(e) Date of manufacture, if known.

(f) Dimensions of each specimen (T_i, L_i, W_i) to the nearest 1 mm.

(g) Conditions of each specimen that differs significantly from the rest of the lot.

(h) Ambient mass (m_{ai}) of each specimen, recorded to the nearest 1 gram.

(i) Oven dried mass (m_{di}) of each specimen, recorded to the nearest 1 gram.

(j) Calculated moisture content (m_{di}, m_{di}/V_i) of each specimen, recorded to the nearest kg/m^3 and 0.1%.

(k) Mean dry density of the sample, recorded to the nearest 5 kg/m^3.

Unless stated otherwise, all data shall be reported to three significant numbers.

APPENDIX I

AAC DRYING SHRINKAGE

(Normative)

I1 SCOPE

This Appendix sets out the method for determining the mean drying shrinkage of the AAC component of Reinforced AAC members.

NOTE: An alternative test method is set out in EN 680.

I2 PRINCIPLE

The drying shrinkage of each prismatic AAC specimen is determined by measuring the change in gauge lengths on each specimen, when it is dried from the saturated condition to the condition where constant length is achieved. The results are graphed and the reference value of drying shrinkage ($\varepsilon_{cs,ref}$) is taken as the relative change in length between those at moisture contents of 30% and 6% by mass.

NOTE: The total value of drying shrinkage ($\varepsilon_{cs,tot}$) can also be determined.

I3 APPARATUS

The following equipment shall be used in the performance of this test:

(a) Callipers, capable of reading dimensions to an accuracy of ±0.1 mm.

(b) Comparator for measuring changes in gauge length on the specimens by difference. This device shall be such that it measures length changes along the longitudinal axis of the specimens, has a range that can cater for differences in lengths of the various specimens, permits the determination of relative change of length from the original length ($\Delta L/L$) of less than 10^{-5}, and maintains positive contact with the gauge plugs. The accuracy of the comparator shall be checked against an unchanging reference bar each time it is used to determine the lengths of the specimens.

(c) Invariable reference bar of FeNi36 (invar) steel rod, fitted with an insulated grip, approximately equal in length to the test specimens.

(d) Container of a size that allows the specimens to be held fully immersed in water.

(e) Gauge plugs, fixed into the end surfaces of the specimens. Such plugs shall be corrosion resistant and shall facilitate positive contact with the comparator.

(f) Room or cabinet with temperature controlled at 20 ±2°C and relative humidity (RH) at 45 ±5%, or at 23 ±2°C and RH at 50 ±5%.

(g) Saw for cutting the specimens to size.

(h) Balance, capable of determining the specimen mass with a limit of performance of 0.3 grams.

(i) Ventilated drying oven, capable of maintaining a temperature of 105 ±5°C.

I4 SAMPLING AND PREPARATION OF TEST SPECIMENS

I4.1 Sampling

Specimens shall be sampled such that they are representative of the AAC material.

Specimens shall not be sourced from within 150 mm of any location in the AAC where there is visible damage or deviations from the normal material appearance.

Specimens shall not include any reinforcement.

In each sample of three specimens, one specimen shall be sampled from the upper third of the rise of the AAC mass, one from the middle third and one from the lower third.

NOTE: The 'thirds' described herein are those used in the manufacturing process, and, in the case of panels, are cut from each side and centre of a panel.

I4.2 Number of specimens

Each sample shall consist of three specimens.

I4.3 Preparation of specimens

Specimens shall be prisms, cut from the Reinforced AAC, each of which has dimensions of 45 mm × 45 mm × 200 mm.

The longitudinal axis of the specimens shall be perpendicular to the direction of the rise.

Specimens shall be cut such that flatness (measured across the diagonals) does not deviate by more than 0.1 mm. Specimens that are outside this tolerance shall be ground or milled to achieve the requirement.

Gauge plugs shall be firmly inserted in the 45 mm × 45 mm ends of the specimens, using an adhesive that does not affect the result.

Each specimen shall be marked to identify it and to indicate its orientation in the comparator.

I5 TEST PROCEDURE

I5.1 Mass of gauge plugs

The gauge plugs shall be weighed and the mass of each pair of plugs recorded (m_{gi}).

I5.2 Determination of dimensions

The length (L_i) and sides (S_{1i}) and (S_{2i}) of each prism shall be determined to an accuracy of ±0.1 mm, by applying the callipers at more than one location in each direction.

The lengths of prisms (L_i), defining the longest dimension of the AAC, shall be measured near the centre of the two ends, beside the position of the gauge plugs. This length, used to determine the AAC volume, shall be measured on the AAC, not on the gauge plugs.

The sides of prisms (defining the cross-sectional area) shall be measured at the mid-length and at the two ends.

NOTES:

1 In this test procedure, the 'length' (L_i) is defined as the longest of the dimensions, and is normally oriented horizontally in the test apparatus, and the 'sides' (S_{1i}) and (S_{2i}) are the shorter dimensions, which are intended to be equal.

2 The dimensions should be such that the calculated volume is within 1% of the specified volume.

I5.3 Conditioning of specimens

After determining the dimensions, the specimens shall be conditioned in water at 20 ±2°C or 23 ±2°C as follows:

(a) Immerse the bottom third of each specimen in water for 24 h.

(b) Immerse the bottom two-thirds of each specimen in water for a further 24 h.

(c) Totally immerse each specimen in water for a further 24 h.

(d) After a total of 72 h, each specimen shall be removed from the water, sealed in plastic and stored at 20 ±2°C or 23 ±2°C as above.

I5.4 Drying shrinkage and mass

The procedure shall be as follows:

(a) For each specimen in turn—

(i) remove the plastic from around the specimen;

(ii) wipe any dirt or other contaminant from the surface of the gauge plugs;

(iii) weigh each specimen (m_{oi});

(iv) determine the length across the gauge plugs ($L_{G\,0i}$) for each specimen; and

(v) determine the reading of the invariable reference bar ($L_{inv\,0i}$) using the comparator.

These measurements shall be performed within 1 h of removing the plastic.

(b) The specimens shall be stored for a period in the room or cabinet with temperature controlled at 20 ±2°C and RH at 45 ±5%, or at 23 ±2°C and RH at 50 ±5%, with space around each specimen to allow air to circulate freely.

(c) At 7 d intervals during the storage period, the following shall be performed:

(i) Wipe any dirt or other contaminant from the surface of the gauge plugs.

(ii) Weigh each specimen (m_{7i}, m_{14i}, m_{21i}, m_{28i}).

(iii) Determine the length across the gauge plugs ($L_{G\,7i}$, $L_{G\,14i}$, $L_{G\,21i}$, $L_{G\,28i}$) for each specimen.

(iv) Determine the reading of the invariable reference bar ($L_{inv\,7i}$, $L_{inv\,14i}$, $L_{inv\,21i}$, $L_{inv\,28i}$) using the comparator.

(d) If the decrease in length across the gauge plugs between 21 d and 28 d ($L_{G\,21} - L_{G\,28i}$) exceeds 0.02 mm/m, the storage, mass measurement and shrinkage measurement shall be continued until the shrinkage over a period falls below 0.02 mm/m.

I5.5 Oven-dry mass at 105 ±5°C

The specimens shall be placed in a ventilated drying oven at a constant temperature of 105 ±5°C, until a constant mass is achieved.

Each specimen shall be removed from the oven and weighed.

The oven-dried mass (m_{di}) of each specimen shall be determined and recorded.

After weighing, each specimen shall be returned to the oven for a further 24 h, before reweighing. If the mass has not changed by more than 0.2%, it shall be considered to be the dry mass. If the variation is greater than 0.2%, the procedure in this Paragraph shall be repeated.

I6 CALCULATIONS

The following shall be calculated:

(a) *Volume and density* The volume (V_i) of each specimen shall be determined as follows:

$$V_i = L_i S_{1i} S_{2i}$$

The dry density (ρ) of each specimen shall be determined as follows:

$$\rho_i = m_{di}/V_i$$

The mean dry density (ρ) of the sample shall be determined in accordance with Appendix A.

(b) *Moisture content* The moisture content (μ_{mi}) of each specimen at each time of measurement shall be determined, as a percentage, using the following equation:

$$\mu_{mi} = (m_{mi} - m_{di})/(m_{di} - m_{gi}) \times 100$$

where

μ_{mi} = moisture content of each specimen at each time of measurement as a percentage, i.e. 7, 14, 21 and 28 d

m_{mi} = mass of each specimen at each time of measurement, i.e. 7, 14, 21 and 28 d (m_{7i}, m_{14i}, m_{21i}, m_{28i})

m_{di} = mass of each specimen after drying in the oven at 105 ±5°C

m_{gi} = mass of each pair of gauge plugs

(c) *Relative length change* The relative length change (ε_{csi}) in millimetres per metre of each specimen at each time of measurement shall be determined using the following equation:

$$\varepsilon_{csi} = [(L_{G0i} - L_{Gmi}) - (L_{inv0i} - L_{invmi})]/L_i \times 1000$$

where

L_{G0i} = length of each specimen measured over the gauge plugs at the commencement of the test

L_{Gmi} = length of each specimen measured over the gauge plugs at each time of measurement, i.e. 7, 14, 21 and 28 d (L_{G7i}, L_{G14i}, L_{G21i}, L_{G28i})

L_{inv0i} = reading of the invariable reference bar using the comparator at the commencement of the test

L_{invmi} = reading of the invariable reference bar using the comparator at each time of measurement, i.e. 7, 14, 21 and 28 days (L_{inv0i}, L_{inv7i}, L_{inv14i}, L_{inv21i}, L_{inv28i})

L_i = length of each AAC specimen before conditioning

(d) *Reference shrinkage* The reference shrinkage of the sample ($\varepsilon_{cs\ ref}$), in millimetres per metre, shall be determined as follows:

(i) For each specimen, determine the relative length change corresponding to a change in moisture content (μ_{mi}) from 30% to 6% by mass.

NOTE: This may be determined either graphically or by mathematical interpolation.

(ii) Calculate the reference shrinkage of the sample ($\varepsilon_{cs\ ref}$), in millimetres per metre, calculated as the mean value of the relative length changes corresponding to changes in moisture content from 30% to 6% for each specimen.

(e) *Total shrinkage* The total shrinkage of the sample ($\varepsilon_{cs\ tot}$), in millimetres per metre, shall be determined as follows:

(i) For each specimen, determine the relative length change from the commencement of the test to the completion of the test.

(ii) Calculate the total shrinkage of the sample ($\varepsilon_{cs\ tot}$), in millimetres per metre, as the mean value of the relative length changes from the commencement of the test to the completion of the test for each specimen.

I7 RECORDS AND REPORT

The following information shall be retained in test records and shall be included in the test report, if a test report is required:

(a) Reference to this test method.

(b) Description of the marking and identification of the lot from which the specimens have been sampled.

(c) Sample and specimen identification.

(d) Date of sample and test.

(e) Date of manufacture, if known.

(f) Dimensions of each specimen (L_i, S_{1i}, S_{2i}) to the nearest 1 mm.

(g) Conditions of each specimen that differs significantly from the rest of the lot.

(h) Mass of each specimen (m_{0i}, m_{7i}, m_{14i}, m_{21i}, m_{28i}), recorded to the nearest gram.

(i) Length for each specimen across the gauge plugs (L_{G0i}, L_{G7i}, L_{G14i}, L_{G21i}, L_{G28i}), recorded to the nearest 0.1 mm.

(j) Reading of the invariable reference bar (L_{inv0i}, L_{inv7i}, L_{inv14i}, L_{inv21i}, L_{inv28i}) using the comparator, recorded to the nearest 0.1 mm.

(k) Oven dried mass (m_{di}) of each specimen, recorded to the nearest gram.

(l) Calculated dry density (ρ_i) of each specimen, recorded to the nearest 5 kg/m^3.

(m) Calculated moisture content (μ_{mi}) of each specimen, recorded to the nearest 1 kg/m^3 and 0.1%.

(n) Relative length change (ε_{csi}), in millimetres per metre, of each specimen at each time of measurement.

(o) Reference shrinkage of the sample ($\varepsilon_{cs\ ref}$), in millimetres per metre.

(p) Total shrinkage of the sample ($\varepsilon_{cs\ tot}$), in millimetres per metre.

Unless stated otherwise, all data shall be reported to three significant numbers.

APPENDIX J

AAC FREEZE-THAW PROPERTIES

(Normative)

J1 SCOPE

This Appendix sets out the method for determining the loss of density and compressive strength of the AAC component of Reinforced AAC members due to freeze-thaw conditions.

NOTES:

1 The method set out in this Appendix is based on specimens that can be cut from 75 mm thick panels, which are common in Australia.

2 An alternative test method is set out in EN 15304. This method is based on different specimen sizes, and therefore the two methods will not necessarily provide identical results.

J2 PRINCIPLE

The loss of dry density and compressive strength of AAC due to freeze-thaw conditions is determined by testing AAC reference samples for dry density and compressive strength in accordance with Appendices C and D, and comparing the results to the dry density and compressive strength results for samples that have been subjected to a specified number of freeze-thaw cycles of specified intensity. Moisture content of the reference samples is also determined and recorded.

J3 APPARATUS

The following equipment shall be used in the performance of this test:

(a) Callipers, capable of reading dimensions to an accuracy of ±0.1 mm.

(b) Container of a size that allows the specimens to be held fully immersed in water.

(c) Feeler gauges, 0.1 mm, 0.5 mm and 1.0 mm in thickness.

(d) Freezing chamber for freezing the specimens, with temperature controlled at −15 ±2°C, of a size that permits air to circulate freely about the specimens.

(e) Room or cabinet for storing the reference specimens, with temperature controlled at 20 ±2°C and relative humidity (RH) above 95%, or at 23±2°C and RH at 50 ±5%, of a size that permits air to circulate freely about the specimens.

(f) Room or cabinet for thawing the frozen specimens, with temperature controlled at 20 ±2°C and RH above 95%, of a size that permits air to circulate freely about the specimens.

(g) Saw for cutting the specimens to size.

(h) Balance, capable of determining the specimen mass with a limit of performance of 0.3 grams.

(i) Straight-edge not less than 200 mm in length, true to within 0.1 mm in 100 mm.

(j) Square with sides at right angles within 0.1 mm in 100 mm.

(k) Ventilated drying oven, capable of maintaining a constant temperature of 105 ±5°C.

J4 SAMPLING AND PREPARATION OF TEST SPECIMENS

J4.1 Sampling

Specimens shall be sampled such that they are representative of the AAC material.

Specimens shall not be sourced from within 150 mm of any location in the AAC where there is visible damage or deviations from the normal material appearance.

Specimens shall not include any reinforcement.

In each sample of three specimens, one specimen shall be sampled from the upper third of the rise of the AAC mass, one from the middle third and one from the lower third.

NOTE: The 'thirds' described herein are those used in the manufacturing process, and, in the case of panels, are cut from each side and centre of a panel.

J4.2 Number of specimens

Each test shall consist of four samples, each consisting of three specimens, designated as follows:

(a) Dry density freeze-thaw sample.

(b) Compressive strength freeze-thaw sample.

(c) Dry density reference sample.

(d) Compressive strength reference sample.

J4.3 Preparation of specimens

Specimens shall be cubes, cut from the Reinforced AAC, each of which has dimensions of 75 mm × 75 mm × 75 mm to within a tolerance of ±2 mm.

Specimens shall be marked to indicate the location from which they were cut, including the position in and direction of the rise, and the sample of which they are part.

Specimens shall be cut such that their flatness (measured across the diagonals) does not deviate by more than 0.1 mm, and shall comply with the requirements of Appendix C for dry density and Appendix D for compressive strength. Specimens that are outside this tolerance shall be ground or milled to achieve the requirement.

J5 TEST PROCEDURE

J5.1 Determination of dimensions of all specimens

For each specimen, the thickness (T_i), length (L_i) and width (W_i) shall be determined to an accuracy of ±0.1 mm, by applying the callipers at more than one location in each direction.

J5.2 Conditioning of specimens

All specimens shall be conditioned in water at 20 ±2°C as follows:

(a) Immerse the bottom half of each specimen in water for 24 h.

(b) Totally immerse each specimen in water for a further 24 h.

(c) After a total of 48 h, remove each specimen from the water, seal in plastic (e.g. polythene bags), and store at 20 ±2°C for a further 24 ±1 h to enable equilibrium to be approached.

J5.3 Dry density and compressive strength of freeze-thaw samples

The specimens of the 'dry density freeze-thaw sample' and 'compressive strength freeze-thaw sample' shall be removed from the plastic sealing and subjected to 15 cycles of the following procedure:

(a) Weigh the specimens of the 'dry density freeze-thaw sample' and 'compressive strength freeze-thaw sample' ($m_{m0\,i}$).

(b) Place the specimens of the 'dry density freeze-thaw sample' and 'compressive strength freeze-thaw sample' in the freezing chamber, in which the temperature has been previously lowered to −15 ±2°C. The specimens shall be held in the chamber at this temperature for 8 h. The specimens shall have at least 50 mm clearance to adjacent specimens, and the chamber walls and roof, to permit air to circulate freely.

(c) Remove the specimens of the 'dry density freeze-thaw sample' and 'compressive strength freeze-thaw sample' from the freezing chamber and place in the thawing room or cabinet, with temperature controlled at 20 ±2°C and RH above 95% to minimize loss of moisture. The specimens shall be held in the thawing room or cabinet under these conditions for 16 h. The specimens shall have at least 50 mm clearance to adjacent specimens, and the chamber walls and roof, to permit air to circulate freely.

NOTE: An acceptable means of achieving the abovementioned cycle is to insert the specimens into the freezing chamber at 0900 each morning and remove them to the thawing room at 1700 each afternoon. The procedure should be commenced on a Monday and continued for 15 d (including two weekends).

(d) Repeat the procedure set out in Items (c) to (d) to provide a total of 15 complete cycles. At the end of 15 complete cycles, remove the specimens of the 'compression freeze-thaw sample' and 'dry density freeze-thaw sample' from the thawing room or cabinet for subsequent measurement of dry density and compressive strength.

(e) Weigh the specimens of the 'dry density freeze-thaw sample' and 'compressive strength freeze-thaw sample' on completion of the specified cycles ($m_{mn\,i}$).

(f) Record any visible damage to the specimens.

(g) Determine the mean dry density of the 'dry density freeze-thaw sample' in accordance with Appendix C.

(h) Determine the mean compressive strength of the 'compressive strength freeze-thaw sample' in accordance with Appendix D.

J5.4 Moisture content, dry density and compressive strength of reference samples

The specimens of the 'dry density reference sample' and 'compressive strength reference sample' shall be subjected to the following procedure:

(a) Weigh the specimens of the 'dry density reference sample' and 'compressive strength reference sample' ($m_{r0\,i}$).

(b) Place the specimens of the 'dry density reference sample' and 'compressive strength reference sample' in the room or cabinet with the temperature controlled at 20 ±2°C and RH above 95%. The specimens shall be held in the room or cabinet under these conditions for the duration of the 15 cycles. The specimens shall have at least 50 mm clearance to adjacent specimens, and the chamber walls and roof, to permit air to circulate freely.

(c) At the end of 15 complete cycles, remove the specimens of the 'dry density reference sample' and 'compressive strength reference sample' from the temperature and humidity controlled room or cabinet for subsequent measurement of dry density and compressive strength.

(d) The specimens of the 'dry density reference sample' and 'compressive strength reference sample' shall be weighed on completion of the specified cycles ($m_{rn\,i}$).

(e) Determine the mean dry density of the 'dry density reference sample' in accordance with Appendix C.

(f) Determine the mean dry density of the 'dry density reference sample' in accordance with Appendix H.

(g) Determine the mean compressive strength of the 'compressive strength reference sample' in accordance with Appendix D.

J6 CALCULATIONS

The following shall be calculated:

(a) The mean dry densities of the 'dry density freeze-thaw sample' (ρ_m) and 'dry density reference sample' (ρ_r) shall be determined in accordance with Appendices A and C.

(b) The mean compressive strengths of the 'compressive strength freeze-thaw sample' (f_{cm}) and 'compressive strength reference sample' (f_{cr}) shall be determined in accordance with Appendices A and D.

(c) The relative change in mean dry density due to the freeze-thaw process ($\Delta\rho/\rho_r$) shall be determined, as a percentage, as follows:

$$\Delta\rho/\rho_r = (\rho_r - \rho_m)/\rho_r$$

where

ρ_r = mean dry density of the reference sample

ρ_m = mean dry density at the end of the freeze-thaw process

(d) The relative change in mean compressive strength due to the freeze-thaw process ($\Delta f_c/f_{cr}$) shall be determined, as a percentage, as follows:

$$\Delta f_c/f_{cr} = (f_{cr} - f_{cm})/f_{cr}$$

where

f_{cr} = mean compressive strength of the reference sample

f_{cm} = mean compressive strength at the end of the freeze-thaw process

(e) The mean moisture content of the 'dry density reference sample' (μ_r) shall be determined in accordance with Appendices A and H.

J7 RECORDS AND REPORT

The following information shall be retained in test records and shall be included in the test report, if a test report is required:

(a) Reference to this test method.

(b) Description of the marking and identification of the lot from which the specimens have been sampled.

(c) Sample and specimen identification.

(d) Date of sample and test.

(e) Date of manufacture, if known.

(f) Dimensions of each specimen (T_i, L_i, W_i), to the nearest 1 mm.

(g) Conditions of the test.