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1.0 RANGE

1.1 Architectural Masonry - 10 Series

**AM10.01**
Standard Whole
(also supplied as two core in some areas)

**AM H10.01**
Standard Whole Half High
(also supplied as two core in some areas)

ARCHITECTURAL MASONRY - STOCKED 20 SERIES FAIR FACE

**AM2014U**
Universal Bond Beam

**AM20.30 ST**
Standard Column

**AM20.12**
Lintel and Half End - Closer

**AMH20.04**
Plain End Half High

**AM20.09**
Rebate Whole

**AM20.11**
Rebate Lintel

**AM20.08**
Sill (projecting)
(available North Island Only)

**AM05.17**
Capping

1.2 Finish

Available as Made To Order only for the remainder of the country. Check with your local Firth branch for availability, and minimum quantities. Firth’s Architectural Masonry Colours - may differ from different manufacturing sites due to locally sourced materials. Ensure product is ordered and supplied from one plant to avoid variations in aggregate and colour.

**COLOUR:** ONYX

Unsealed
Sealed

**FINISHES**

**Fair Face**
A standard “out of the mould” finish, providing a classic look.

**Honed**
By grinding the outer few millimetres of the block’s surface, the richness of the recipe is exposed creating an appealing, smooth, exposed aggregate finish that highlights the natural ingredients of the mix.

Note: Firth recommends sealing all masonry walls as soon as practical rather than after the project is completed.

North Island blocks need to be honed insitu. Our South Island facility allows us to provide pre-honed blocks to your site.
2.0 DESIGN CONSIDERATIONS

2.1. NZ Standards

NZS 4230 - Structural - specific design
NZS 4229 - Structural - non specific design
NZS 4210 - Materials and Workmanship
NZS 4218 - Thermal Compliance
NZS 3604 - Timber Framed Buildings
CCANZ CP 01 - Weathertightness

“The following standards NZS 4230, NZS 4229, NZS 4210, NZS 4218 and NZS 3604 referenced has been given permission by Standards New Zealand to do so under licence 001003. Please refer to the Standard for full details, available for purchase from www.standards.co.nz”

2.2. Laying Options

Running bond / Stretcher bond - Standard method of construction
Stack bond - Popular for effect but requires specific design (NZS 4230)

Stack bond is outside the scope of NZS 4229 and NZS 3604 and therefore requires specific engineering design. Engineers designing for stack bond blockwork need to allow for additional reinforcing such as in-joint reinforcing, to prevent or minimise vertical cracking in the mortar joints. Prop and brace end of walls whilst pouring, and grout using lower lifts. Care is needed in construction of the mortar to ensure no pin holes are in the mortar joint that may affect the sealer warranty. Extract from 2011 NZMA Masonry Manual

5.0 Veneer Walls

5.1 Veneer Walls
Cavity wall construction has been recognised as an excellent means of offering the greatest weather resistance.

5.2 Concrete Bricks and Wall Ties
Information on the bond strength characteristics of concrete bricks was required by the Standards New Zealand Committee revising NZS 4210. In addition, the matter of pull values for ties particularly with regard to the reduced embedment lengths for 70 mm veneer needed to be investigated.

5.3 Specification for Concrete Masonry Bricks
The specification for the manufacture of concrete bricks follows the provisions of AS/NZS 4455 Part 1 Masonry Units and NZS 4210 with testing carried out in accordance with AS/NZS 4456.

5.4 Miscellaneous Details

5.5 Veneer - Stack Bond
This section has been prepared to provide designers, territorial authorities and builders with some standard design details for block masonry veneer using stack bond laying format.

In-joint Reinforcing
In-joint reinforcing is highly recommended. Half bond / running bond blockwork ties alternate courses together. So the more frequently placed in-joint reinforcing is used the stronger the blocks are tied together, particularly ends of walls and jambs etc. Blockwork is the decorative boxing of a reinforced concrete structure. It is extremely important to achieve solid fill. Ensure blocks are laid open end to closed end at all times. Grout infill is to be vibrated or rodded, preferably vibrated as required by code.

2.3 Mortar

On site mix ratio is three buckets of sand to one bucket of cement. Remember you may be called upon to verify your site mix strength so cylinders should be taken at regular intervals.

The minimum requirement for Firth brick veneers is 12.5Mpa. The volume of water, additives, and mixing time, all need to be consistent to achieve a quality mortar of an even colour. If the temperature exceeds 27 degrees Celsius, ensure the bricks are kept damp for the first 24 hours to prevent rapid loss of moisture. Discard any mortar which is over 1.5 hours old, in summer; and for temperatures below 5 degrees Celsius discard after 2 hrs old. Avoid re-tempering mortar with water. NZS4210 sect 2.2.2.2 (e).

The correct time to tool a mortar joint is when a clear thumb print can be made on the surface. If joints are not tooled at the same moisture content they will vary in colour. Dricon bagged mortar is recommended for quality control to ensure compliance with the code. Refer to Firth’s “+Concepts Designer brick + Architectural Masonry” brochure for available colours. Firth’s Masonry Veneers Planner is an online tool to help you choose your size of brick and match it with your choice of coloured mortar.

<table>
<thead>
<tr>
<th>Bricks</th>
<th>Notes</th>
<th>Size (W x H X D)</th>
<th># Bricks Per m2</th>
<th>Bricks per 30kg Bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>MASONRY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H10.01 block veneer</td>
<td>Cored</td>
<td>390 x 90 x 90</td>
<td>25</td>
<td>24 – 30</td>
</tr>
<tr>
<td>10.01 block veneer</td>
<td>Cored</td>
<td>390 x 190 x 90</td>
<td>12.5</td>
<td>18 – 24</td>
</tr>
<tr>
<td>FIRTH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Devonstone®</td>
<td>70 series/Cored</td>
<td>290 x 160 x 70</td>
<td>19.6</td>
<td>40 – 46</td>
</tr>
<tr>
<td>Manorstone®</td>
<td>90 series/Cored</td>
<td>390 x 190 x 90</td>
<td>12.5</td>
<td>18 – 24</td>
</tr>
<tr>
<td>Firth® Brick &amp; Pioneer</td>
<td>Solids</td>
<td>230 x 90 x 75</td>
<td>42.0</td>
<td>33 – 38</td>
</tr>
</tbody>
</table>

2.4 Mortar Joints

Grooved joint
Also known as Concaved or rolled. This type of joint is formed by using a curved steel jointing tool. Its recessed profile and tight seal mean that it is very effective at resisting moisture penetration. This type of joint can be good for hiding small irregularities. Should be tooled to a maximum depth of 6mm after initial stiffening has occurred.

Raked joint
For this type of joint the mortar is raked out and once pointed and tooled shall not exceed a maximum depth of 6mm. It is important to compact the mortar to improve its weather tight performance, this design creates a form of ledge where water can pool and therefore should only be used for internal walls. Not recommended for exterior walls.

Flush joint
Firth does not recommend the use of flush joints unless they are compacted. If the mortar is flush jointed and not compacted it can lead to the following issues:

- When brick veneer is to be honed, the mortar can ‘flick’ out with honing process.
- When brick veneer is to be plastered it can lead to hairline cracking in the plaster where the outline of the brick can be seen.

Dricon® Architectural Mortar

Architectural Mortar is an ideal spreadable and workable mortar for use with the Firth’s Architectural Masonry Bricks.

- Available in 3 colours
- Strength of 12.5MPa after 28 days
- Minimises on site waste
- Consistent colour & strength throughout the job

- Endorsed by BBFNZ
- Meets NZS 4210 Masonry Construction: Materials and Workmanship
2.5 Joint Types

Figure 1 shows some of the tooling details commonly practiced. Some are not recommended for external application because of their poorer weatherproofing properties, but this will be of lesser significance where cavity protects the inner wall.

Because of the positive barrier to ingress of moisture, any of the joint details illustrated in Figure 1 may be applied to external cavity or brick veneer walls without risk to inside finishes.

Of the details shown, types A, B and C are suitable for internal or external use. Raked and extruded joints should not be used externally except in cavity or brick veneer construction. Raked joints will also accentuate the normal horizontal rough edge on brick veneer blocks and increase the potential for efflorescence to present.

The flush joint is recommended only for walls which receive a later applied finish or coating.

The joints A, B and C, should only be tooled to a maximum depth of 6mm after initial stiffening has occurred. The delaying of the tooling operation is vital if a tight weatherproof joint is to be produced in horizontal and, particularly, vertical joints.

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**Figure 2** illustrates in an exaggerated way what is happening in the joint and how tooling gives an improved weather tightness. The whole matter of the tooling of external joints is of paramount importance and strict attention to delaying the operation after initial set of the mortar must be given.
Extract from CCANZ CP01, Page 19

COMMENT:
The mortar quality and workmanship are important to the weathertight performance of concrete masonry. Mortar depth of horizontal and vertical joints shall be the full thickness of the face shell.

COMMENT:
Face shell describes the thickness of the shell of the masonry block.

Mortar depth of horizontal and vertical joints shall be the full thickness of the face shell.

COMMENT:
Face shell describes the thickness of the shell of the masonry block.

Mortar shall meet the requirements of NZS 4210 and shall achieve a compressive strength of 12.5 MPa. Mortar joints shall be compressed by tooling in accordance with NZS 4210 and Detail 70. The mortar joint shall be tooled after the initial water loss, once the mortar is thumbnail hard. The depth of the vertical mortar joint shall match that of the horizontal joints.

COMMENT:
Flush joints may be used where plaster or EIFS (Exterior Insulation and Finish System) is to be applied to the concrete masonry, but they should still be tooled first.

NZS 4210: 2001 STATES
Hollow Units
Hollow units shall have full mortar beds under face shells and shall have vertical joints filled to the same depth. In reinforced hollow masonry the cross-webs that adjoin cells containing reinforcing shall be fully bedded on mortar, provided that this requirement need not apply when all cells in a particular wall are to be grouted.

The following standards NZS 4230, NZS 4229, NZS 4210, NZS 4218 and NZS 3604 referenced has been given permission by Standards New Zealand to do so under licence 001003. Please refer to the Standard for full details, available for purchase from www.standards.co.nz.

Half Round / Concaved Joint
In the case of honed block, the mortar joint must be tooled deeper. The Marshalltown No. 83, 3/8" & " jointer would be recommended for this process. Sledge runner jointers give a higher class of finish to the joint. This is due to their length. They produce a flatter, straighter joint, in both half round and recessed.
2.6 Control Joints

Must be installed as per requirements of NZS 4229 and NZS 4210

![Diagram of control joint](image)

Figure 2 – Control joint (top bondbeam to be continuous)

3.0 Compliance Considerations

Requires compliance with NZS 4218

- For an external finish the interior requires strapping and lining or construction as a veneer
- For an internal finish the exterior face requires suitable (polystyrene + plaster) insulation.

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3.1 Weathertightness

Code of Practice For Weathertight Concrete and Concrete Masonry Construction CCANZ CP 01 (Document available on the CCANZ website as a free download www.cca.org.nz)

**EXTRACT FROM CP 01, SECTION 4.4 PAGE 36**

**4.4 Clear Coating System**

This section specifies clear coating systems applied directly to either:

a) A Concrete Masonry Wall type A1 or A3, or
b) An In Situ Concrete Wall type B1 or B3, or
c) A Precast Concrete Wall type C1 or C3.

Clear coating systems complying with section 4.4.2 are weathertight. The coating system shall be supplied by a single supplier who takes responsibility for the system as a whole, encompassing the weathertight coating. The system shall be applied by the coating manufacturer’s approved applicator. Clear coating systems are to be recoated every five years at a minimum or in accordance with the manufacturer's specifications. The clear coating system shall be designed to prevent water ingress into the pores of the concrete or masonry. The system shall allow the passage of water vapour from the interior to the exterior.

**COMMENT:**

Clear coatings have been included in this Code of Practice recognising the move to ‘minimalist architecture’ using unpainted concrete and masonry. Clear coatings do not always have the flexible film forming ability that acrylic coatings have. Therefore they require a strict maintenance regime and need recoating at shorter intervals. Request information that the proposed sealer complies with the performance requirements of CP 01.

**4.4.1 Permeability Test**

Clear coating system shall be tested for permeability in accordance with AS/NZS 4456.16. The test shall be conducted on a standard masonry block with a density of between 1350 –1500 kg/m3 over a test period of two hours.
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4.4.2 Acceptable Clear Coating Systems
Clear sealers for in situ and precast concrete walls shall have a permeability of 3 mm/hr or less when tested in accordance with section 4.4.1. Clear sealers for concrete masonry walls shall have:

a) A permeability of 1 mm/hr or less when tested in accordance with section 4.4.1, or

b) A permeability of 3 mm/hr or less when tested in accordance with section 4.4.1 if the wall is constructed of low permeability blocks. Low permeability blocks shall have a permeability of less than 10 mm/hr when tested in accordance with section 4.4.1. CCANZ CP 01

4.4.3 Ingress of Water
Additional protection can be achieved by:
1. Ensuring vertical mortar joints are the full length of the face shell as required by CP 01
2. Laying 2016 with open end to closed end.

4.0 Installation

4.1 Customer Expectations - Appearance and Quality

It is always recommended that a sample panel of the blocks be constructed prior to the start of the project for client inspection. Different block profiles will vary in texture and colour as they will never be made from the same batch. Be selective when laying the blocks - put damaged or chipped blocks to one side.

Chips of varying sizes may be evident on the edges and / or corners of the block units. Complete product breakages may also be experienced during cartage especially on long distance haulage or during other movements of the product such as HIAB or forklift loading and unloading. These are unfortunately an unavoidable part of distributing any masonry product. Product types are palletised uniformly. Ensure pallets can be placed on a flat surface to minimise potential chipping.

**DO NOT** use 20.30’s in the middle of the wall, use 20.14U’s, unless you cut the ends out of the 20.30’s. Fig 1, below depicts two 20.30 blocks used in the middle of the wall. The cavity between the adjacent ends can potentially retain water, which can result in leaking issues long after the wall has been completed.

Minor cracks and chips (Ref 4.2) can occur but are not recognised as block defects. These result from the manufacturing process and delivery and may only become apparent after the honing process. Honing contractors should allow for this when pricing and take care when selecting units on site.

The top and bottom edges of the block may have minor chips and the use of a “raked” joint will emphasise this. Concave or flush joints will tend to hide these minor chips.

**Note:** Raked joints are not recommended for external walls as the joint may retain water.
Any product which will not achieve the performance requirements outlined in 4.2, should not be incorporated into the project.

The cost of replacing any product on site, which has been rejected by the customer or their agent due to chips or breakage will be the customer’s responsibility (i.e. some product attrition should be expected no matter how the product is palletised or delivered). Due to this a wastage percentage needs to be applied to every costing and order – please bear in mind the further the product is transported the more breakages could be incurred and typically an extra 10% should be ordered to compensate for this.

4.2. In Situ Finish and Appearance Valuation

Minor variations to surface appearance are a typical feature of masonry. Evaluation of a completed masonry wall shall be in accordance with ASTM C90 as follows: For exposed wall construction chips and imperfections shall not be evident when viewed from a distance of not less than 6.1m under diffused light. Materials and installation shall be in accordance with NZS 4210.

4.3. Selecting The Right Installer

Installers should provide proof of projects that can be inspected as evidence they are capable of installing Architectural blockwork. Check the blocklayer is a registered (LBP) Licensed Building Practitioner (LBP). Ask if the blocklayer is familiar with the relevant details in NZS 4210.

4.2. Tolerances & Aesthetic Appearance

It is possible for a masonry wall to be building code compliant but not have the visual look that reflects the skills of an experienced bricklayer. This is referred to as ‘workmanship quality’.

It is important to discuss with your bricklayer the aesthetic look you are hoping to achieve with your masonry and if possible, include them in your selection process.

The Brick and Blocklayers Federation recommends that parties to a masonry construction enter into a clear, written contract that sets out the expectations of parties including agreed workmanship quality standards, quality checking responsibilities and an agreement on how disputes will be managed – even if it is not a compulsory requirement under legislation.

CHIPPING

C.M.U. may be transported several times before arriving onsite and occasionally chipping can occur. Chips are more noticeable on bricks that have a surface colour different from the body of the brick. A workmanship quality standard is achieved if imperfections, including chips, are not visible when viewed from a distance of not less than 6.1m under diffused light as per ASTM C90.

New Zealand does not have a standard to assist a Brick/Blocklayer to evaluate the level of chipping acceptable in a C.M.U. prior to laying however ASTM C216-15 has been adopted by BBFNZ.

ASTM C216-15 for a general purpose face brick (FBS textured) basically has the following requirements:

• Chips from the edge should not be deeper than 8mm
• Corner chips should not be deeper than 13mm
• When all the length of the chips are added up that the total does not exceed 10% of the perimeter of the brick face (as an example, the accumulative lengths of the chips for a 230mm x 75mm brick shall not exceed 61mm).

Although C.M.U. have two faces, it is good practice for Bricklayers to set aside C.M.U. that do not meet this standard and to assess whether to discard it or use it for cuts.

Reference: Brick and Blocklayers Federation New Zealand, “Brick Veneer Best Practice Guide” www.bbfnz.co.nz
5.0 On Site Honing and Factory Hone

Firth Industries have honing facilities at Christchurch only. All honing done at a Firth plant is a secondary process – so is subject to lead-times. An alternative for honed product outside of these regions is on-site honing for Architectural Masonry and Grey Masonry from the standard range of 10,15,20 and 25 series hollow blocks. The block surfaces are then ground back, giving a finish that reveals the aggregate, similar to a Terrazzo effect. Hairline cracks may be exposed after honing. Hairline cracks at the top of corner blocks will always be evident as this occurs as part of the manufacturing process – this is strictly an aesthetic issue which needs to be discussed with the client. “Touch ups” to rectify these should be part of the honing contractors price.

TIPS OF THE TRADE:

• Only contractors who specialize in this process should be used
• Mortar joints have to be deep enough to give required finish once honed.
• Can’t be done in the rain.
• Walls can be wavy if block honer is inexperienced.
• Core bar cracks and aesthetic blemishes may only be exposed after honing and require attention.

NOTE: As masonry is manufactured using natural products, some variation in the shade and aggregate density should be expected.

5.1 Minor Aesthetic Defects

May be apparent in face shell after honing (core bar cracks). Image below depicts core bar cracks that need filling prior to sealing for weather tightness.

Dimensions of honed blocks will differ from form-faced blocks due to the honing process of removing 2mm – 3mm off the block face.

5.2 Cleaning and Sealing

Good communication is very important between your builder, the block layer and whoever is going to be cleaning and sealing the blockwork. It should be the responsibility of the block layer to lay the walls to ensure compliance with NZS: 4210, keeping them clean right through the construction and the pouring. The use of a registered (LBP) Licensed Building Practitioner.

NOTE: structural masonry, is recommended.

Allowance should be made for moisture to dissipate after pouring prior to cleaning and sealing. Walls that remain open at the top and allow the ingress of rain into the core of the wall will promote efflorescence and increase the amount of leaching and hence cleaning. Once the cleaning has been done the sealing should follow; as soon as the blocks have dried sufficiently. Efflorescence may re-occur if the sealing is left too long and the blocks are allowed to get wet, the blocks will have to be cleaned again. If the efflorescence is given enough time to calcify it cannot be removed by acid washing.

NOTE: Black blocks have been known to go brown with aggressive and multiple acid washing.

Always do a trial section of wall to evaluate whether the wall is clean enough for sealing. Once the sealer is on it’s difficult to remove by grinding it off and will not always guarantee a result.

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6.0 Final Appearance

6.1 On Site Care

Walls should be protected or covered from inclement weather during the construction process to avoid the walls being saturated as this will promote efflorescence. If efflorescence is left on the wall for a period of time and is allowed to calcify it is extremely difficult to remove. Therefore if efflorescence appears it should be scrubbed off with a plastic brush and some detergent whilst it is still in its powdered form.

Example of a wall left exposed to inclement weather where the excessive moisture has promoted efflorescence

Timing: Seal as soon as possible subject to sealer recommendation (Avoid leaving sealing of wall until project is complete).

6.2 Efflorescence

Efflorescence is generally a whitening look (although it can sometimes be brownish) on the surface of a masonry unit. It is a common natural phenomenon experienced to a variety of degrees by all forms of concrete, and is to be anticipated on any job. It can vary in appearance from a thin hazy layer (which is at times confused as surface fading) to a thick white crust.

As the cement in concrete progresses through the hydration processes (i.e. sets) free calcium hydroxide (Ca(OH)2) is formed. Ca(OH)2 is partially soluble in water. Consequently the Ca(OH)2 can migrate through capillaries in the concrete out to the surface as the water is drawn out. Having reached the surface of the concrete, the Ca(OH)2 reacts with carbon dioxide in the air to form water in-soluble calcium carbonate which is essentially limestone.

Efflorescence has two forms, primary and secondary. Migration can take place either in the setting processes whilst water within the concrete is still hydrating (primary), or through hardened concrete when exposed to the effects of rain or dew (secondary).

Because the calcium carbonate (which has migrated to the surface) is water in-soluble, it (efflorescence) can only be forcibly removed by washing with diluted acid (e.g. 10 – 12:1 water to hydrochloric acid dilution) or other commercially available aqueous solutions /organic acids. Acid washing must be done in accordance to manufacturers instructions. Firth recommends this be done by a professional.

7.0 Availability

7.1 Coloured Architectural Masonry is a made to order process and has lead times attached to produce the products. Small runs of individual units will be expensive, refer to “Architectural Masonry Guidelines For Block Orders” booklet to reduce or eliminate this happening.

8.0 Wastage

It is recommended that the number of units ordered, to be ordered or required have a percentage added (normally 10%)to account for damage in transit, on site wastage, job site alterations and estimating anomalies. This is intended to ensure that there is sufficient product available to service the entire job, which is especially critical for Made to Order products due to the minimum run requirements (refer 2.2) and colour matching (refer 2.5).

NOTE: Firth does not accept returns on made to order products.
Environmentally compliant manufacturing plants
Surplus water and some aggregates recycled
Low transport impacts
Leftover concrete returned from construction sites
Passive solar heated thermal mass makes completed buildings more energy-efficient

Most wash water returned from construction sites
Highly durable, low maintenance buildings and no rot
High degree of noise control
Inherent fire resistance
Overall longer effective building life
Demolished concrete can be recycled as hard fill or aggregate