

Grout, or “block-fill” as it is sometimes referred to, is specified to CSA A179-04.

TYPES OF GROUT

Coarse Grout, the most commonly used type of grout, has a maximum aggregate size of 12 mm (1/2”). The slump should be between 200 and 250mm (8”-10”). This is much higher than typical ready mix concrete, but is very necessary to properly fill the cores of masonry units and flow around reinforcement or other elements within the wall.

Fine Grout uses coarse sand for aggregate. It may be used where grout is required to flow through small openings such as small core units reinforced brick. A grout slump of over 250mm may be necessary for some conditions.

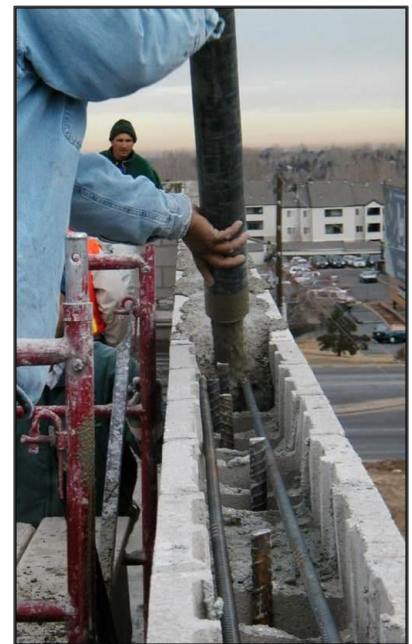
Grout is usually supplied in ready-mix trucks, with quality control data available from the supplier. Field test cylinders may also be taken.

GROUT STRENGTH

Grout strength specification is a topic requiring clarification. Because grout must flow for substantial distances through small core openings, it must be placed at a very high slump of 200 to 250 mm. After placing, the water required to increase the slump is then absorbed into the units to provide a concrete mix with a normal water content - and higher final strength. Grout tested using standard non-absorptive plastic or metal cylinders still contains the extra water, and develops correspondingly lower strength results.

The “Pinwheel” test simulates the absorption conditions the grout would experience in the wall, but is awkward to use on site and is seldom used.

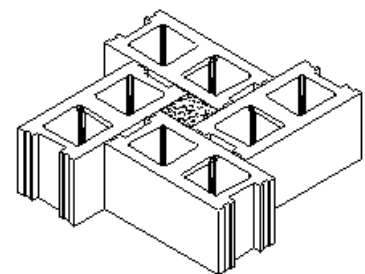
CSA A179 recognizes this difference in sample preparation by calling for only 12.5 MPa grout strength when cylinders are used. The actual



The Typical test results for the same grout mix:

Pinwheel test: 18 to 25 MPa

Cylinder test: 12.5 MPa



“Pinwheel” used to test grout

strength in the wall will be much higher, typically over 20 MPa which exceeds the 15 MPa strength of standard concrete blocks. This grout strength is compatible with the design strengths contained in CSA S304.1 for all block strengths.

However, Structural Notes and specs have typically called for 20 or 25 MPa grout tested by cylinders. In reality, a 20 MPa grout may be preferred for pumping reasons anyway. If Structural Notes do not recognize the 12.5 MPa strength minimum, then a project cylinder test result below 20 or 25 MPa specified strength should not be treated as a cause for concern. A 25 MPa high slump grout designed for cylinder testing may actually be 40 MPa in the wall. This is a waste of money (extra cement) and may be a less satisfactory product (compatibility and shrinkage). (Also see Section 3.3 – Guide Structural Notes)

Sample spec: Grout to CSA A179-04
Minimum compressive strength 12.5 MPa
at 28 days by cylinder test under the property
specification
Maximum aggregate size 12 mm diameter
Grout slump 200 to 250 mm

CLEANOUT / INSPECTION HOLES

Unit cores that are to be grouted should be free of excessive mortar protrusions and mortar droppings at the base. Clean-out/inspection holes at the base of the reinforced cores will facilitate the removal of excessive mortar droppings, and confirm that grout has reached the bottom of the core. Clause 8.2.3.2.2 of CSA A371-04 Masonry Construction allows the requirement for clean-out/inspection holes to be waived by the designer when the contractor has demonstrated acceptable performance or where the walls are not structurally critical. In some cases the designer will require the initial walls to have clean-outs pending demonstrated performance, and then waive cleanouts for the remaining walls.

GROUTING

While grouting, care must be taken to completely fill the reinforced cores and to ensure that all bars, bolts and anchors are fully embedded. Grout is typically pumped in 2.4m (8') pours from bond beam to bond beam. The maximum pour height in CSA A371-04 is 4.5 m, but this would only be practical for H-block or 250 or 300 mm units. For a grout pour of 3 m or more, the grout must be placed in lifts of 2 m or less.

(For more detail, see Section 3.3 - Guide Structural Notes)

Grout Lift: that portion of a total grout pour placed in one pass of the grout filling process.

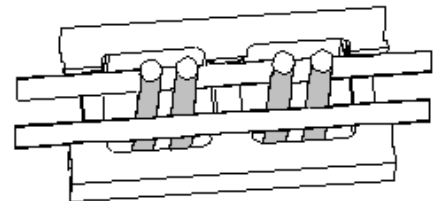
Grout Pour: the total height of grout placed in a wall during a grouting operation. A grout pour consists of one or more grout lifts.

REINFORCEMENT

See Section 1.2.1 for minimum reinforcement requirements.

The core size of the masonry units will dictate the size and number of bars that can be effectively grouted. Typically, reinforced masonry makes use of 15M or 20M bars. Units 125, 150 and 200mm wide should not contain more than one vertical bar per core. Units 125 and 150mm wide should be restricted to one horizontal bar per course in bond beams. (See also Section 3.3 - Guide Structural Notes)

NOTE: At splices, the number of bars per core is doubled – increasing congestion.



2 bars vertically and 2 bars horizontally in a 200mm wall are almost impossible to grout, particularly at splices where steel is doubled.

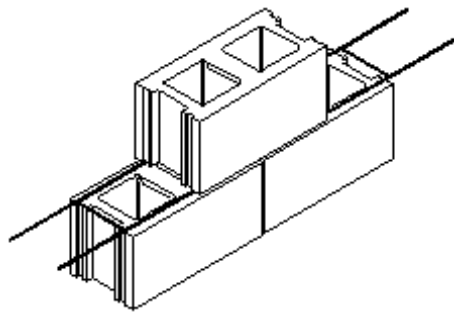
Maximum number of bars	100 mm	125 mm	150 mm	200 mm	250 mm	300 mm
Vertical bars per core	N/A	1	1	1	2	2
Horizontal bars per course (lintel, bond beam)	N/A	1	1	2 *	2 *	2 *

* 2 bars in bond beam can help to center vertical steel

Reminder: for every bar specified, there are two at splices.

JOINT REINFORCEMENT

Joint reinforcement is used in addition to horizontal steel bars when bond beams are spaced at more than 1200 mm. It is a ladder of 9 gauge (3.7 mm) wire installed in the mortar joint, which positions a wire in the center of each block faceshell. It is spaced at a maximum of 600mm, 400 mm for stack pattern, and at 400 mm in seismic zones. Joint reinforcement resists wall cracking and can contribute to the horizontal steel area in the wall.



Joint Reinforcement