



# walltech

WALLTECH SYSTEMS AUSTRALIA

Engineered & Manufactured | Building Systems for Builders

## **Walltech Building Systems Residential Walls Technical Manual**

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### **The Walltech Building System**

The Walltech Building System is unique and integrates the structure and services of internal and external walls of buildings, enabling them to be installed in one operation, eliminating on-site waste & dust, and minimising installation time, on-site finishing, tradesman involvement, and most importantly costs.

Walltech walls are factory produced en masse, with panels produced joint free to a maximum size of 7 x 2.7m and in thicknesses of 110 and 156mm. Any services or components, including plumbing, electrical backing plates, supports etc are pre-installed.

The Walltech Building System also offers increased design flexibility, especially in regards to detailed cut-outs and component inclusion, and superior aesthetics, as a variety of internal & external surface finishes can be achieved and the joint-free finish eliminates the impact of glancing light.

An innovative 3D design system has been developed that allows the Walltech design team to completely “build” and then customise a 3D model of the entire building or project. This innovative design system also automatically generates manufacturing “G”-Code instructions for the fabrication of the walls, directly “driving” the ordering and production scheduling. This ensures accuracy & quality and eliminates common construction errors that are costly and time consuming to rectify.

In addition, Walltech walls are fully documented and information is stored on readily accessible computer files, so future owners or tenants will know the exact locations of structural components, conduits and plumbing within each internal and external wall.

The system is particularly suitable for all types of project homes, medium-density dwellings, aged care, hospitals and the commercial partition market, but it is also perfectly suited to demountable, modular, industrial or commercial construction in any climatic conditions, due to the superior thermal efficiency offered.

## **The Walltech Advantage**

The Walltech Building System offers numerous, significant advantages:

- Increased design flexibility, especially in regard to detailed "cut-outs" and components
- Superior aesthetics, including a joint free finish and eliminating the impact of glancing light
- A variety of internal and external surface finishes can be achieved
- Eliminates the possibility of surface cracking, as wall surfaces are not load bearing
- Structural integrity assured and integrated into each design to suit individual project site conditions, wind loadings, etc
- Superior thermal efficiency to traditional materials, with every wall panel offering this rating, rather than just the external walls.
- Superior fire resistance to traditional coating and foam insulation materials
- Walls can be left unprotected on site for a reasonable period, and there is no interstitial condensation risk for finished buildings
- No possibility of "toxic mould"
- No "bait" to attract vermin
- All specified services and components are included in the delivered wall
- Future innovations are easily adopted into the system
- Walls are fully documented and information is stored on easily accessible files
- Future tradesmen and householders will know exactly where any services or components are located within each wall
- Fully recyclable components and finished product
- Decreased environmental impact, both direct and indirect
- Elimination of on-site building waste and dust, along with associated costs, space and OH & S implications
- Improves site safety
- Reduced panel & square metre weight
- Reduced crane time required on commercial sites
- Accuracy, quality and reproducibility are guaranteed
- Reduces the opportunity for contractor or tradesman error
- Other trades can pre-build or design with confidence
- Reduces the need for on-site trades and cost items, including scaffolding, site sheds, etc
- Reduces vulnerability to trade skills shortages
- Decreases the period to "lock-up", and as a result reduces theft and vandalism
- Decreases project construction times
- Delivers total cost savings for each project

## **System Overview**

- **Applications**

Internal - 110mm wall panels

External – 110mm & 156mm wall panels

- **Weight**

110mm walls                    15 kg per m<sup>2</sup> (approximately)

156mm walls                    17 kg per m<sup>2</sup> (approximately)

- **Maximum size**

Wall panels can be produced joint free to a maximum size of 7m x 2.7m

- **Fire resistance**

The non-combustible barrier coating satisfies the BCA requirements for spread of fire related to many applications. Walltech's PIR cored panels complies with the BCA "Group 1" classification as per ISO 9705 fire test carried out at BRANZ in New Zealand. The test simulated a room (3.6m long x 2.4m wide x 2.4m high) built with the Walltech System wall and ceiling panels engulfed in fire.

- **Impact resistance**

The multi-layer barrier coating provides significant impact resistance in accordance with the BCA.

- **Wind resistance**

Full-scale tests carried out at CSIRO (as per TR440 and classified as per AS1170.2 : 2002 and AS4055 : 2006) proved that the 110mm & 156mm external walls comply with N3 wind classifications per the BCA, while the 156mm external wall can be engineered to a higher wind classification on request.

- **Water penetration resistance**

A comprehensive test simulating static water and wind driven rain as per the BCA was conducted at CSIRO with satisfactory performance.

- **Thermal performance**

Thermal tests conducted on 50mm PIR foam panels at BRANZ in New Zealand have shown the following:

Thermal Conductivity @ 23<sup>0</sup>C    =    0.0219 W / mK

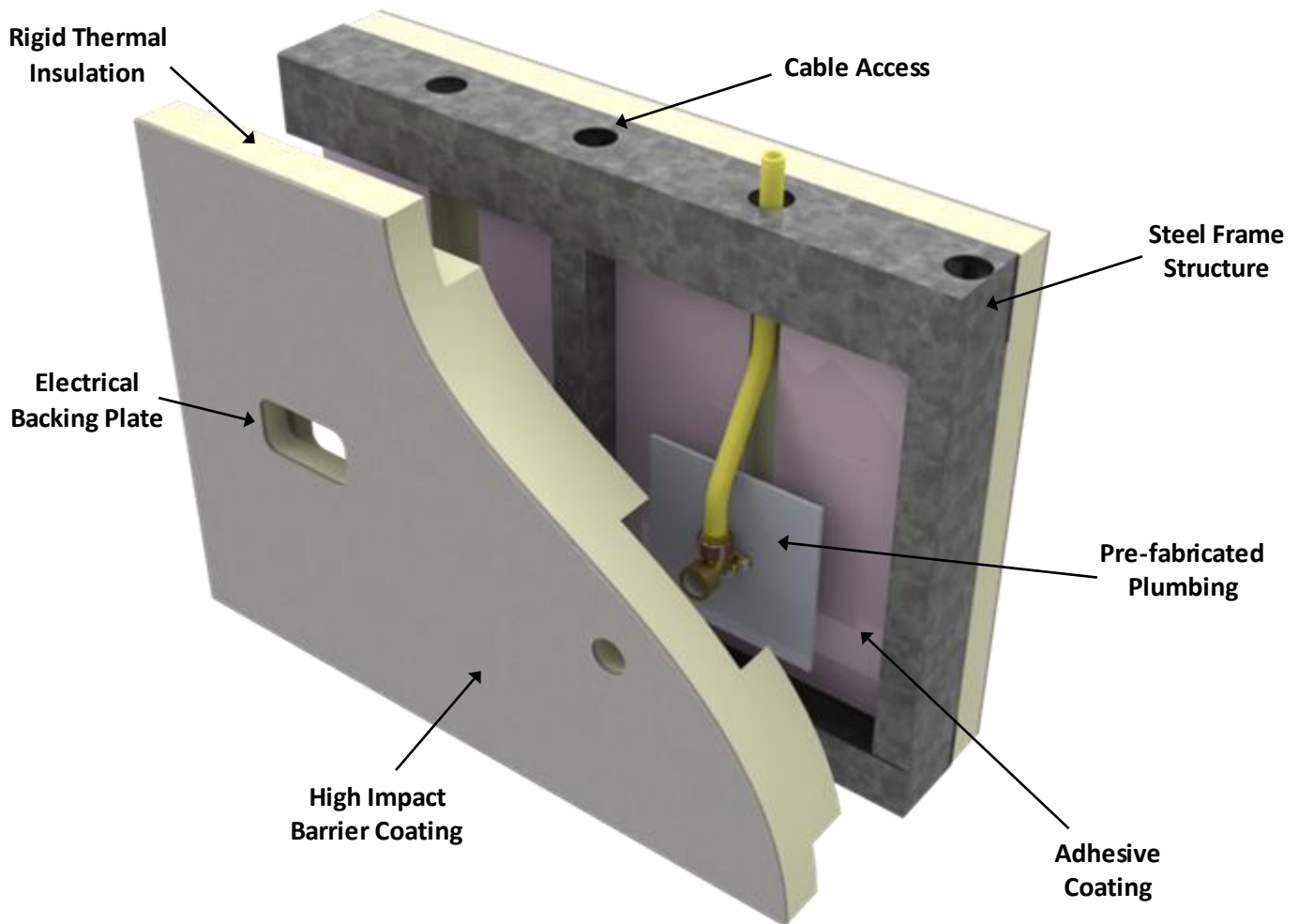
Thermal Resistance @ 23<sup>0</sup>C      =    2.2 m<sup>2</sup> K / W

- **Acoustic performance**

Wall panels can be designed and produced to suit a range (Rw+Ctr = 30–50) of acoustic requirements

### **System Description**

The Walltech Building System is comprised of a steel structural frame encapsulated within PIR foam protected by a barrier coating. Pre-fabricated plumbing and cable access with backing plates are factory installed. While the structural frame resists the static and dynamic loads, surrounding foam provides lateral restraint to the steel studs, and enhanced stiffness to the wall. It also provides thermal insulation under normal and fire exposed conditions. The barrier coat protects the wall from fire, accidental damage, impact and weather, including wind driven rain.



### **System Components & Materials**

#### **A. Insulation**

The rigid PIR foam has very good thermal stability. According to the full-scale tests performed as per ASTM 1363-97 at BRANZ in New Zealand, the R values for 110mm and 156mm thick walls are 3.5 and 5 respectively.

#### Attributes of PIR

- Thermally efficient and long term R value
- Moisture resistant
- Excellent dimensional stability
- Superior performance in fire compared to all other type of foam
- Resistant to solvents used in construction adhesives

Walltech walls are comprised of Polyisocyanurate (PIR) foam, which is formed by reacting a polyisocyanate and a polyol in the presence of catalysts and a pentane blowing agent. Polyisocyanurate, also referred to as ISO, is essentially an improvement on polyurethane (PUR). The reaction of polyol and MDI takes place at higher temperatures compared to the reaction temperature for the manufacture of PUR. As a result the MDI will also react with itself, producing strong chains of isocyanurate. These cross links are stronger than normal bonds in polyurethane. Therefore they are more difficult to break. As a result PIR foam is chemically and thermally more stable (disintegration starts above 200°C).

PIR foam has numerous advantages to other insulating materials including:

- **Superior thermal efficiency**

Walltech PIR foam panels with barrier coating have very good thermal stability and the pentane-blown PIR agent contributes to excellent insulation performance.

50mm panels will provide an R value in excess of 2.2, this is stable over a long period and the thermal conductivity has a value of 0.022 W / mK.

- **Superior fire resistance**

PIR is a “thermo-set”, closed cell material, which chars when exposed to flame, but does not melt.

- **Weather resistant**

An important function of the external skin of a building is to provide protection against water penetration under wind driven rain, snow or ice. Recent full-scale CSIRO testing of the Walltech Building System did not result in any water penetration through the PIR foam panels with integrated barrier coating, or the system joints. In addition, there is no water absorption or water condensation.

- **Dimensional stability**

Due to the tight processing parameters employed and the fine cell structure, the PIR foam with barrier coat panels remain dimensionally stable when compared to many other foam materials.

- **Lightweight**

Standard 50mm Walltech PIR foam panels with barrier coating weigh approximately 5 kg per sqm.

- **Suitable for extreme temperatures**

High thermal resistance of the Walltech PIR foam panels with barrier coating creates a homogeneous insulation without cold bridges, which eliminates surface condensation.

In addition, due to the tight processing parameters employed and the fine, closed cell structure, the Walltech PIR foam panels with barrier coating remain dimensionally stable when compared to many other foam materials under freezing and high atmospheric temperatures.

- **No possibility of "toxic mould & fungi growth"**

Walltech PIR foam panels with barrier coating resist any kind of mould and fungi growth, which are becoming major issues for building owners and tenants around the world. Mould and fungi forms when moisture is trapped and cannot dissipate. Organic coatings are one of the main causes of mould growth in both new and old buildings. These traditional organic coatings, such as paper, paints, etc, allow moisture to form and gravitate to lower areas, such as cracks and crevasses. Areas typically affected are the kitchen, bathroom and basement. High humidity and hot water from cooking and

showering provides most of the heavy moisture that creates the perfect environment for the airborne mould spore to form and grow. If the moisture form between walls and the mould gets a foothold, it will eat anything it exists upon, creating toxic gases that build up in the wall cavities and have the potential to make people extremely ill. This mould will also eat the timber supports, producing rot and reducing the structural integrity of the building.

- **No "bait" to attract vermin**

There are no materials or components used in the Walltech PIR foam panels with barrier coating that are "attractive" to vermin.

- **Environmentally friendly & CFC free**

The pentane based chemistry of PIR foam provides 100 percent reduction in harmful green house gasses compared to other traditional blowing agents. Traditional blowing agents are considered to be ozone-depleting substances, as over time cells break down in the presence of strong UV radiation and tend to release chlorine or bromine atoms, which destroy ozone molecules.

In addition to this, the amount of volatile organic compounds generated in PIR foam formation is very low, which also reduces the global warming potential.

The very fine cell structure of the PIR foam offers significantly higher thermal efficiency, which also indirectly benefits global warming.

- **Fully recyclable**

Any dust or waste produced during production or machining of the PIR foam panels with barrier coating is contained and recycled. In addition, all components and the finished product are recyclable.

## **B. Barrier Coating**

Walltech has developed its own barrier coating which has significant fire resistance.

Many properties of this coating can be attributed to its structure and chemical constituents. It is hard, stable at high temperatures and, unlike many organic based materials, it is non-flammable. It is stable towards chemical attacks; it is especially acid-resistant and sulphate-resistant. It is strong and durable.

The barrier coating provides sufficient protection against wind driven rain. A comprehensive test simulating static water and wind driven rain as per BCA was conducted at CSIRO with satisfactory performance.

Toxic mould and fungi growth are major problems faced by building owners. Mould and fungi forms when moisture is trapped and cannot dissipate. Organic coatings are one of the main causes of mould growth in all buildings, historical or newly built. The film itself allows moisture to form and run down to lower areas, such as cracks and crevasses, through gravity. Typical areas are the kitchen, bathroom and basements. High humidity and hot water from cooking and showering provides most of the heavy moisture that creates the perfect environment for the airborne mould spore to form and grow. If moisture forms between walls and mould gets a foothold, it will eat anything upon which it exists creating toxic gases that build up in the wall cavities and make many people ill. This mould will also eat the timber supports, producing rot and reducing the structural integrity of the building.

The Walltech barrier coating is made of inorganic materials. The use of an inorganic coating eliminates much of this problem as the coating breathes and does not trap moisture. The coating itself is inert and of a high alkali content which will not support mould growth.

This also provides high impact and fire resistance to the wall. A mineral coated fibre glass mesh is laid over the barrier coating in order to provide a smooth surface for application of paint or a range of other internal or external surface coatings.

The Walltech barrier coat has the following characteristics:

- Fire resistant
- Moisture resistant
- Sound resistant
- Insulating
- Lightweight
- Impact resistant
- Chemical resistant
- Erosion resistant
- Not attractive to vermin
- No risk of toxic mould

### **C. Structural**

- High strength performance characteristics of BlueScope TrueCore steel
- Will not rot, warp, shrink or twist
- Termite and vermin resistant
- Fire resistant
- Environmentally friendly and electrically safe
- Frames pre punched for all electrical and plumbing services
- Extremely low maintenance. The steel frame is rigid and stable, eliminating wall cracking, fastening popping, door and window jamming
- Quality finish and design flexibility
- 70mm – stud profile is 70mm x 33mm x 12mm lipped “C” section with 70mm x 46mm bottom plate and 70mm x 66mm structural top plate.
- Factory installed steel strap bracing
- Joint fastening with high tensile 6.4mm blind s/s rivets
- Walltech use BlueScope TrueCore BMT0.6mm & 0.8mm and 1mm G550 high tensile coil steel
- Structural top plates for truss load and layout efficiencies
- Window head / sill openings over 1200mm engineered and fully installed in the factory
- Wall frames with respect to design and construction, satisfies all requirements for AS1170 Pt 1 & 2 Loading Code, Wind, AS/NZ4600 Cold Formed Steel Structures, AS4100 1990 Steel Structure Code, AS3823 1993 Domestic Metal Framing, AS3588 2000 Self Drilling Screws and the Building Codes of Australia.
- Resistant to warping, twisting, and shrinkage, steel framing eliminates the costly recall of tradesmen to repair leaks and cracks resulting from structural defects
- Steel is both non-combustible and impervious to termites and vermin. Walltech uses BlueScope TrueCore coated high tensile steel in its manufacture of light weight Residential Walls
- Walltech’s system meets and exceeds all Australian Building Codes Standards and is fully engineered to industry standards

### **D. Windows**

The Walltech system can accommodate any window type. The structural components are designed to suit and a clear opening on all sides, allowing for traditional fixing of window

frames, with or without reveals. Sills and shadow lines are integrated as specified or required.

**E. Doors**

The Walltech system can accommodate any door type. The structural components are designed to suit and a clear opening with steel framing on three sides, allowing for traditional fixing of jambs on doorways.

**F. Plumbing**

Pre-fabricated plumbing components are assembled into the walls as specified, with protruding tails ready for connection to water supply using either PVC or copper piping . All factory installed plumbing units are pressure tested to comply with AS3500 16.3.1.

**G. Electrical**

Concealed recesses are routed into the wall panel top to bottom to accommodate cabling. A 80mm x 40mm cable connection access hole is cut in the finished face of the wall and a backing plate factory installed 25mm back for finished face.

**H. Supports**

Noggins or other supports are provided within walls to allow for fitting of specified heavy items, such as wall-hung TV screens, wall basins, shelving, etc

**I. Final Coating Options**

The finished face will accept all traditional surface finishes both internally and externally.

## **System Performance**

### **A. Environmental Impact / Recyclability**

The materials used in Walltech system in reasonably large quantities include:

- Steel studs and wall plates
- PIR foam
- Barrier coating

The pentane based chemistry of PIR used by Walltech provides 100 percent reduction compared to other traditional blowing agents. Traditional blowing agents are considered to be ozone-depleting substances as over time cells break down in the presence of strong UV radiation and release chlorine or bromine atoms, which destroys ozone molecules. The added benefit of very low global warming potential is an indirect advantage of pentane formulation. Significantly higher thermal resistance due to the very fine cell structure achieved in the PIR foam system also indirectly benefits global warming. In addition, the amount of volatile organic compounds generated in PIR formation is very low.

Most barrier coatings contain some content of cement. In general terms, during cement manufacturing one tonne of carbon dioxide is said to be released with every one tonne of cement manufactured. The barrier coating used in Walltech is made of inorganic materials and it does not release any ozone-depleting substances into the atmosphere during manufacturing. It does not have any volatile organic compounds.

In addition, any dust generated during production is contained and compounded into bricks which will be used in the production of a commercially viable floor board product, while panel off-cuts and cut-outs are re-used in the production of other thicker walls.

Furthermore, a process has been developed so that any installed walls can be returned for recycling. This involves separation of the panel halves, removal of the composite framing system and components, and re-use or re-processing of each item.

### **B. Structural**

Walling frames have been properly designed in accordance with AS/NZS 4600:2005. In general, the frame consists of vertical roll-formed steel studs spaced at 600mm centres and engaged with top and bottom plates. Vertical studs are laterally restrained over their full height by the surrounding PIR foam. Walls can be 110mm or 156mm depending on the applications. For in-plane shear resistance bracing panels have been designed, which can resist up to 3kN/m. External walls have been designed to resist ultimate design gust speed of 50m/sec.

Walltech walls are very light (under 15kg/m<sup>2</sup> - depend on the wall thickness), and therefore loads transferred to the foundation is significantly less compared to the conventional walling systems. The vertical strength to weight ratio of Walltech walls is very high.

External walls are stiff and strong to resist lateral loads

- Ultimate limit state design gust speed of 50m/sec
- Serviceability limit state design gust wind speed of 33m/sec
- Studs are laterally restrained over full height by rigid PIR foam
- Characteristic vertical design capacity > 12kN/m for 70mm x 30mm 0.8mm stud walls
- Walls are relatively light - <0.4kN/m

In-plane shear capacity

- Bracing panels with strap braces
- Characteristic racking shear capacity for 2.7m high walls > 3kN/m

### **C. Weather Resistance**

Satisfactorily performs under wind driven rain  
Pressure equalised concept has been developed  
A wall was tested at CSIRO

- Tested wall : 5m long x 3m high
- Tested wall incorporated:
- Internal & external corners
- Vertical & horizontal joints
- Window

Test conditions:

- As per AS/NZS 4284:1995
- Serviceability test pressure = 1000Pa
- Exercised the wall to design +ve & -ve pressures three times prior to test for water penetration

### **D. Water Resistance**

The Walltech barrier coating and conventional joining system protects the wall from water penetration.

### **E. Fire Resistance**

Pilot fire test carried out at CSIRO showed excellent results

Test specimen

- 1.15m x 1.15m
- 4mm thick barrier coating
- Vertical and horizontal joints were included
- A junction between joints was included
- Joints filled with intumescent joint filler
- Four wall segments
- Top & bottom plates in each wall segment with 2 studs
- Simply supported around the edges

Test conditions

- Tested to heating conditions of AS1530:Part 4:2005
- Satisfied the integrity & insulation for 74min
- Test terminated after 75min
- Fire did not penetrate through wall segments

### **F. Fire Resistance of Components / Materials**

PIR foam stays intact during fire exposure

- Thermoset material
- Service temperature : 40°C – 120°C
- Form a protective char layer when exposed to fire
- Remain in place without being liquefied

Barrier coating is extremely stable at high temperatures

- Inorganic material
- Non-flammable
- Hard
- Joint Filler

Steel studs

- Melts above 1200°C
- Protected by PIR and barrier coating

#### **G. Fire Resistance Heat Release**

Complies with AS/NZS 3837:1998

Tested at CSIRO

- Three specimens were tested
- Specimen size : 100mm x 100mm
- With 4mm thick barrier coating

Excellent performance

- Satisfy Group 1 of BCA requirements
- Ignited after 200sec at the edge
- No damage to the surface
- Peak heat release rate (HRR) < 50kW/m<sup>2</sup>
- Average HRR after 300sec < 35kW/m<sup>2</sup>

#### **H. Impact Resistance**

The multi-layer barrier coating provides significant impact resistance that far exceeds BCA requirements.

#### **I. Thermal / Energy Efficiency**

Walltech PIR foam panels with barrier coating have very good thermal stability and the pentane-blown PIR agent contributes to excellent insulation performance.

According to the full-scale tests performed as per ASTM 1363-97 at BRANZ in New Zealand, the R values for 110mm and 156mm thick walls are 3.5 and 5 respectively.

#### **J. UV Resistance**

The Walltech System and components are completely covered by surface finishes, which will provide suitable UV protection.

For other internal or external surface coatings, please refer to the manufacturer's information.



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