Technical Manual

Part 6: Appendices

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Appendix A

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B.1 Thermal Principles

Heat Flow and Temperature

Heat is a form of energy appearing as motion of atoms, molecules and ions, or as radiation travelling through space. The SI unit of heat is the Joule (J). The units kilojoule (kJ), megajoule (MJ) and kilowatt-hour (kWh) are often used. 1 kWh = 3.6MJ.

Temperature (T) is a measure of the thermal state of a material due to the presence of heat. Degrees Celsius (˚C), is commonly used for everyday measurement of temperatures although the S.I. unit is the Kelvin. The Kelvin scale has its zero at "absolute zero" when all atoms, molecules and ions cease to move. This occurs at a temperature of - 273.16˚C.

The Celsius scale uses the freezing point of water as its zero, with the boiling point of water occurring at 100˚C. A change in temperature of 1K is the same as a change in temperature of 1˚C. To convert from one scale to the other, the following formula is used:

T (K) = T (˚C) + 273.16

Energy Transfer

Heat flow will occur between two bodies if there is a difference in their temperatures. This exchange of energy always occurs from the hotter to the colder surface. Objects at different temperatures will exchange energy via three thermal mechanisms; conduction, convection and radiation.

Thermal **conduction** occurs whenever energy transfer is due to the exchange of kinetic energy between particles at the atomic or molecular level. In metals, thermal conduction takes place through the motion of free electrons. Liquids and non electrically conducting solids conduct heat primarily via longitudinal oscillations of thelattice structure. Gases conduct via elastic collisions of molecules.

Thermal **convection** involves energy transfer from a solid to a fluid such as air or water, or energy transfer within a fluid due to the movement of zones at higher or lower temperature than the surrounding fluid. Convection heat transfer often refers to the flow of heat from one surface, through a fluid, to another surface. Since heat transfer in fluids involves both convection and conduction, reference to convection heat flow rates often includes the conduction component.

Natural convection occurs when fluid in contact with a hot surface is heated and rises due to its expansion and resultant lower density. This fluid is replaced by cooler fluid of lower density which also starts to expand and rise, and a cycle is established. Fluid near a colder surface will be cooled, become denser, start to fall, and again a cycle is established.

Forced convection heat transfer occurs when fluid currents are produced by some external source such as the wind, blowers or pumps.

Thermal radiation is energy emitted by a body as a consequence of its temperature alone. Radiant energy takes the form of electromagnetic waves or photons. Unlike conduction or convection there is no heat transfer due to the movement of matter.

In a vacuum all radiant energy travels at a constant speed, (the speed of light), irrespective of its energy or wavelength.

The **radiative** properties of materials, such as emittance, absorptance, reflectance and transmittance are wavelength dependent. Emittance generally refers to a property of a material in the long wavelength part of the spectrum, i.e. its ability to emit in the far infrared. Absorptance generally refers to short wavelength properties, i.e. the ability to absorb light.

Emittance (ε), is a measure of the ability of a surface to radiate. It is the ratio of the thermal radiation emitted from a surface to that of a perfect radiating body at the

same temperature.

Reflectance (r), is a measure of the ability of a surface to reflect radiation. It is the ratio of the thermal radiation reflected from a surface to that which falls on it.

Absorptance (}), is a measure of the ability of a surface to absorb radiation. It is the ratio of the thermal radiation absorbed by a surface to that absorbed by a perfectly absorbing surface.

Transmittance (t), is a measure of the ability of a surface to transmit radiation. Opaque materials do not transmit radiation.

Conductance of Heat

The heat loss or gain through a building element such as a wall, roof or floor, is determined by:

- the area of the element;
- the air speed on either side of the element;
- the resistance to heat flow of the element as determined by the materials and air spaces making up the element.

R-Values

The resistance to heat flow between two surfaces at different temperatures is a combination of radiation, conduction and convection. The relatively small range of temperatures to which buildings are subject allow these three resistances to be combined as a single resistance, often known as the **R-Value**. Homogeneous materials, air gaps and surfaces can all be assigned resistances. The units used in Australia are m^2.K/W.

R-Values of Bulk Materials.

Bulk materials have R-Values directly proportional to their thickness. The R-Value can be calculated from:

$$R = \frac{d}{k}$$

where,

- k is the conductivity; and
- d is the thickness.

Resistance of Air Spaces

The radiation component of heat transfer across an air gap depends on the emittance of the surfaces on either side, but otherwise is not strongly dependent on gap width unless that width is small. When either one, or both surfaces have a low emittance, the radiative heat flow across the gap is reduced significantly.

When air spaces are vented, or air is forced to circulate in, or move through the space, the heat transfer by convection becomes the dominant factor.

Resistance of Surfaces

Differences between surface temperature and air temperature occur because the air film next to the surface resists the flow of heat to the bulk of ambient air. This air film resistance causes a sharp temperature gradient next to the surface.

The air film resistance is dependent on the emittance of the surface, the direction of heat flow (for all but vertical surfaces) and the amount of air movement next to the surface. If air movement is forced past the surface (eg. wind outside, fans inside) the heat losses are dominated by forced convection.

Surfaces with a low emittance offer better insulating properties in still air conditions. Nearly all common building surfaces, including that of glass, have ahigh emittance of about 0.90, however. Clean, bright metal surfaces such as that of aluminium foil have a low emittance.

Building Section U-Value

A building element is made up of a number of materials, some of which create air spaces. Heat transfer is determined by

a number of thermal resistances, including inside and outside air film resistances.

This is mathematically equivalent to having a single total resistance, R_T, equal in value to the sum of the individual resistances. The overall heat transfer coefficient, or U-Value, is calculated as the reciprocal of the equivalent total resistance.

U-Value may also be referred to as thermal transmittance. Although transmittance and conductance use the same units, i.e. $W/m^2.K$, conductance is calculated from surface to surface, whereas transmittance is calculated from air to air. The U-Value represents the rate of heat transfer through a $1m^2$ area of the building element when there is a temperature difference of 1K between the air on either side.

Thermal Mass

The heat capacitance of a material is a measure of how much heat must be absorbed by the material to produce a rise in temperature of one Kelvin (1K). This property when applied to building elements is often referred to as thermal mass. Thermal mass delays temperature peaks and reduces the transfer of heat. The effectiveness of mass in a building depends on the area, and to a lesser degree the thickness, of the exposed mass.

Lightweight and heavyweight buildings behave differently thermally and are usually operated differently by the occupants. Heavyweight buildings are much less sensitive to problems caused by over glazing than lightweight buildings, which can overheat very quickly if they have inadequate means of dumping excess heat.

The absorption of heat by mass in the walls or floor prevents the rapid rise in temperature which could otherwise lead to overheating when sunlight is absorbed. Mass in a building has a stabilising effect by reducing the daily temperature swing.

This **thermal mass** can be of benefit in winter by absorbing solar radiation coming through windows and making heat available later in the day when temperatures have dropped. In summer, if the building is ventilated in the evening, (when it is cooler outside), the mass of the walls and floor will release heat, giving lower internal temperatures the next day.

The effectiveness of storing or releasing heat is greatly reduced if the mass is insulated from the room in any way. A brick veneer wall provides no useful mass because the bricks are thermally isolated from the room by an insulating air gap. Similarly, the usefulness of a concrete slab floor is reduced when it is covered by carpet.

B.2 Calculating the Thermal Performance of a Building

Steady State Versus Thermal Simulation

The U-value of a building element is a good indicator of the conductance of heat through it, if both the inside and outside of a building stay at a constant temperature for a long period of time, i.e. when “steady state” conditions apply. In real situations however, the external temperature changes in a non uniform way over a 24 hour cycle, and the internal temperature is also likely to vary with time. Consequently the thermal behaviour of a building element is determined by a complex relationship between the conductance and capacitance of the materials from which it is constructed. The thermal performance of a building is a consequence of further complex interaction between its components.

These dynamic interactions can only be adequately described by modelling them with computer software which simulates thermal performance by using real climatic data, usually on an hourly basis, over an entire year. The calculated heating and cooling energy required to maintain thermal comfort is then used as a basis for assessing the thermal quality of the building envelope. In Australia, two building energy rating schemes use thermal simulation to provide a star rating. These are BERS, (Building Energy Rating Scheme), and NatHERS, (Nationwide House Energy Rating Schemes), which both use the same thermal simulation "engine", CHENATH, under licence to the CSIRO. Other schemes, such as First Rate, ACTHERS and Baby BERS are based on the results of many thermal simulations to provide a simplified means of rating a home. The latter schemes have reduced accuracy but are faster and easier to use.

The information on R-Values for air films, materials and air spaces is provided for guidance and does not constitute professional advice. CSR Hebel recommends obtaining professional advice, as necessary, in relation to the information.

Table B1: R-Values of Air Films

Surface Air Film Resistance	R-Value (m^2.K/W)
Outdoor (R_{so})	0.05
Indoor, non reflective surfaces (R_{si})	0.11
Indoor, reflective walls (R_{si})	0.30
Indoor, reflective ceiling (R_{si})	0.23
Indoor, reflective floor (R_{si})	0.80

Table B2: R-Values for Materials

Material	R-Value for 1m thickness (m^2.K/W)
Adobe/Mud brick	1.3
Aluminium	0.005
Fibro-cement	1.54
Brickwork	1.63
Carpet/underlay	20.0
Ceramic tiles	0.88
Cork tiles	12.5
Concrete, standard	0.69
Concrete block (190 mm)	1.105
Concrete block (90 mm)	1.111
Glass	0.85
Hardboard	4.55
Particleboard	8.3
Plasterboard	5.9
Rendered plaster	2.0
Roofing tiles	1.18
Softboard	16.7
Steel	0.02
Timber (hardwood)	5.0
Timber (pine)	10.0
Vinyl flooring	1.27
Cellulose fibre insulation	25
Glass fibre insulation	20
Polystyrene/UF foam insulation	28
Polyurethane insulation	40
Rockwool insulation	28.5
Verticore	1.0

Notes: To calculate the R-Value for a particular thickness, multiply the R-Value given for 1 m by the thickness in metres.

Table B3: R-Values of Air Spaces

Wall	In	Out
Ventilated		
Air space, 20-100 mm, reflective	0.54	0.54
Air space, 20-100 mm, non-reflective	0.14	0.14
Unventilated		
Air space, 100 mm, reflective	0.61	0.61
Air space, 20 mm, reflective	0.58	0.58
Air space, 100 mm, non-reflective	0.17	0.17
Air space, 20 mm, non-reflective	0.16	0.16
Ceiling-Roof	**In**	**Out**
Raked Ceiling		
Air space, reflective	0.77	0.53
Air space, non reflective	0.16	0.17
Roof Space-Ventilated		
Roof space, non-reflective	0.46	0.11
Roof space, reflective	1.36	0.34
Roof Space-Unventilated		
Roof space, non-reflective	0.28	0.18
Roof space, reflective	1.09	0.56
Under Floor Air Space	**In**	**Out**
Non Enclosed		
Reflective	0.50	1.40
Non reflective	0.17	0.17
Enclosed, Down Facing Outer Surface Non Reflective		
Reflective	0.56	1.51
Non reflective	0.23	0.28
Enclosed, Down Facing Outer Surface Reflective		
Reflective	0.68	1.40
Non reflective	0.35	0.93

B.3 Examples of Thermal Calculations

Example 1.

An extension house wall is constructed of an outer layer of red clay bricks, a 100mm ventilated air gap and an internal layer of 150mm of CSR Hebel Thermoblok masonry units. Calculate the thermal resistance, R-Value and thermal transmittance, U-Value of the system.

The thermal resistances are summed up as follows:

Outside air surface, R_{so} = 0.05

Brickwork (110mm through) = 0.17

Air cavity (non-reflective) = 0.14

150mm thick CSR Hebel Thermoblok Masonry unit = 1.15

Inside surfaces air film, R_{si} (non-reflective) = 0.11

Total resistance, R_T = $1.62 m^2.K/W$

Transmittance, $U = 1/R_T$ = 0.62 $W/m^2.K$

Example 2.

Thermal resistance calculation of uninsulated building elements, and what reduction in heat loss can be expected from using CSR Hebel AAC Wall System.

A dwelling with $120m^2$ wall area. Basing calculations on an average minimum outside temperature of 5˚C (cold winter conditions) and an inside temperature of 20˚C.

Internal and External Surface Film Resistances are not included in the following examples.

200mm CSR Hebel AAC Block Wall with 2-3mm external texture coating + 10mm Gyprock plasterboard internal lining.

Total Resistance, R_T : 1.75 $(m^2.K)/W$

$$\text{Transmittance, } U = \frac{(1)}{R} : 0.571 W/(m^2.K)$$

Cavity Brick Wall with a 50mm Airspace

Total Resistance, R: 0.82 $(m^2.K)/W$

$$\text{Transmittance, } U = \frac{(1)}{R} : 1.22 W/(m^2.K)$$

190mm Core-filled Concrete Block Wall (2000kg/m^3)

Total Resistance, R : 0.54 $(m^2.K)/W$

$$\text{Transmittance, } U = \frac{(1)}{R} : 1.85 W/(m^2.K)$$

Heat loss through AAC wall,

Q_{Hebel}

= U x A x Δt x T

= 0.571 $W/m^2.K$ x 120 m^2 x 15°C x 10^{-3}

= 1.028 kWh

Heat loss through 270mm cavity brickwall,

$Q_{Cavity\ Brick}$

= U x A x Δt x T

= 1.22 $W/m^2.K$ x 120 m^2 x 15°C x 10^{-3}

= 2.196 kWh

Heat loss through 190mm core-filled concrete blockwall,

$Q_{Core\text{-}filled\ Concrete\ Block}$

= U x A x Δt x T

= 1.85 $W/m^2.K$ x 120 m^2 x 15°C x 10^{-3}

= 3.330 kWh

Reduction in heat transfer over cavity brickwall

$$= \frac{1 - 1.028}{2.196} x100\%$$

= 53.1%

Reduction in heat transfer over concrete blockwall

$$= \frac{1 - 1.028}{3.330} x100\%$$

= 69.1%

Reduction in heat transfer by adopting CSR Hebel AAC wall, in place of 270mm cavity brickwork

= 53.1%,

or

in place of 200mm concrete blockwork (2000kg/m^3) = 69.1%.

C.1 Condensation Control

Atmospheric water vapour will condense when it, or the air containing it, can contact a surface at or below the dew point. The dew point is the temperature at which the water vapour reaches saturation, or 100% relative humidity.

Condensation becomes a problem when it occurs either:

a) On interior surfaces of walls, ceilings, windows, etc.

b) On the interior of building cavities such as wall cavities, in roof or attic spaces, etc.

Condensation may be controlled or avoided by:

a) Controlling relative humidifies; or

b) Controlling the temperature of interior surfaces.

The short and long term costs of damage caused by condensation, justify consideration of means of avoiding it.

It may be controlled by a combination of ventilation, vapour barrier and insulation.

Vapour Barriers

The vapour barrier system should have a permeance no more than 0.1 perm as determined by ASTME- 96-53T (dry cup) or ASTM C355-59T (dry cup) where little or no ventilation of the space on the “cold” side of the cavity can be predicted.

For building elements such as walls, roof/ceilings, etc. the vapour barriers should be continuous and should be installed on the “warm” side of the building material. In tropical regions, the direction of vapour flow can be reversed and the vapour barrier should be placed on the outside.

In addition there should be no membrane (such as external cladding) on the “cold” side of the vapour barrier/insulation system, which has a lower permeance than the vapour barrier itself.

Reference should be made to the manufacturer’s literature for the permeance data for the vapour barrier system under consideration. CSR Hebel recommends obtaining professional advice, in relation to condensation control.

Relative Humidity

Under normal circumstances air is not saturated with water. Rather a certain percentage only of the maximum possible humidity is contained in air. This percentage is called the relative humidity.

Relative humidity =

$$\left(\frac{\text{Humidity content}}{\text{Max. possible humidity content (at saturation)}} \right) \times 100\%$$

Temperature Calculations

When considering condensation control, it is necessary to calculate the temperature of the internal wall or ceiling surface when the outside temperature is at the lowest level anticipated. The appropriate formula is:

$T_s = t_i - QR_{si}$

$Q = t_i - (Q/f_i)$

Where,

t_s = internal surface temperature (˚C)

t_i = inside air temperature (˚C)

Q = calculated heat flow per square metre per second (W/m)

R_s = resistance on inside air film (m^2.K/W)

F_i = inside surface heat transfer coefficient (W/m^2.K)

If the internal surface temperature calculated in this manner is less than the anticipated dew point temperature, there is a risk of condensation forming on the surface. This can promote mould growth and the accumulation of dust and stains, and lead to the eventual breakdown of paint and paper finishes.

It is therefore recommended that sufficient building material thickness be added to raise the surface temperature of the wall or ceiling above the dew point. Under extremely cold conditions, the use of avapour barrier should be considered. This is located immediately behind the facing sheet with the objective of preventing the migration of moisture vapour from within the living space into the wall and ceiling cavities.

If this happens the thermal resistance of the insulation can be seriously reduced and structural damage can result.

Table C1 can be used as a guide in establishing the lowest anticipated dew point temperature. It lists the dew point temperatures for a range of inside air temperatures and relative humidities.

Table C1: Dew Point Temperature (˚C)

Ambient Air Temp. (Dry Bulb) (˚C)	Relative Humidity – R.H. (%)							
	20	30	40	50	60	70	80	90
5	-14.4	-9.9	-6.6	-4.0	-1.8	0.0	1.9	3.5
10	-10.5	-5.9	-2.5	0.1	2.7	4.8	6.7	8.4
15	-6.7	-2.0	1.7	4.8	7.4	9.7	11.6	13.4
20	-3.0	2.1	6.2	9.4	12.1	14.5	16.5	18.3
25	0.9	6.6	10.8	14.1	16.9	19.3	21.4	23.3
30	5.1	11.0	15.3	18.8	21.7	24.1	26.3	28.3
35	9.4	15.5	19.9	23.5	26.5	29.0	31.2	33.2
40	13.7	20.0	24.6	28.2	31.3	33.9	36.1	38.2

Example 1.

Determine whether condensation will occur in the assembly in Example 1, assuming winter conditions and outside air temperatures of 0˚C and inside atmosphere of 20˚C and 80% R.H.

Heat Flow, $Q = U(t_i - t_o)$

$= 0.62\ (20 - 0),$

$= 12.4\ W/m^2$

Where

t_i = inside air temperature (˚C)

t_o = outside air temperature (˚C)

The rate of heat flow is the same through all resistances.

Therefore, $$Q = \frac{(t_1 - t_h)}{R_{si}}$$

Where th is the surface temperature on the warm (internal) side, and Rsi is the inside surface resistance.

i.e., $$12.4 = \frac{(20 - t_h)}{0.11}$$

from which, th = 18.6˚C

Referring to the appropriate table, air at 20˚C and 80% R.H. has a dew point of 16.5˚C (see Table C1). The calculated internal temperature of 18.6˚C is well above the dew point, therefore no condensation is likely.

D.1 Construction Notes

General Notes

G01. These drawings are to be read in-conjunction with the current edition of CSR Hebel Technical Manual, architectural drawings and other contract documentation.

G02. All materials and workmanship shall be in accordance with the current edition of the CSR Hebel Technical Manual and other CSR Hebel documentation.

G03. Refer to architectural drawings for all setting out dimensions.

G04. Do not scale drawings, use written dimensions.

G05. Should any omission, penetration, cutting of panels, discrepancy or fault exist, contact CSR Hebel immediately for a decision before proceeding with work.

G06. All load-bearing walls, bearing on CSR Hebel floor panels, shall be supported separately in accordance with the project engineer's design.

G07. CSR Hebel accepts no responsibility for the design or selection of supporting walls, lintels, beams, columns or other structural members.

G08. All panel dimensions are the responsibility of CSR Hebel's client and are subject to approval by the client before commencing manufacture of panels.

G09. Corrosion protection of all structural steelworks shall be specified by the project engineer or architect.

G10. The temporary restraint of CSR Hebel panels is the responsibility of the builder or installer.

Floor Panel Notes

F01. The ring anchor reinforcement shall be a minimum of N12 grade in accordance with AS1302, unless noted otherwise.

F02. Grout for the ring anchor system, where required, shall have a nominal composition of 1 Cement: 3 Sand: 2 Aggregate (5mm maximum coarse aggregate). The grout shall have a slump of 150mm and a minimum characteristic compression strength of f'cg= 15MPa at 28 days.

F03. Additives to reduce the grout shrinkage shall only be used in accordance with the manufacturer's instructions.

F04. The installer shall support (chair) reinforcement to enable grout to fully surround the reinforcement. Reinforcement shall not be in contact with the panel when grout is placed.

F05. Grout shall be rodded to ensure filling of notch and groove.

F06. The installer shall provide notch and groove at panel joints as per CSR Hebel standard detail.

F07. Ensure notch is cleared of all loose material and reinforcement cleaned of all foreign material.

F08. Lightly pre-wet notch prior to pouring the grout.

F09. Panels shall only be cut on-site as indicated on CSR Hebel drawings, otherwise contact CSR Hebel.

F10. Propping of panels maybe required to accommodate minor misalignments until 3 days after ring anchor grout is poured.

F11. All propping shall be removed from CSR Hebel floor panels before any walls are erected over.

F12. Traffic on floor panels is to be avoided for a period of 3 days after the ring anchor grout is poured.

F13. Exposed reinforcements at the ends of panels shall be corrosion protected. Use only anti- corrosion agent supplied by CSR Hebel.

F14. All bearing surfaces to be level and even, providing continuous support for the panel. Bearing dimensions shall be as noted on CSR Hebel drawings, otherwise contact CSR Hebel.

F15. Bearing Length requirements:

- End bearing: maximum of 60mm; or clear span / 80; and
- Edge bearing: 50mm minimum.

F16. For fire-rated panels with exposed reinforcement at the ends of panels, reinstate cover to reinforcement with 100mm thick AAC blocks.

Wall Panel Notes

W01. Panels shall only be cut on-site as indicated on CSR Hebel drawings, variations from the drawings require written approval from CSR Hebel.

W02. Exposed reinforcements at the ends of panels shall be corrosion protected. Use only anti- corrosion agent supplied by CSR Hebel.

W03. All bearing surfaces to be level and even, providing continuous support for the panel. Bearing dimensions shall be as noted on CSR Hebel drawings, otherwise contact CSR Hebel.

W04. Joint between wall panels shall be 10mm, unless noted otherwise.

W05. Bearing length requirements: 50mm minimum.

CSR Hebel Blockwork Notes

B01. Masonry strength shall be in accordance with requirements of structural engineer's documents.

B02. Provide temporary propping to walls during construction in accordance with AS3700.

B03. Control joints shall be located as specified by the structural engineer or building designer. Recommend locating control joints at expansion or construction joints in the slab, slab endings, at different support levels or where indicated on drawings, unless noted otherwise.

B04. All walls shall be tied at their intersection, unless noted otherwise, refer to structural engineer's documents.

B05. All non-loadbearing masonry shall be kept clear of the soffit over and the void filled with an approved sealant to detail by others.

B06. For all loadbearing masonry, the top coarse shall be finished level, smooth and detailed in accordance with structural engineer's detail.

B07. All chasing shall be in accordance with structural engineer's documents and AS3700.

B08. All propping shall be removed from the suspended slabs before any walls are erected over.

E.1 Guide Specifications - Hebel Blocks

General

1. Scope

This guide specification section, specifies performance requirements for supply and installation of Autoclaved Aerated Concrete (AAC) blocks as manufactured by CSR Hebel. The work shall be carried out by a contractor with previous experience in other projects of this type.

Tenderers shall submit references, certificates and full details of their experience and supervised training in the erection and laying of Autoclaved Aerated Concrete (AAC) blocks.

2. Work Program

The site of the works shall be in possession of the Project Manager who will continue to complete the works during the currency of the Contract. The Contractor shall confer with the Project Manager and arrange for his work to suit the Project Manager's program.

3. Documents/Drawings/Dimensions

This specification is to be read in conjunction with the drawings listed in the Schedule of Drawings listed under "Table of Contents", and all documents issued in the tender package.

Where an item is usual or necessary or is reasonably or properly inferred in the type of work but not specifically mentioned, it shall be deemed to be included in this specification.

4. Standards

The following Australian and other Standards are referenced in this Specification:

- AS/NZS 1530.3:1999 Methods for fire tests on building materials, components and structures – Simultaneous determination of ignitability, flame propagation, heat release and smoke release.
- AS/NZS 1530.4:1997 Methods for fire tests on building materials, components and structures – Fire resistance tests of elements of building construction.
- AS/NZS ISO 717.1:2004 Acoustics – Rating of sound insulation in buildings and of building elements – Airborne sound insulation.
- AS ISO 717.2:2004 Acoustics – Rating of sound insulation in buildings and of building elements – Impact sound insulation.
- BS 4315-2:1970 Methods of test for resistance to air and water penetration. Permeable walling constructions (water penetration).
- AS 3700:2001 + Amdt 1-2002 + Amdt 2-2003 Masonry structures
- AS/NZS 1170.0:2002 + Amdt 1-2003 Structural design actions – General principles.
- AS/NZS 1170.1:2002 Structural design actions – Permanent, imposed and other actions.
- AS/NZS 1170.2:2002 Structural design actions – Wind actions.
- AS 1170.4:1993 + Amdt 1-1994 Minimum design loads on structures – Earthquake loads.
- AS/NZS 2699.1:2000 Built-in components for masonry construction – Wall ties.

- AS/NZS 2699.1:2000 Built-in components for masonry construction – Connectors and accessories. • AS/NZS 2699.1:2000 Built-in components for masonry construction – Lintels and shelf angles (durability requirements).
- AS/NZS 4455:1997 Masonry units and segmental pavers.
- BS 5628-1:1992 Code of practice for use of masonry. Structural use of unreinforced masonry.
- BS 5628-3:1992 Code of practice for use of masonry. Materials, components, design and workmanship.
- AS 2870:1996 (Amended) Residential slabs and footings – Construction.

5. Approvals

The complete installation shall comply with all applicable requirements of the building regulations/ Building Code of Australia.

The complete installation shall be to the approval of the 'RELEVANT AUTHORITY'. The contractor shall have responsibility to perform all required tests and make all required submissions to obtain such approvals.

All units shall be subject to inspection and approval by the Project Manager. The inspection will as far as possible by carried out at the Works but the Project Manager may at his discretion defer inspection of any units until after delivery to site and such deferment shall not affect the Contractor's responsibilities under the Contract.

The Contractor shall provide all requisite facilities and assistance for the Project Manager to inspect the units.

Give 2 working days notice of:

- Flashings, damp-proof courses in position; and
- Lintels in position.

6. Samples

At a location as directed by the Project Manager, prepare a mock-up wall sample of Hebel blockwork no larger than 1.8m^2. Notify the Project Manager 24 hours prior to wall construction. Approval of wall to include adhesive mixing procedures. Where procedures and samples have been approved, sample shall be designated as Control Sample for all project blockwork.

Discard prototypes not approved by the Project Manager and construct additional prototypes and seek approval. When approved for surface finish, and all tolerance, commence production.

All units delivered to the site shall match the approved prototype. Submit samples of blocks to be used and obtain approval before placing orders.

7. Quality Assurance

All work shall comply with applicable provisions of the current edition of the listed Standards. Appoint an on-site representative who shall receive training from CSR Hebel and shall be responsible for the training of the workmen performing the work of this section.

The Contractor shall not vary the methods of preparation and installation from that recommended by the manufacturer/ supplier.

Materials

1. Properties

The lightweight blockwork shall be CSR Hebel Autoclaved Aerated Concrete (AAC) as manufactured by CSR Building Products Ltd, trading as CSR Hebel, consisting of sand, cement and lime, and shall be installed to areas as indicated on architectural drawings or project drawings.

The lightweight blockwork shall have the following performance criteria:

- Nominal dry density of between 470kg/m^3 and 650kg/m^3
- Dimensional accuracy of ±1.5mm on all faces
- Minimum characteristic compressive strength of 2.5MPa
- Minimum characteristic flexural tensile strength of 0.2MPa
- Minimum modulus of rupture of 0.44MPa
- Contain no asbestos or toxic substances
- Ignitability Index: zero (AS 1530.3)
- Spread of Flame Index: zero (AS 1530.3)
- Heat Developed Index: zero (AS 1530.3)
- Smoke Developed Index: zero (AS 1530.3)
- Thermal Conductivity 0.13 W/m.K)

2. Workmanship

Fixings, fastenings, anchors, lugs and the like shall be of a type approved by CSR Hebel or project engineer, and shall transmit the loads and stresses imposed and ensure the rigidity of the assembly.

Block laying shall be in accordance with CSR Hebel's current published specification, the on-site training provided by CSR Hebel and CSR Hebel's written instructions.

3. Tolerances

Maximum planar misalignment shall be 2mm along butt joints. The thickness and width of walls shall not vary by more than 5mm from design sizes. Deviation from plumb, level or dimensional angle must not exceed 5mm per 3.5m of length of any member, or 6mm in any total run in any line. Deviation from theoretical position on plan or elevation, including deviation from plumb, level of dimensional angle, must not exceed 9mm total at any location. Change in deviation must not exceed 3mm for any 3.5m run in any direction.

Installation

1. Set Out

All lightweight blockwork shall be installed using Hebel Adhesive to all horizontal joints and perpends. The first course must be made true and level using Hebel Mortar, and Hebel Adhesive to fully seal the perpends.

All Hebel Adhesive shall be applied using a CSR Hebel recommended notched trowel to obtain an even distribution of adhesive to achieve joint thickness of 2-3mm.

All lightweight blockwork shall be laid in a format that the vertical joint of the lower course must be staggered at least 100mm relative to the vertical joint of the overlaying course.

A slip joint/bond breaker must be installed between the first course and the foundations, or slab on all internal and external walls to allow for differential movement between the AAC masonry and the supporting structure.

Unless otherwise directed and/or shown, setout of block walling shall be interpolated to the centre lines of the wall

and setout dimensions, excepting where the AAC block walls abut concrete faces where flush face shall be achieved. Perform all operations necessary for the proper execution of the work, such as cutting, corbelling, chasing, beam- filling, bonding and making good.

Build in as necessary all flashings, reinforcements, arch bars, lintels, frames, straps, bolts, lugs, wall ties, metalwork, precast units, sills, partitions, joists and the like.

Carefully set out and leave openings for other trades to eliminate cutting.

2. Handling, Transport and Storage

Site provision for storage of materials and for the mixing of adhesive shall be as agreed with the Project Manager. The Project Manager shall provide hoisting to deliver the CSR Hebel blocks to the floor and general area of the work as required. All labour and equipment required for the distribution of CSR Hebel blocks, once delivered to the floor level of installation, shall be the responsibility of this Contractor.

3. Control Joints

Control joints should be built into walls at no greater than 6m centres, and at locations in accordance with the project engineer's specifications. Closer spacings may be required due to slab or foundation design. Refer to CSR Hebel Technical Manual for guidance on control joint set out.

Masonry expansion ties shall be installed across the joint every third course, as a minimum.

4. Rejection Criteria

CSR Hebel blockwork shall be liable to rejection if any of the following defects occur:

- A joint has been made at a location or in a manner not in accordance with this Specification.
- The construction tolerances have not been met.
- Items embedded in blocks or jointing material have been displaced from their correct position.
- Blockwork has cracks of category 3 or 4 in accordance with AS 2870.1.
- The work can be shown to be otherwise defective.
- Perpendicular joints are not fully sealed with Hebel Adhesive.

The Project Manager may permit blockwork liable to rejection to be retained on the following basis:

- A structural investigation.
- Additional tests.
- Approved remedial work.
- Repair of damaged units.

The proposed repair methods shall be demonstrated to the Project Manager and his acceptance of the method shall be obtained in writing. Repairs to exposed surfaces shall normally only be effected using the same type of cement and mix proportions. The repaired unit shall have the same appearance and durability of a similar undamaged unit.

5. Cleaning

Take care at all times to keep walls clean. Remove excess adhesive progressively. Clean strictly in accordance with manufacturer's recommendations.

6. Completion

On completion clean out all blocks, mortar droppings, debris, etc. and remove all scaffolding, make good all put-log holes and other blemishes, and leave all work in perfect condition and protect until handover.

E.2 Guide Specifications - Hebel PowerPanel

General

1. Scope

This guide specification section specifies performance requirements for supply and installation of Autoclaved Aerated Concrete (AAC) panels as manufactured by CSR Hebel. The work shall be carried out by a contractor with previous experience in other projects of this type.

Tenderers shall submit references, certificates and full details of their experience and supervised training in the erection and laying of Autoclaved Aerated Concrete (AAC) panels.

2. Work Program

The site of the works shall be in possession of the Project Manager who will continue to complete the works during the currency of the Contract. The Contractor shall confer with the Project Manager and arrange for his work to suit the Project Manager's program.

3. Drawing/Dimensions

This specification is to be read in conjunction with the drawings listed in the Schedule of Drawings listed under "Table of Content", and all documents issued in the tender package.

Where an item is usual or necessary or is reasonably or properly to be inferred in the type of work but not specifically mentioned, it shall be deemed to be included in this specification.

The Project Manager and Contractor shall check and agree all dimensions on site before manufacture of CSR Hebel panels.

If agreed in the contract, CSR Hebel shall supply drawings showing the following information where appropriate to the item:

- Layout (sectional plan and elevation) of complete assembly
- Scale plan view and section of panels
- Methods of installation, including fixings
- Junctions and trim to adjoining surfaces
- Routing
- Jointing
- Window and parapet details
- Bevelling of edges
- Fire Resistance Level
- Displacement of steel reinforcement from nominal location where necessary to maintain minimum concrete cover at edges, panel edges cut after production (i.e. non-typical panels) and where routing otherwise reduces normal cover.

CSR Hebel can arrange for a contractor to prepare "Layout Drawings". The lead-time for drawing preparation, cost, and approvals to be arranged with CSR Hebel. Important, client approval of the layout drawings detailing the panel geometry is required before the production of panels.

The Contractor shall prepare setting out drawings of all fixings required to be fixed to the structure.

The Contractor shall be responsible for the co-ordination of all requirements for fixings for subsequent installation of doors, windows, mechanical and electrical services and the like and shall show all such fittings on his manufacturing drawings.

The Contractor shall be responsible for and ensure that all window opening sizes in panels are accurately dimensioned and constructed to the sizes shown on the drawings or as otherwise directed by the Project Manager.

4. Standards

The following Australian and other Standards are referenced in this Specification:

- AS/NZS 1530.3:1999 Methods for fire tests on building materials, components and structures – Simultaneous determination of ignitability, flame propagation, heat release and smoke release.
- AS/NZS 1530.4:1997 Methods for fire tests on building materials, components and structures – Fire resistance tests of elements of building construction.
- AS/NZS ISO 717.1:2004 Acoustics – Rating of sound insulation in buildings and of building elements – Airborne sound insulation.
- AS ISO 717.2:2004 Acoustics – Rating of sound insulation in buildings and of building elements – Impact sound insulation.
- BS 4315-2:1970 Methods of test for resistance to air and water penetration. Permeable walling constructions (water penetration).
- AS 3700:2001 + Amdt 1-2002 + Amdt 2-2003 Masonry structures
- AS/NZS 1170.0:2002 + Amdt 1-2003 Structural design actions – General principles.
- AS/NZS 1170.1:2002 Structural design actions – Permanent, imposed and other actions.
- AS/NZS 1170.2:2002 Structural design actions – Wind actions.
- AS 1170.4:1993 + Amdt 1-1994 Minimum design loads on structures – Earthquake loads.
- AS/NZS 4455:1997 Masonry units and segmental pavers.
- BS 5628-1:1992 Code of practice for use of masonry. Structural use of unreinforced masonry.
- BS 5628-3:1992 Code of practice for use of masonry. Materials, components, design and workmanship.

5. Approvals

The complete installation shall comply with all applicable requirements of the building regulations/building code of Australia.

The complete installation shall be to the approval of the 'RELEVANT AUTHORITY'. The Contractor shall have responsibility to perform all required tests and make all required submission to obtain such approvals.

All units shall be subject to inspection and approval by the Project Manager. The inspection will as far as possible be carried out at the Works but the Project Manager may at his discretion defer inspection of any units until after delivery to site and such deferment shall not affect the Contractor's responsibilities under the Contract.

The Contractor shall provide all requisite facilities and assistance for the Project Manager to inspect the units.

Give 2 working days notice of:

- Flashings, damp-proof courses in position;
- Lintels in position; and
- Panels ready for ring anchors to be poured.

6. Samples

Where procedures and the sample has been supplied and approved, the sample shall be designated as Control Sample for all project panel erection.

Discard prototypes not approved by the Project Manager and construct additional prototypes and seek approval. When approved for surface finish, and all tolerance, commence production. All units delivered to the site shall match the approved prototype.

Submit samples of panels to be used and obtain approval before placing orders.

7. Quality Assurance

The Contractor shall not vary the methods of preparation and installation from that recommended by the manufacturer/ supplier.

Materials

1. Properties

The panels shall be CSR Hebel Autoclaved Aerated Concrete (AAC), consisting of sand, cement and lime, and shall be installed to areas as indicated on architectural or project drawings.

The lightweight panels shall have the following performance criteria:

- Nominal dry density between 550kg/m^3 and 580kg/m^3
- Dimensional accuracy of ± 2mm uncut, and ± 5mm cut ends
- Minimum characteristic compressive strength of 2.5MPa
- Minimum Modulus of Rupture of 0.6MPa
- Contain no asbestos or toxic substances
- Specific heat 1kJ/kg°C
- Co-efficient of thermal expansion of 10 x 10^{-6}/°C
- Ignitability Index: zero
- Spread of Flame Index: zero
- Heat Developed Index: zero
- Smoke Developed Index: zero
- Thermal Conductivity 0.13 W/m.K

Any fixings used shall be capable of developing sufficient anchorage strength in the material. The reinforcement used in the panels shall be coated to protect it from corrosion.

2. Workmanship

Fixings, fastenings, anchors, lugs and the like shall be of a type approved by the manufacturer or project engineer for use in CSR Hebel products and shall transmit the loads and stresses imposed and ensure the rigidity of the assembly.

Panel erection shall be in accordance with CSR Hebel's current published specification, the on-site training provided by CSR Hebel and CSR Hebel's written instructions.

3. Tolerances

Maximum planar misalignment shall be 2mm along butt joints. The thickness and width of panels shall not vary by more than 5mm from design sizes. Deviation from plumb, level or dimensional angle must not exceed 5mm per 3.5m of length of any member, or 6mm in any total run in any line. Deviation from theoretical position on plan or elevation, including deviation from plumb, level of dimensional angle, must not exceed 9mm total at any location. Change in deviation must not exceed 3mm for any 3.5m run in any direction.

Panels shall be designed to allow for deflection of structural supporting beams up to span/500.

Installation

1. Set Out

All panels shall be secured by fixings as detailed.

Fasteners shall be stainless steel or galvanised steel as shown on the drawings. The contractor shall be responsible for co-ordinating with the Project Manager and check the exact position of fixing clips or angles on site.

The contractor shall supply and erect CSR Hebel panels as scheduled on the drawings.

The manufacturer shall clearly and permanently identify each panel unit and relate to the units shown on the Layout Drawings. The identifying mark shall be placed on a surface of no visual significance.

2. Handling, Transport and Storage

Protect panel units from damage from the time of arrival on the ground on site until the completion of the installation and finishes. In particular, protect against damage from the local crushing and chafing effects of lifting and transport equipment, torsional loading, scraping and scouring.

During transport, protect all visible arises with thick, non-rigid, inert, non-absorbent, crushable casings such as 50mm polyurethane foam.

Store and handle units in a manner approved by the manufacturer. Store units horizontally on edge supported on timber bearers. Handle and support to ensure that no overstress will occur during handling.

Keep units in storage clear of ground, in positions where they cannot be walked on and clear of materials capable of staining or marking.

Stack units so that they support their own weight only, and not that of other units.

Site provision for storage of materials and for the mixing of adhesive shall be as agreed with the Project Manager. The Project Manager shall provide hoisting to deliver the Hebel blocks to the floor and general area of the work as required.

All labour and equipment required for the distribution and erection of panels, once delivered to the floor level of installation, shall be the responsibility of this Contractor.

3. Rejection Criteria

CSR Hebel panels shall be liable to rejection if any of the following defects occur:

- A joint has been made at a location or in a manner not in accordance with this Specification.
- The construction tolerances have not been met.
- The reinforcing steel has been displaced from its correct position.
- Items embedded in panels or concrete have been displaced from their correct position.
- The work can be shown to be otherwise defective.

Panels requiring modification shall be removed from the site.

Inspect panels for cracks before installation and on completion of each structural bay.

The Project Manager may permit panels liable to rejection to be retained on the following basis:

- An appraisal of the statistical information related to the panel strength and appearance.
- A structural investigation.
- Additional tests.
- Approved remedial work.
- Repair of damaged units.

The proposed repair methods shall be demonstrated to the Project Manager and his acceptance of the method shall be obtained in writing.

Repairs to exposed surfaces shall normally only be effected using the same type of cement and mix proportions. The repaired unit shall have the same appearance and durability of a similar undamaged unit.

Remove panels finally rejected to the extent determined by the Project Manager.

4. Fixings

Supply all fixing assemblies, items fixed to the structure, temporary fixings, shims, braces, protection, sealants, jointing adhesive and flashings required for erection of units on the site.

5. Erection

Erect precast elements into their final position within the specified tolerances and connect and join in accordance with the requirements of the product.

Remove lifting hooks and similar devices after erection, and make good lifting ferrule recesses, to ensure that they cannot be exposed to water or permit water penetration even if the sealants fail.

6. Jointing

Joint location and details are shown on the drawings.

Do not eliminate, vary the location of, or make additional joints without prior approval.

Dry and clean joints before joining material is applied.

7. Penetrations

All penetrations shall be clearly marked on the 'Layout Drawings' and subject to the client's approval, prior to manufacture of the panels. Any additional penetrations shall be installed after written approval is obtained from the Project Manager. Should penetrations be installed which are detrimental to the performance of the panel under the specified design loads, the panels shall be replaced at the expense of the contractor, or an acceptable reduced design loads shall be certified by the project designer.

8. Scaffolding

Scaffolding for panel installation and sealant application to be provided by Contractor, scaffolding for coating and surface finishes of the panels will be provided by others.

9. Cleaning

Take care at all times to keep walls clean. Remove excess adhesive progressively. Clean strictly in accordance with manufacturer's recommendations.

10. Completion

On completion clean up of all panels, mortar droppings, debris, etc. and remove all scaffolding, make good all put-log holes and other blemishes and leave all work in perfect condition and protect until handover.

E.3 Guide Specification - Renders for CSR Hebel Autoclaved Aerated Concrete Products

General

1. Scope

This specification sets out the performance requirements and provides practical advice for rendering CSR Hebel autoclaved aerated concrete (AAC) products. CSR Hebel AAC products include; Thermoblok masonry units, Sonoblok masonry units, PowerPanel™ special purpose masonry units, and wall panels.

It covers cement based renders that are supplied pre-mixed.

2. Overview

Rendering over AAC is different from rendering over conventional masonry. Simply, the AAC products have different properties than that of conventional masonry and a suitable render has to be adopted to accommodate these unique properties. Compatibility is important, as a common mistake is the substitution of AAC products for conventional bricks and blocks with no consideration to the impact of a brick/block styled render used in conjunction with AAC products.

Although AAC products are manufactured to tight tolerances, small surface irregularities due to the cutting process in manufacture of CSR Hebel AAC products, provide a substrate which is suitable for a wide range of renders. Rendered CSR Hebel AAC products are suitable for solid walls or external and internal leaves of cavity wall construction to provide thermally efficient buildings in all areas of exposure, except very severe exposure where some form of cladding should be used.

All renders should comply to the requirements outlined in with the Australian Standard AS3700: Masonry Structures and referenced literature, the performance requirements set out in this specification, and the German Standard DIN 18555.

All rendered surfaces shall be finished with a vapour permeable coating.

3. Surface Preparation of AAC Substrate

Adhesion is provided by key and suction. The natural suction of AAC should be augmented with a mechanical key, such as an initial splatter coat treatment. The AAC surface should be kept clean and free of dust and loose particles, which may have occurred during construction by brushing down the surface with stiff broom. In addition, any contaminants should be removed which may affect the adhesion of the render.

All holes should be filled and damaged areas patched, and all joints shall be filled with Hebel Adhesive. All vertical joints shall be finished flush. The damp proof course (DPC) should protrude the specified distance from the wall beyond the external finish of the render (render should not bridge the DPC).

The wall surface should be neither saturated nor very dry. CSR Hebel products normally provide a ‘medium suction background’. Given certain ambient conditions, or where the AAC product has been allowed to dry out, high rates of initial suction may be experienced. This condition can have an adverse effect on hydration and adhesion and measures should be taken to reduce the suction. This condition should be avoided by rendering and applying external finishes within 12 months of installation of the CSR Hebel product.

Alternatively, should high rates of suction persist a splattered treatment may beconsidered. This will enhance the keying action of the render to the surface.

External Renders

1. Pre-mixed Renders

Render can be supplied as a pre-mixed in bags, or prepared on-site. Pre-mixed renders have the advantage of being a consistency quality produced material, unlike on-site mixed renders, which can result in product variations if the raw material quality and preparation processes are not well controlled. The manufacturer of pre-mixed renders shall provide the requirements, instructions and guarantees for the use of their render product on AAC substrates.

2. Render Strength

The strength of the various CSR Hebel AAC products is available in Part 2 of the CSR Hebel Technical Manual. The selected render mix should have similar strength to the AAC substrate. With successive coatings the strength should be weaker than the previous. A suitable render for the lower strength AAC products is a pre-mixed render.

The compressive strength of renders over CSR Hebel AAC products should not exceed 4.0MPa, with 3 to 4MPa being optimum. Renders with a compressive strength exceeding 5.0MPa, including site renders with 1:3 Cement:Sand mixes are not recommended.

Raw Materials

1. Cement

The cement should be GP (General Purpose) class cement in accordance with appropriate Australian Standards.

2. Lime

The lime should be hydrated and comply with BS 890:1995 Specification for building limes.

3. Sand

The sand in all coats should be sharp, clean and shall comply with the requirements of BS 1199 and BS 1200:1976 Specification for building sands from natural sources. The grading of the sand is extremely important as it will affect the quality and performance of the finished render. Sands with excessive proportions of very fine material should be avoided as the finer the sand, the greater the capacity of the render to hold water. In addition to inhibiting adhesion, excessive moisture retention will lead to high drying shrinkage with cracking and spalling.

Conversely, sand that is too coarse will retain insufficient moisture within the render resulting in inadequate hydration and adhesion.

Construction

1. Render Application

The appearance and durability depends also on the workmanship. It is normal practice to apply the render in two coats. The first coat (undercoat) should be trowelled on to a thickness of 8mm to 18mm and scratched.

An appropriate period of time should elapse between applications of coats in order to allow the undercoat to dry out thoroughly, but not too quickly, before the next coat is applied.

The thickness of the final coat will be governed to some extent by the texture required, but will normally be 6mm to

10mm as finished. The final coat should be thinner and no stronger than the undercoat and this, in turn, no stronger than the background substrate.

The overall final thickness of render should not exceed 20 percentage of the thickness of the AAC product substrate) with a maximum thickness of 20mm (panel thickness ≥100mm). Important: when thick renders, say greater than 15mm, it is critical that the characteristics of the render are similar to the AAC substrate.

The rate of drying will vary with atmospheric conditions of temperature, humidity and degree of ventilation. If necessary, precautions should be taken to retain sufficient moisture to allow hydration to be completed.

2. Meshing

General

The use of matting (woven fibreglass, expanded stainless or galvanised steel, or plastic) is recommended around areas on walls, such as:

- Ends of lintels over doors and windows, where a fixed end is detailed;
- Across the sill of windows;
- Across the chases in the wall for services;
- Around external corners at the top of the wall;
- Across joints on the underside of floor, wall and ceiling panels.

The matting should be bedded into a thin layer of render (Stage 1) prior to the final coat of render (Stage 2). This matting is available in two grades:

- 10mm grid x 330mm wide for external use; and
- 5mm grid x 330mm wide for internal use.

Note the purpose of the matting is to keep the render together and minimise consequential cracking of the render, it does not act as reinforcement. The different types of matting will minimise the cracking to various levels. The designer in conjunction with the render contractor should determine and specify the appropriate matting for the project.

CSR Hebel Panel Products

For walls constructed with CSR Hebel panel products (including CSR Hebel RWS), fibreglass matting is recommended in the following areas:

- The panel joint at all external corners, which do not have a control joint. Note CSR Hebel recommends a control joint be located at the corner or at the end of the first panel from the corner;
- Joints on the corners of splays, such as 45° windows; and
- All panel joints, other than control joints, when the coating system proposed is comprised of a sand/cement render and thin paint finish only. This is optional for a coating system that includes a high build acrylic texture coat or highly flexible acrylic membrane. The guarantee of a coating system without fibreglass matting is the responsibility of the coating manufacturer. CSR Hebel recommends the use of matting.

3. Control Joints

General

The control joint is a necessary part of the wall system to ensure the location of possible cracking is controlled, movement isolated and stresses relieved from the wall element. The control joint may serve as a location for the joint to open or close only, or both. The designer must consider the type and magnitude of movement when detailing the control joints.

A common mistake with cement render and control joints is the application of the

render over the joint. For joints that are designed to accommodate closing, this canbe detrimental. The render restricts the joint from closing and reveals itself with cracking and spalling of the render. Secondary damage can result from water ingress through the crack and working its way behind the coating system. Importantly all joints should be filled with an appropriate flexible sealant that can accommodate the movements and durability for the application.

Ideally, the render should be terminated at the sealant/panel interface and not impede the differential movement between the panel and adjacent concrete structure or another panel.

F.1 Fire Test Certificates

Included in this appendix are some of the relevant Test Reports conducted by CSIRO on the CSR Hebel product. The enclosed copies of the Test Certificates have been included with the permission of the CSIRO.

No. 216

Certificate of Test

This is to certify that the element of construction described below was tested by CSIRO Division of Building, Construction and Engineering in accordance with Australian Standard 1530.4-1990 Methods for fire tests on building materials, components and structures, Part 4: Fire resistance tests of elements of building construction, on behalf of

CSR Hebel Australia Pty Ltd
Unit 4A, 4 Central Avenue
THORNLEIGH NSW

A full description of the test specimen and the complete test results are detailed in the Division's report FSV 0079

Product Name: Non-loadbearing wall constructed of 100 mm thick Autoclaved Aerated Concrete blocks laid in CSR Hebel thin bed adhesive.

Description: The specimen comprised a single-leaf non-loadbearing wall of autoclaved aerated concrete blocks, laid up in stretcher bond, using CSR Hebel thin bed adhesive with joints in the range 1 mm to 3 mm thick. The wall was 3000 mm high x 3000 mm wide x 100 mm thick. The individual blocks were 600 mm long x 200 mm high x 100 mm wide. All edges of the wall were restrained by the specimen frame. Construction is detailed in
.drawing numbered HB 18-1, dated 19 July 1990 by CSR Hebel Australia Pty Ltd.

The element of construction satisfied the following criteria during the fire test for the period stated

Structural Adequacy	no failure at 241 minutes
Integrity	no failure at 241 minutes
Insulation	no failure at 241 minutes

and therefore for the purposes of Building Regulations in Australia achieved FRL of 240/240/240

Testing Officer L B Retson Date of Test 22 May 1990

Issued on the 14 th day of August 1990
without alterations or additions

R. J. Dayeh

R J Dayeh
Principal Experimental Scientist
for Manager, Fire Technology.

CSIRO
AUSTRALIA

National Building Technology Centre PO Box 310 North Ryde 2113 Australia Telephone (02) 888 8888 Fax (02) 888 9335 Telex AA123400
Division of Building, Construction and Engineering Institute of Minerals, Energy and Construction

Certificate of Test

No. 504

This is to certify that the element of construction described below was tested by the CSIRO Division of Building, Construction and Engineering in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures Part 4-1990, Fire-resistance tests of elements of building construction and the general principles of British Standard 476, Fire Tests on Building Materials and Structures, Parts 20 & 22-1987 on behalf of

CSR Hebel
2nd Floor, 9 Help Street, CHATSWOOD, NSW

A full description of the test specimen and the complete test results are detailed in the Division's report FSV 0258

Product Name: A 100 mm thick CSR Hebel block wall laid up with thin bed adhesive.

Description: The specimen comprised a wall built of CSR Hebel lightweight concrete blocks measuring 600 mm x 200 mm x 100 mm wide. The blocks were laid up in stretcher bond with CSR Hebel thin bed adhesive. The wall was 3000 mm high x 3000 mm wide. The test frame measured 3020 mm x 3020 mm. Ceramic fibre was inserted along the top of the wall in a 20 mm gap and along the sides and bottom of the wall in a 10 mm gap. Along the top of the specimen were 5 evenly spaced steel angles, 200 mm in length. The wall was built on a rectangular mild steel section placed along the length of the wall at the centre of the blockwork.
Details of the construction are shown in the following:
. Drawing numbered FTS30, dated 21 July 1993 by CSR Hebel Australia..

Restraint: The wall was subject to lateral restraint at the top and bottom but no rotational restraint. Both vertical sides of the specimen were free.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated

Structural Adequacy	no failure at 241 minutes.
Integrity	no failure at 241 minutes.
Insulation	no failure at 241 minutes.

and therefore for the purpose of Building Regulations in Australia achieved a FRL of 240/240/240
The rating applies to elements of the same construction as the specimen and is applicable from either side.

Testing Officer: L B Retson **Date of Test:** 31 August 1993

Issued on the 13th day of October 1993
without alterations or additions

R J Dayeh
for, Manager, Fire Technology

Division of Building, Construction and Engineering
PO Box 310 NORTH RYDE NSW 2113 Telephone (02) 888 8888 Fax (02) 888 9335

CSIRO AUSTRALIA

No. 223

Certificate of Test

This is to certify that the element of construction described below was tested by CSIRO Division of Building, Construction and Engineering in accordance with Australian Standard 1530.4-1990 Methods for fire tests on building materials, components and structures, Part 4: Fire resistance tests of elements of building construction, on behalf of

CSR Hebel Australia Pty Ltd
Unit 4A, 4 Central Avenue
THORNLEIGH NSW

A full description of the test specimen and the complete test results are detailed in the Division's report FSV 0093 .

Product Name: A loadbearing wall constructed of 150 mm thick Autoclaved Aerated Concrete Blocks laid in CSR Hebel thin bed adhesive.

Description: The specimen comprised a single-leaf loadbearing wall of autoclaved aerated concrete blocks, laid up in stretcher bond, using CSR Hebel thin bed adhesive with joints in the range 1 mm to 3 mm thick. The wall was 3000 mm high x 3000 mm wide x 150 mm thick. The individual blocks were 600 mm long x 200 mm high x 150 mm wide. A load of 68 kN/m was applied for the duration of the test. Construction is detailed in

. drawing numbered HB 18-3, dated 19 July 1990 by CSR Hebel Australia Pty Ltd.

The element of construction satisfied the following criteria during the fire test for the period stated

Structural Adequacy	no failure at 241 minutes
Integrity	no failure at 241 minutes
Insulation	no failure at 241 minutes

and therefore for the purposes of Building Regulations in Australia achieved FRL of 240/240/240

Testing Officer: G E Collins

Date of Test: 12 September 1990

Issued on the 18th day of October 1990 without alterations or additions

R J Dayeh
Principal Experimental Scientist
for Manager, Fire Technology.

CSIRO
AUSTRALIA

National Building Technology Centre PO Box 310 North Ryde 2113 Australia Telephone (02) 888 8888 Fax (02) 888 9335 Telex AA123400
Division of Building, Construction and Engineering Institute of Minerals, Energy and Construction

Certificate of Test

No. 555

This is to certify that the element of construction described below was tested by the CSIRO Division of Building, Construction and Engineering in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-1990, Fire-resistance tests of elements of building construction, on behalf of

CSR Hebel Australia Pty Ltd
Level 2, 9 Help Street
CHATSWOOD NSW

A full description of the test specimen and the complete test results are detailed in the Division's report FSV 0327

Product Name: Non-Loadbearing Lightweight Concrete Wall.

Description: The specimen comprised a non-loadbearing lightweight concrete wall 3000 mm high x 3000 mm wide x 100 mm thick. Each individual panel was 3000 mm high x 600 mm wide x 100 mm thick. The bottoms of the panels were slotted to fit onto a 50 mm x 20 mm x 1.2 mm steel angle, while the tops of the panels were secured by FD8 Hebel brackets, nailed to the panels and welded to 75 mm x 6 mm steel plate bolted to the frame. Thin bed adhesive was used between panels. The specimen was unrestrained on the vertical sides. The vertical gap between specimen frame and wall was filled with compressed ceramic fibre.

Construction is detailed in the following:

- Drawing numbered SK-012, dated July 1994, by CSR Hebel Australia Pty Ltd.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy	-	241 minutes.
Integrity	-	165 minutes.
Insulation	-	112 minutes.

and therefore for the purpose of Building Regulations in Australia achieved a FRL of 240/120/90. The fire-resistance level is applicable for exposure to fire from the same side as the test.

Testing Officer: G R G Everingham **Date of Test:** 8 August 1994

Issued on the 15th day of September 1994 without alterations or additions.

G E Collins
for Manager, Fire Technology

Division of Building, Construction and Engineering
PO Box 310 NORTH RYDE NSW 2113 Telephone (02) 888 8888 Fax (02) 888 9335

CSIRO AUSTRALIA

Certificate of Test

No. 409

This is to certify that the construction described below was tested by the Division of Building, Construction and Engineering in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-1990, Fire-resistance tests of elements of building construction, on behalf of

CSR Hebel Australia Pty Limited
Unit 4A, 4 Central Avenue THORNLEIGH NSW

A full description of the test specimen and the complete test results are detailed in the Division of Building, Construction and Engineering's report numbered FSV 0221

Product Name: Non-Loadbearing Wall System Incorporating 125 mm thick Autoclaved Aerated Concrete Panels

Description: The specimen comprised a 3020 mm x 3020 mm x 125 mm wall system fabricated from 600 mm wide x 125 mm thick CSR Hebel Reinforced Autoclaved Aerated Concrete Panels. Each panel was reinforced with 5 mm diameter mesh. The panels were keyed together with a 10 mm deep tongue and groove system and installed vertically using thin bed adhesive. The panels were secured to the specimen containing frame with 125 mm x 50 mm (FB8) angles at the top and bottom. The angles were attached to the frame with masonry nails and to the individual panels with FB5/1 nails. One end the panels were attached to the frame with two FB8 angles. Construction is detailed in

- drawing numbered STD-601; and
- drawing numbered STD-602, dated 3 August 1992, by CSR Hebel Australia Pty Limited.

Orientation: The specimen was symmetrical.

The element of construction satisfied the following criteria for fire-resistance for the period stated

Structural Adequacy	no failure at 241 minutes
Integrity	no failure at 241 minutes
Insulation	no failure at 241 minutes

and therefore for the purpose of Building Regulations in Australia achieved a FRL of 240/240/240 when exposed to fire from either direction.

Testing Officer: G E Collins Date of Test: 17 September 1992

Issued on the 17 th day of November 1992
without alterations or additions

R J Dayeh
for Manager, Fire Technology.

Division of Building, Construction and Engineering
PO Box 310 NORTH RYDE NSW 2113 Telephone (02) 888 8888 Fax (02) 888 9335

CSIRO AUSTRALIA

No. 225

Certificate of Test

This is to certify that the element of construction described below was tested by CSIRO Division of Building, Construction and Engineering in accordance with Australian Standard 1530.4-1990 Methods for fire tests on building materials, components and structures, Part 4: Fire resistance tests of elements of building construction, on behalf of

CSR Hebel Australia Pty Ltd
Unit 4, 4 Central Avenue
THORNLEIGH NSW

A full description of the test specimen and the complete test results are detailed in the Division's report FSV 0081

Product Name: Non-loadbearing wall constructed of 150 mm thick Autoclaved Aerated Concrete Panels laid horizontally in CSR Hebel thin bed adhesive.

Description: The specimen comprised a single-leaf non-loadbearing wall of autoclaved aerated concrete panels, laid horizontally using CSR Hebel thin bed adhesive with. The wall was 3000 mm high x 3000 mm wide x 150 mm thick. The individual panels were 600 mm high x 150 mm thick. All edges of the wall were restrained by the specimen frame. Construction is detailed in
. drawing numbered HB 18-2, dated 19 July 1990 by CSR Hebel Australia Pty Ltd.

The element of construction satisfied the following criteria during the fire test for the period stated

Structural Adequacy	no failure at 241 minutes
Integrity	no failure at 241 minutes
Insulation	no failure at 241 minutes

and therefore for the purposes of Building Regulations in Australia achieved FRL of 240/240/240 which is applicable from either direction.

Testing Officer: G E Collins

Date of Test: 4 July 1990

Issued on the 16 th day of October 1990
without alterations or additions

R J Dayeh
Principal Experimental Scientist
for Manager, Fire Technology.

CSIRO
AUSTRALIA

National Building Technology Centre PO Box 310 North Ryde 2113 Australia Telephone (02) 888 8888 Fax (02) 888 9335 Telex AA123400
Division of Building, Construction and Engineering Institute of Minerals, Energy and Construction

Certificate of Test

No. 529

This is to certify that the element of construction described below was tested by the CSIRO Division of Building, Construction and Engineering in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-1990, Fire-resistance tests of elements of building construction, on behalf of

CSR Hebel Australia Pty Limited
2/9 Help Street
CHATSWOOD NSW

A full description of the test specimen and the complete test results are detailed in the Division's report FSH 0291

Product Name: Autoclaved Aerated Concrete Flooring System 150 mm Thick.

Description: The specimen comprised a precast reinforced autoclaved , aerated concrete panels of nominal overall dimensions of 3920 mm long x 600 mm wide x 150 mm thick. An end panel of nominal overall dimensions of 3920 mm long x 470 mm wide x 150 mm thick was included to suit the furnace chamber dimensions. The panels were butted against each other and Y12 ring anchor steel reinforcing was placed in the resultant recesses to encircle the individual panels. After placement of reinforcement in every recess, the recesses were filled with grout and finished flush with the top surface. The resultant floor was supported on three sides by 230 mm brickwork, the panels projecting 130 mm over the brickwork. The outside edges of these three sides were capped by cement grout 50 mm thick reinforced with Y12 ring anchoring steel all round the specimen. The fourth unrestrained side was placed with a 20 mm gap against a 230 mm wall. The gap between panel and wall was filled with ceramic fibre. A uniformly distributed load of 3 kPa was applied to the top surface of the specimen. The specimen was supported on three sides by 230 mm brickwork. The fourth edge of the specimen, in the direction of the span, was butted against a 230 mm brick wall and left unrestrained against a 20 mm thick ceramic fibre gasket.

Construction is detailed in the following:
- drawing numbered 0946, undated, by CSR Hebel Australia Pty Limited

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy	-	no failure at 71 minutes.
Integrity	-	no failure at 71 minutes.
Insulation	-	no failure at 71 minutes.

and therefore for the purpose of Building Regulations in Australia achieved a FRL of 60/60/60 for exposure to fire from the same direction as in the test.

Testing Officer: C Broadhead **Date of Test:** 18 March 1994
Issued on the 29th day of March 1994 without alterations or additions.

R J Dayeh
for Manager, Fire Technology

Division of Building, Construction and Engineering
PO Box 310 NORTH RYDE NSW 2113 Telephone (02) 888 8888 Fax (02) 888 9335

CSIRO AUSTRALIA

No. 331

Certificate of Test

This is to certify that the element of construction described below was tested by the CSIRO Division of Building, Construction and Engineering in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures Part 4-1990, Fire-resistance tests of elements of building construction on behalf of

CSR Hebel Australia Pty Ltd
Unit 4A 4 Central Avenue
THORNLEIGH, NSW

A full description of the test specimen and the complete test results are detailed in the Division's report FSH 0150

Product Name: The sponsor identified the specimen as a floor system constructed with reinforced autoclaved, aerated concrete precast panels.

Description: The specimen comprised precast reinforced autoclaved aerated concrete panels of nominal overall dimensions of 4000 mm long x 600 mm wide x 200 mm thick. The panels were butted up against each other and the spaces between were filled with grout from the top which was finished flush at the joint. A uniformly distributed load of 5 kPa was applied to the top surface of the specimen.
Construction is detailed in
. drawings numbered FR-1 and FR-2, dated July 1991, by CSR Hebel Australia Pty Ltd.

Orientation: The floor panels were tested to model fire on the underside.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated

Structural Adequacy	-	164 minutes
Integrity	-	162 minutes
Insulation	-	164 minutes

and therefore for the purpose of Building Regulations in Australia achieved a FRL of 120/120/120.

The rating applies to elements of the same construction as the specimen and exposed to fire from the same side as in the test

Testing Officer: L B Retson Date of Test: 14 November 1990

Issued on the 4th day of October 1991 without alterations or additions

R J Dayeh
for Manager, Fire Technology.

Division of Building, Construction and Engineering
PO Box 310 NORTH RYDE NSW 2113 Telephone (02) 888 8888 Fax (02) 888 9335

CSIRO AUSTRALIA

Certificate of Test

No. 964

This is to certify that the element of construction described below was tested by the CSIRO Division of Building, Construction and Engineering in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-1997, Fire-resistance tests of elements of building construction, on behalf of

CSR Hebel Limited
702 Woodville Road
VILLAWOOD NSW

A full description of the test specimen and the complete test results are detailed in the Division's sponsored investigation report numbered FSV 0706.

Product Name: Non-loadbearing Hebel block wall

Description: The specimen comprised a single leaf non-loadbearing Hebel block wall 3000 mm high x 3000 mm wide x 100 mm thick. The block wall was built using 400 mm long x 250 mm high x 100 mm wide Grade 1 Hebel blocks. The blocks had a density of 500 kg/m^3. The blocks were laid up in stretcher bonds with 10 mm fully filled beds and perpends, using a mortar mixture that comprised one part cement, no lime and four parts of sand plus dynex - water thickener (mortar classification m3 in accordance with AS3700). The specimen was unrestrained along one of the vertical sides. The vertical gap on the unrestrained side between specimen frame and wall was filled with compressed ceramic fibre. The vertical gap along the restrained side and along the top of the wall was sealed (on each side) with a fire rated sealant against a backing rod. Construction as detailed in drawings numbered JS-001, JS-002 and JS-003, all dated 25 September 1999, by CSR Hebel Limited.

The elements of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy	-	no failure at 240 minutes
Integrity	-	no failure at 240 minutes
Insulation	-	220 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of 240/240/180. The FRL is applicable for exposure to fire from either direction.

Testing Officer: Chris Wojcik Date of Test: 28 September 1999

Issued on the 5th day of October 1999 without alterations or additions.

Garry E Collins
Manager, Fire Testing and Assessments

Accreditation No. 3632

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of accreditation.

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Improving the Built Environment

Building, Construction and Engineering
14 Julius Avenue, Riverside Corporate Park, Delhi Road, North Ryde NSW 2113 AUSTRALIA
Telephone: 61 2 9490 5444 Facsimile: 61 2 9490 5555

Certificate of Test

No. 1111

This is to certify that the element of construction described below was tested by the CSIRO Division of Building, Construction and Engineering in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-1997, on behalf of

CSR Hebel Limited
702 Woodville Road
VILLAWOOD NSW

A full description of the test specimen and the complete test results are detailed in the Division's sponsored investigation report numbered FSV 0797.

Product Name: Loadbearing Hebel Block Wall.

Description: The specimen comprised a single leaf loadbearing Hebel block wall 2980 mm high x 3000 mm wide x 75 mm thick. The block wall was built using 600 mm long x 200 mm high x 75 mm wide Hebel Thermoblok blocks (HBT75). The blocks had a dry density of 500 kg/m^3. The blocks were laid up in thin beds and perpends, using a thin bed adhesive prepared in accordance with supplied instructions. The specimen was unrestrained along the vertical sides. The vertical gaps between specimen frame and wall were filled with compressed ceramic fibre. The wall specimen was 2980 mm high x 3000 mm wide x 75 mm thick to suit the load-bearing specimen containing frame. All dimensions are nominal. Uniformly distributed load of 41 kN was applied to the specimen for the duration of the test. Construction is detailed in: -

- Drawings numbered 75LB-01, 75LB-02 and 75LB-03, all dated 19 October 2000, by CSR Hebel Limited.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy	-	82 minutes
Integrity	-	82 minutes
Insulation	-	no failure at 82 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of 60/60/60. The FRL is applicable for exposure to fire from either direction.

Testing Officer: Chris Wojcik Date of Test: 20 October 2000

Issued on the 26th day of October 2000 without alterations or additions.

Garry E Collins
Manager, Fire Testing and Assessments

Accreditation No. 3632

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of accreditation.

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14 Julius Avenue, Riverside Corporate Park, Delhi Road, North Ryde NSW 2113 AUSTRALIA
Telephone: 61 2 9490 5444 Facsimile: 61 2 9490 5555

Certificate of Test

NKCE NE2226

REPORT NO. FNE6844

SIMULTANEOUS DETERMINATION OF IGNITABILITY, FLAME PROPAGATION, HEAT RELEASE AND SMOKE RELEASE

TRADE NAME: CSR HEBEL AAC

SPONSOR: CSR Limited (CSR Hebel)
702 Woodville Road
VILLAWOOD NSW

DESCRIPTION OF TEST SPECIMEN: The sponsor described the specimen as an autoclaved aerated concrete (AAC) product with CSR Hebel External Render applied to the exposed face.
Nominal total thickness (AAC): 75 mm
Nominal thickness of render: 3 mm
Nominal total mass: 37.5 kg/m²
Colour: grey

TEST PROCEDURE: Six samples were tested in accordance with Australian Standard 1530.3-1989, Simultaneous Determination of Ignitability, Flame Propagation, Heat Release and Smoke Release.
For the test each sample was clamped to the specimen holder in four places.

RESULTS: The following means and standard errors were obtained:

Parameter	Mean	Standard Error
Ignition Time (min)	N/A	N/A
Flame Spread Time (s)	N/A	N/A
Heat Release Integral (kJ/m²)	N/A	N/A
Smoke Release ($\log_{10}$D)	-2.522	0.279

For regulatory purposes these figures correspond to the following indices:

Ignitability Index (0-20)	Spread of Flame Index (0-10)	Heat Evolved Index (0-10)	Smoke Developed Index (0-10)
0	0	0	0-1

The results of this fire test may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all fire conditions.

DATE OF TEST: 15 April 1997

Issued on the 28th day of April 1997 without alterations or additions.

Z Trajko
Project Officer

G E Collins
Manager Fire Testing/Assessment

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of accreditation.

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Building, Construction and Engineering • Lot 12 Riverside Corporate Park, Delhi Road (PO Box 310) North Ryde, NSW 2113, Australia
Telephone: 61 2 9934 3444 Facsimile: 61 2 9934 3555 Web: http://www.dbce.csiro.au

Certificate of Test

No. 479

This is to certify that the construction described below was tested by the Division of Building, Construction and Engineering in accordance with Australian Standard 1530, Methods for Fire Tests on Building Materials, Components and Structures, Part 4-1990, Fire-resistance Tests of Elements of Building Construction, on behalf of

CSR Hebel Australia Pty Ltd
Level 2, 9 Help Street
Chatswood NSW

A full description of the test specimen and the complete test results are detailed in the Division of Building, Construction and Engineering report **FSP 0251**

Product Name: Joint between CSR Hebel 125 mm Thick Autoclaved Aerated Concrete Blockwork and Wall Panel.

Description: The specimen comprised a single leaf composite wall measuring 1150mm x 1150mm x125mm built of CSR Hebel AAC blockwork in stretcher bond, butting against a CSR Hebel AAC wall panel. The joint was filled with CSR Hebel adhesive with an average thickness of 2mm.
Two MET 38mm x 125mm brackets were used to tie the blockwork to the panel.

Construction is detailed in:
Drawing numbered PSK1, dated 31 May 1993,by CSR Hebel.

The Element of Construction satisfied the following criteria for fire-resistance for the period stated

Structural Adequacy	Not Applicable
Integrity	192 minutes
Insulation	241 minutes

and therefore for the purpose of Building Regulations in Australia achieved a fire-resistance level of **NA/180/240.**

This fire-resistance level applies to joints of the same specification exposed to fire from either direction.

Testing Officer **L B Restson** Date of Test **4 June 1993**
Issued on the **29th** day of **June 1993** without alterations or additions

R J Dayeh
Principal Experimental Scientist
for Manager, Fire Technology

Division of Building, Construction and Engineering
PO Box 310 NORTH RYDE NSW 2113 Telephone (02) 888 8888 Fax (02) 888 9335

CSIRO AUSTRALIA

G.1 PowerPanel™ Handling & Installation Guidelines

Introduction

This guide is to compliment all other CSR Hebel Technical Literature, safe work method statements and design documentation related to the installation of CSR Hebel PowerPanel™. In this document, CSR Hebel has endeavoured to outline all handling issues to be addressed during the PowerPanel™ installation. Although there is no replacement for common sense.

For further information on walls constructed using PowerPanel™ refer to the following publications; Hebel PowerWall 501 Design Guide, Hebel PowerWall 530 Design Guide, and Hebel PowerWall 101 Design Guide.

Panel Delivery

When CSR Hebel panels are delivered to site, it is recommended that the panels be taken from the truck to the appropriate work area. This will reduce the amount of double handling and product damage.

Layout

The panels should be positioned around the work area at the locations where the panels are to be installed. This will minimise the degree of double handling required by the installers, and reduce clutter in the work area.

It is recommended that at the start of the project, time is taken to discuss bundling with the CSR Hebel representative. This time spent preparing the bundling procedure will pay dividends in time saved due to searching for the correct panel.

Layout Drawings

When layout drawings are provided, then the panels shall be installed as detailed on the drawings. CSR Hebel or the Project Engineer shall be consulted for prior approval of any variations. Panels should not be cut unless indicated on the Layout Drawings.

Site Preparation

The work area should be kept clear of waste and un-necessary equipment, and panels arranged to allow easy, unobstructed access to the work area (eliminate possible tripping). Sufficient room should be provided to allow the PowerPanel Trolley™ or other approved mechanical lifting device to be operated freely.

All preparation and accessories, such as brackets, fixings, mortars, adhesives, packers, surface treatments (waterproof membranes etc.) should be accessible, installed or completed prior to lifting the PowerPanel™.

Lifting

IMPORTANT: Ensure every member of the installation team is aware of their role and that there is a nominated team leader.

Whenever possible, PowerPanel™ panels are to be lifted and transported to the workface using the PowerPanel Trolley™ or other approved lifting device. Refer to the PowerPanel Trolley™ handling procedures, over page.

When panel lifters are to be used to lift and move the PowerPanel™, CSR Hebel recommends lifting the panel with your legs, keeping your back straight, and stabilising the panel with your shoulder and/or free hand. It is not recommended that the panel be held clear of the lifter's body, causing undue stress to the persons lifting the panel.

During installation, persons not involved in the lifting and fixing process should remainclear of the work area, and make installers aware of your presence before approaching.

Bracing

At ALL times, the panel should be supported, by a person other than the person installing the fixings. NEVER release a panel until ALL fixings are installed and the panel is secure.

Fixings

Ensure CSR Hebel fixings are installed in accordance with CSR Hebel installation specifications and other proprietary fixings are installed in accordance with the manufacturer's specification.

Personal Protective Equipment, PPE

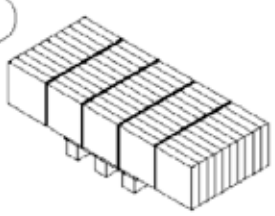
Ensure all recommended safety equipment, such as dust masks, goggles, hearing protection, gloves, clothing, and shoes are worn. Refer to CSR Hebel MSDS sheets for further guidance.

NOTE: This information can be downloaded from the CSR Hebel website www.hebelaustralia.com.au

POWERPANEL HANDLING GUIDELINES

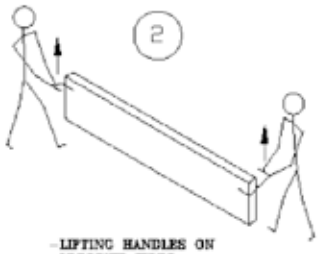
OPTION–1 (NO TROLLEY)

1



–CUT STRAPPING
–MOVE PANEL TO ALLOW ACCESS FOR LIFTING HANDELS
–ENSURE LOOSE PANELS REMAINING ON PALLET ARE BRACED
–ALL PANELS TO BE HANDLED BY MINIMUM OF 2 PEOPLE

2

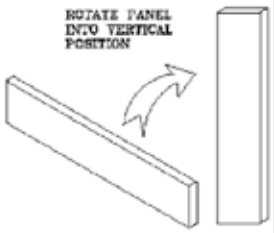


–LIFTING HANDLES ON OPPOSITE SIDES
–LIFT AND CARRY PANELS ON EDGE
–POSITION HANDLES 200mm MIN. FROM TOP

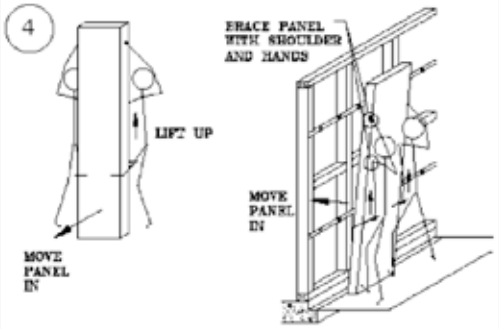
IMPORTANT

1) IT IS NOT RECOMMENDED THAT PANELS BE CARRIED FLAT, SUPPORTED AT EACH END. ALWAYS CARRY PANELS ON EDGE.
2) ALWAYS HANDLE PANELS WITH CARE.
3) DO NOT LIFT PANELS WHEN WET.

3

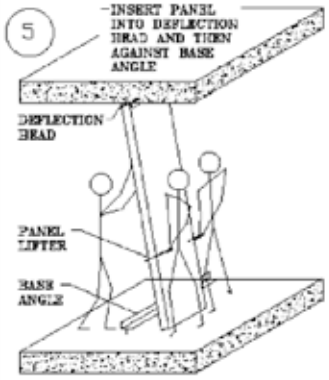


4



–BEND KNEES
–LIFTING HANDLES ARE TO BE POSITIONED SO ARMS ARE STRAIGHT WHEN PANEL IS LIFTED
–LIFT UP WITH LEGS

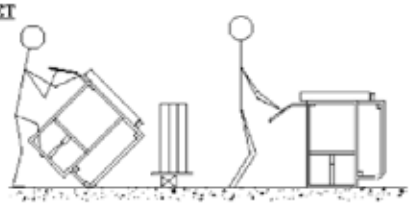
5



OPTION–2 (TROLLEY ASSISTED) – PREFERRED OPTION

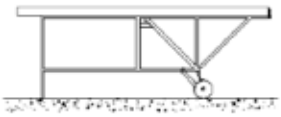
1 PICKING PANEL FROM PALLET

(A) POSITION TROLLEY ADJACENT TO PANEL, SLIDE UNDERNEATH PANEL.



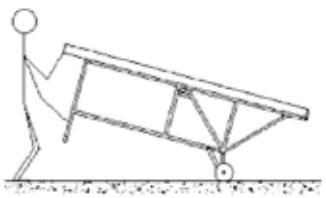
(B) ENGAGE HANDLE AND TILT, WHILE HOLDING PANEL AGAINST TROLLEY INITIALLY.

(C) REMOVE HANDLE AND PLACE SECURE IN HOLDER PROVIDED



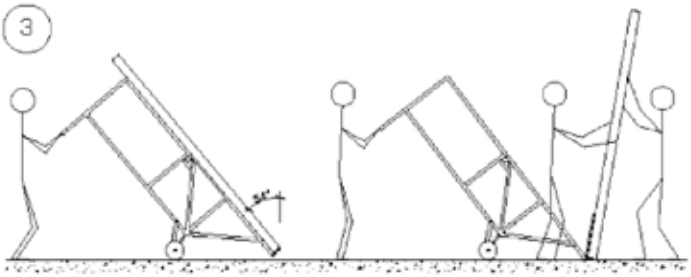
(C) PANEL IS READY FOR TRANSPORTING (SIDE VIEW)

2



(D) LIFT AND TRANSPORT PANEL TO WORKFACE AND THEN STABILISE FOR LIFTING

3



(E) WHEN READY TO INSTALL PANEL INTO VERTICAL POSITION TILT TROLLEY WHILE HOLDING FROM PANEL END

(F) TILT PANEL FORWARD, THIRD PERSON TO HOLD THEN PULL TROLLEY AWAY

G.2 Wall Panel Handling & Installation Guidelines

Introduction

This guide is to compliment all other CSR Hebel Technical Literature, safe work method statements and design documentation related to the installation of CSR Hebel wall panels. In this document, CSR Hebel has endeavoured to outline all handling issues to be addressed during the wall panel installation. Although there is no replacement for common sense.

Panel Delivery

When CSR Hebel wall panels are delivered to site, it is recommended that the panels be taken from the truck to the appropriate work area. This will reduce the amount of double handling and product damage.

Layout

The panels should be positioned around the work area at the locations where the panels are to be installed. This will minimise the degree of double handling required by the installers, and reduce clutter in the work area.

It is recommended that at the start of the project, time is taken to discuss bundling with the CSR Hebel representative. This time spent preparing the bundling procedure will pay dividends in time saved due to searching for the correct panel.

Layout Drawings

When layout drawings are provided, then the panels shall be installed as detailed on the drawings. CSR Hebel or the Project Engineer shall be consulted for prior approval of any variations. Panels should not be cut unless indicated on the Layout Drawings.

Site & Panel Preparation

The work area should be kept clear of waste and un-necessary equipment, and panels arranged to allow easy, unobstructed access to the work area (eliminate possible tripping and slipping). Sufficient room should be provided to allow the PowerPanel Trolley™ or other approved mechanical lifting device to be operated freely.

All preparation, such as installing brackets on panels and surface treatments (waterproof membranes etc.), and accessories, such as fixings, mortars, adhesives and packers should be accessible, installed or completed prior to lifting the panel. We suggest installing a temporary metal angle to the soffit to act as a guide and restraint for the top of the panel.

Lifting

IMPORTANT: Ensure every member of the installation team is aware of their role and that there is a nominated team leader.

Panels are to be lifted and transported to the workface using the PowerPanel Trolley™ or other approved lifting device. Refer to the PowerPanel Trolley™ Handling Procedures, over page.

We recommend using pinch bars or equivalent to move the panel into the final position. When panels are to be manually lifted, CSR Hebel recommends adopting good lifting practices, such as lifting with your legs, keeping your back straight, and ensure the panel is stabilised at all times. Manual lifting shall be kept to a minimum. It is not recommended that the panel be held clear of the lifter's body, causing undue stress to the persons lifting the panel.

During installation, persons not involved in the lifting and fixing process should remain clear of the work area, and make installers aware of your presence before approaching.

Bracing

At ALL times, the panel should be supported, by a person other than the person installing the fixings. NEVER release a panel until ALL fixings are installed and the panel is secure.

Fixings

Ensure CSR Hebel fixings are installed in accordance with CSR Hebel installation specifications and other proprietary fixings are installed in accordance with the manufacturer's specification.

Personal Protective Equipment, PPE

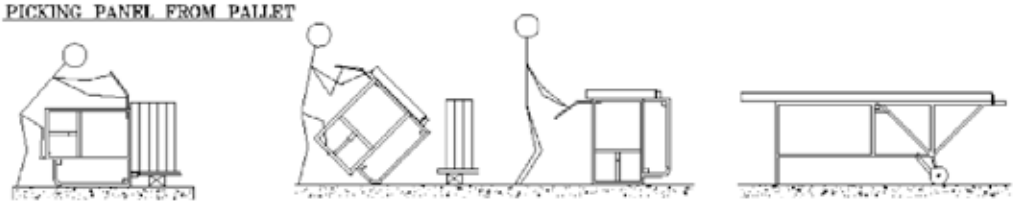
Ensure all recommended safety equipment, such as dust masks, goggles, hearing protection, gloves, clothing, and shoes are worn. Refer to CSR Hebel MSDS sheets for further guidance.

NOTE: This information can be downloaded from the CSR Hebel website – www.hebelaustralia.com.au

HEBEL PANEL HANDLING GUIDELINES

1 PREPARING WALL PANEL TROLLEY

2 PICKING PANEL FROM PALLET



(A) POSITION TROLLEY ADJACENT TO PANEL, SLIDE UNDERNEATH PANEL.

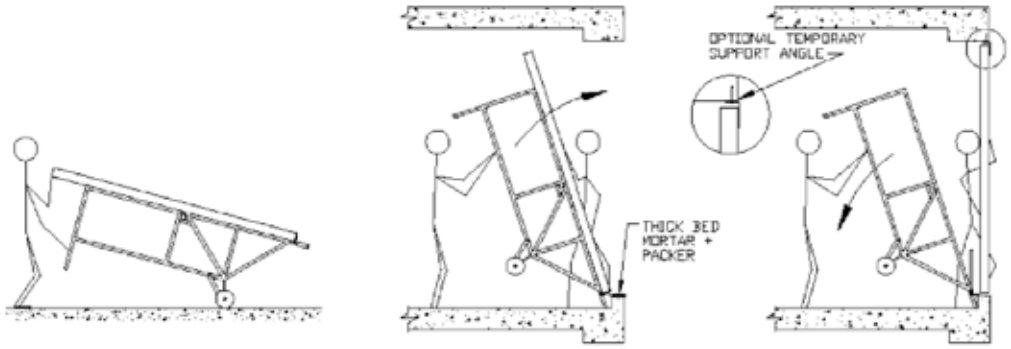
(B) ENGAGE HANDLE AND TILT, WHILE HOLDING PANEL AGAINST TROLLEY INITIALLY.

(C) REMOVE HANDLE AND PLACE SECURE IN HOLDER PROVIDED

(D) PANEL IS READY FOR TRANSPORTING (SIDE VIEW)

3 TRANSPORTING AND HANDLING PANEL AT WORKFACE

NOTE: SCAFFOLDING NOT SHOWN FOR CLARITY



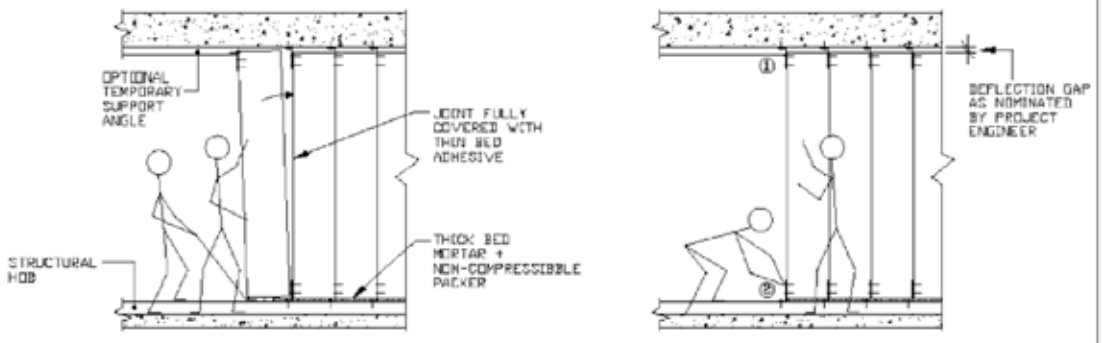
(E) LIFT AND TRANSPORT PANEL TO WORKFACE AND THEN STABILISE FOR LIFTING

(F) INSTALL PANEL INTO VERTICAL POSITION. SECOND PERSON TO STABILISE PANEL

(G) TILT PANEL FORWARD, SECOND PERSON TO STABILISE PANEL. REMOVE TROLLEY AWAY

4 POSITIONING AND INSTALLING PANEL AT WORKFACE

NOTE: SCAFFOLDING NOT SHOWN FOR CLARITY



(H) LEVER BASE OF PANEL AGAINST INSTALLED PANEL. SECOND PERSON TO STABILISE PANEL.

(I) 1. FIX TOP BRACKET AT SOFFIT.
2. INSTALL BASE BRACKET.
SECOND PERSON TO STABILISE PANEL.

H.1 O H & S Issues

Occupational Health & Safety (OH&S)

CSR Hebel as a building material manufacturer has a 'Duty of Care', where reasonably practicable, to provide information on and promote safe work practices and work environment for the purchaser/installer of our CSR Hebel products.

CSR Hebel recommends all persons involved with the installation of CSR Hebel AAC products obtain and read the relevant CSR Hebel Material Safety Data Sheet/s.

Health and Safety Information

Information on any known health risks of our products and how to handle them safely is shown on their package, in this publication and/or the documentation accompanying them. Additional information is listed in the relevant Material Safety Data Sheet (i.e., MSDS).

The CSR Hebel MSDS address the following areas:

- Autoclaved Aerated Concrete;
- Hebel Adhesive;
- Hebel HighBuild;
- Hebel Mortar ;
- Hebel Patch;
- Hebel SkimCoat

To obtain a copy, telephone 1800 807 668, or download the applicable MSDS from
www.hebelaustralia.com.au
> Tech support > MSDS

Cutting, Chasing & Trimming

Approved respirators (AS/NZS1715 and AS/NZS1716) and eye protection (AS1336) should be worn at all times when trimming and chasing. Refer to the relevant CSR Hebel Material Safety Data Sheet.

Handling of CSR Hebel Products

For handling CSR Hebel panel products in the workplace, CSR Hebel has prepared guidelines, which address issues such as:

- Panel delivery;
- Maintaining a safe workplace;
- Panel lifting and installation; and
- Illustrated process of panel installation.