
</tr>
<tr>
<td><strong>1500 x 1000</strong></td>
<td></td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>1.2</td>
<td>0.6</td>
<td>0.5</td>
<td>0.9</td>
</tr>
<tr>
<td>1.2</td>
<td>0.6</td>
<td>0.5</td>
<td>0.9</td>
</tr>
<tr>
<td>1.2</td>
<td>0.6</td>
<td>0.5</td>
<td>0.9</td>
</tr>
<tr>
<td>1.2</td>
<td>0.6</td>
<td>0.5</td>
<td>0.9</td>
</tr>
</tbody>
</table>
10. Glossary of Terms

Absorption: The amount of sound energy incident upon a surface, which is absorbed, changed to heat energy, and not reflected from that surface as sound.

Acoustic impedance: The ratio of sound pressure at the surface to the volumetric velocity through it.

Acoustics: The science of sound including its transmission, production and effects.

Attenuation: The reduction of sound intensity, measured in decibels that is caused by any factor such as distance or the presence of absorbing materials.

British thermal unit (Btu): The quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

Convection: The transfer of heat by mass movement within a fluid.

Decibel (dB): A unit of sound intensity. It is the logarithmic ratio, to the base 10, of the intensity of sound to be reported compared to a standard reference sound intensity. Practically, a change in intensity of 2 dB is not noticeable to the ear, 5 dB is noticeable and 10 dB is twice as loud (or soft).

The decibel is a commonly reported as dB(A), where the A reference conforms to the response of the ear.

Dew point: The temperature at which a sample of air, with no change in pressure or water vapor content, becomes completely saturated, i.e., attains a relative humidity of 100%.

Emissivity: A rating of the ability of a material to give off heat as radiant energy. It is expressed as the percentage of energy given off by a perfect black body radiator. Flanking transmission: The transmission of sound between two points by an indirect path.

Frequency: The number of vibrations per second. The unit is Hertz (Hz) which represents the number of vibrations per second.

Heat capacity: The heat required to raise the temperature of a given mass of a substance by one degree.

Heat transmission coefficient (U): A unit expressing heat passage through a complete building section, including air films. Technically, heat transmission is measured in Watts per square metre, per degree C of temperature difference from air to air for a composite building section. It is used as a basis for determining transmitted heat loss or gain.

Insertion loss: The sound attenuation achieved by insertion of a sound absorbent material.

Intensity: Sound intensity is proportional to the sound power or energy.

Latent heat: The heat required at constant temperature to cause a change of state in matter.

Mass law: The attenuation or sound transmission loss due solely to the surface density or weight per square metre of a material. In general, a doubling of mass will improve attenuation by 4 to 5 dB for a homogeneous material. A non-homogeneous structure such as a partition wall can give much greater attenuation due to stiffness, vibration and reverberation control. For example, use of infilling in a light-weight partition can improve attenuation by 3 to 6 dB, with little increase in mass of the structure.

Noise criteria (NC) curves: Specify the maximum noise levels permitted in each octave band for a specified single rated NC number. Normally used in architectural specifications.

Noise rating (NR) curves: Similar to noise criteria curves but based on a different standard.

Noise reduction coefficient (NRC): A single-number sound absorption coefficient used as a guide to the average acoustic performance of a material. It is the arithmetic average of sound absorption coefficient at 250, 500, 1000 and 2000 Hz. (to the nearest 0.05)

Octave: Two sound frequencies are an octave apart when one frequency is twice the other.
Reflectivity: A measure of the ability of a material to reflect heat moving by radiation through air. It is expressed as a ratio of radiant heat reflected by a material to the radiant heat reflected by a perfect mirror under similar conditions.

Relative humidity: The ratio of the partial pressure of water vapour in a given sample of air to the saturation pressure of water vapour at the same temperature. Resonance: A build-up in amplitude of vibrations of a structure, which occurs when the frequency of the sound impinging on the structure corresponds to the natural frequency of the structure.

Reverberation: The persistence of sound in a room after the sound source has stopped. The greater the absorption in the room, the lower the reverberation.

Sensible heat: The heat required to change the temperature of a substance without a change of state.

Sound absorption coefficient (SAC): The proportion of incident sound energy which is not reflected.

Sound breakout: The residual sound energy transferring through the walls of a duct system from a generated sound source within the system.

Sound transmission class (STC): A single number rating displayed on standardized curves which represents the dB transmission loss performance over all frequencies. The higher the STC, the more efficient the structure.

Specific heat: The ratio of the heat capacity of a given mass of a substance to that of the same mass of water, at a given temperature.

Surface coefficient: Refers to the thermal conductance of an air film immediately adjacent to an exposed surface of a material. Commonly called the 'Y' factor.

Thermal conductance (c): A unit specifying the amount of heat, in Watts, that passes through a square metre of material which has a given thickness and one degree Celsius of temperature difference between its surfaces. Used to compare insulating efficiencies of material with varying but stated thicknesses or materials composed of two or more basic materials.

Thermal conductivity (k): A unit expressing the amount of heat, in Watts, that passes through a square metre of material which is exactly one metre thick and has one degree Celsius of temperature difference between its surfaces. Used for comparing the insulating efficiencies of homogeneous materials.

Thermal radiation: The transmission of heat through space by wave motion.

Thermal resistance (R m²K/W): The reciprocal of thermal conductance; it is used in calculating overall heat transmission coefficients. It can be specified as material/product R or as a Total system R value.

Thermal resistivity (r or 1/k): The reciprocal of thermal conductivity.

Transmission loss: The reduction in sound intensity across a wall. It is the ratio of incident sound to sound transmitted through the wall.

Vapor barrier: A material that does not readily permit the passage of water vapor. Normally a material is rated at one perm or less. (Perm = a vapor transmission rate of 1 grain of water vapor per square foot, per hour, per inch of mercury pressure difference).

Vapor permeability: A rating of material giving the amount of water vapor that passes through a precise thickness of the material.

Watt: A unit of rate of heat loss or gain from a material, measured as joules per second.