Approval & Reception Procedure

DMC – Departamento de Materiais de Construção		
Grout for Prestressing Systems	Document no.	**ARP/DMC/22**
	Rev. no.	**A**
	Date:	**01.01.2014**
	Page no.	**1 of 6**

1 Reference Documents

ASTM C939: 2002 Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)

ASTM C940-98a Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory

BS 1881-124: 1988 Testing concrete Methods for analysis of hardened concrete

EN196-3: 2005 Methods of testing cement: Determination of setting times and soundness

ISO 1920–4: 2005 Strength of hardened concrete

In all issues related to grout for prestressing systems that are not covered by the present ARP, reference is made to LECM ARP/DMC/014.

2 Approval Procedures

2.1 General

Grout for prestressing systems shall consist of ordinary Portland cement, water and admixture. Sand and additions such as PFA shall not be used unless permitted by the Owner's Representative.

Grout shall have a minimum compressive strength of 25 MPa at 7 days and 35 MPa at 28 days, or complies with the specified requirements of project.

Efflux time of grout immediately after mixing shall be between 11 and 30 seconds.

Setting time of grout shall be greater than 3 hours and less than 12 hours.

The amount of bleeding of grout shall not exceed 2% in the first 3 hours and shall not exceed 3% in total. The water shall be reabsorbed by the grout during the 24 hours after mixing.

Free expansion of grout shall not exceed 10% at the ambient temperature.

The maximum total chloride content of grout, expressed as a percentage relationship between the chloride ion and the cementitious content by mass in the grout, shall not exceed 0.06%.

Grout shall have a water/cement ratio as low as possible consistent with the necessary workability and under no circumstances shall the water/cement ratio exceed 0.4.

The following particulars of the proposed grout mix and grouting procedure for prestressing systems shall be submitted:

- Evidence of production control implementation,
- Water/cement ratio by mass,
- Details of mixing and grouting equipment,
- Method of quality control during grout injection, and
- Details of grouting trials.

A grout mix that complies with the specified requirements for trial mixes for grout and for grouting trials shall become an approved grout mix.

2.2 Trial Mix

A trial mix for grout for prestressing systems shall be made to demonstrate that the proposed materials, grout mix and methods of production will produce grout which complies with the specified requirements.

The trial mixes shall be completed at least 10 days before the grout mix is used in the permanent work.

The Contractor shall inform the Owner's Representative at least 24 hours, or such shorter period as may be agreed by the Owner's Representative, before making trial mixes.

Trial mixes shall be made using the materials, grout mix and methods of production submitted to the Owner's Representative.

One sample of grout shall be provided from the trial mix to determine the efflux time, setting time, amount of bleeding and free expansion and compressive strength of the grout. The sample shall be provided and testing commenced within 1 hour after the grout has been mixed. The sample shall be protected from rain before the tests are carried out.

From each sample of grout taken to determine the compressive strength, nine (9) 100 mm cubes for testing shall be made. Each set of cubes shall be tested to determine the compressive strength (3, 7 & 28 days). The method of making, curing and testing of cubes, and the calculation of the test results, shall be as stated in ARP/DMC/014, except that compaction of the grout is not required.

If the result of any test for efflux time, setting time, amount of bleeding, free expansion or compressive strength of trial mixes for grout does not comply with the specified requirements for the property, particulars of proposed changes to the materials, grout mix or methods of production shall be submitted to the Owner's Representative. Further trial mixes shall be made until the result of every test complies with the specified requirements for the property.

If grouting trials are carried out using the non-complying trial mix, further grouting trials shall be carried out.

2.3 Grouting Trials

Grouting trials for grout for prestressing systems shall be carried out to demonstrate that the proposed materials, grout mix, methods of production and methods of construction will produce a grouted duct which complies with the specified requirements. The number and details of grouting trials shall be agreed in advance or as stated in the technical specification of project.

Grouting trials shall be carried out using the materials, grout mix, methods of production and methods of construction submitted to the Owner's Representative.

Grouting trials shall be completed at least 3 days before grouting starts. The Contractor shall inform the Owner's Representative 24 hours, or such shorter period agreed by the Owner's Representative, before carrying out grouting trials.

The profile of ducts and the method of support for grouting trials shall be as agreed by the Owner's Representative. Vents shall be provided in ducts and tendons shall be pulled tight.

Grouting trials shall not form part of the permanent work and shall be removed.

Three sections selected by the Owner's Representative shall be cut from the grouted duct and inspected not less than 2 hours after the grout used in the grouting trial has achieved its final set.

The sections of grouted duct cut in grouting trials shall be completely filled, and the prestressing tendon shall be completely surrounded with grout.

If the result of any test on sections of grouted duct cut in grouting trials does not comply with the specified requirements for the test, or if in the opinion of the Owner's Representative any aspect of the grouting procedure as demonstrated by the grouting trial is unsatisfactory, particulars of proposed changes to the materials, grout mix, methods of production or methods of construction shall be submitted to the Owner's Representative. Further grouting trials shall be carried out until the result of every test on sections of grouted duct complies with the specified requirements for the test and until in the opinion of the Owner's Representative every aspect of the grouting procedure is satisfactory. Further trial mixes for grout shall be made unless in the opinion of the Owner's Representative noncompliance of the grouting trial was not due to the grout mix.

3 Reception Procedure

Samples shall be protected from rain before the tests for efflux time, setting time, amount of bleeding, free expansion and compressive strength are carried out.

3.1 Batch

A batch of grout for prestressing systems is any quantity of grout produced in one cycle of operations of a mixer.

3.2 Samples: efflux time, setting time, bleeding and free expansion of grout

For each grout mix one sample of grout shall be provided from each 25 batches of grout, or from the amount of grout produced in a day, whichever is the lesser, to determine the efflux time, amount of bleeding and free expansion of the grout. Setting time shall be done if necessary.

Samples shall be provided and testing commenced within 1 hour after the grout has been mixed.

3.3 Samples: compressive strength of grout

For each grout mix one sample of grout shall be provided from each 25 batches of grout, or from the amount of grout produced in a day, whichever is the lesser, to determine the compressive strength of the grout.

Samples shall be provided within 1 hour after the grout has been mixed.

Six (6) 100 mm cubes for testing shall be made from each sample of grout. Each set of cubes shall be tested to determine the compressive strength (7 & 28 days).

The method of making, curing and testing of cubes, and the calculation of the test results, shall be as stated in ARP/DMC/014, except that compaction of the grout is not required.

4 Acceptance Criteria

4.1 Non-compliance: efflux time, setting time, bleeding, free expansion and compressive strength of grout

If the result of any test for efflux time, setting time, amount of bleeding, free expansion or compressive strength of grout for prestressing systems does not comply with the specified requirements for the property, particulars of proposed changes to the materials, grout mix or methods of production shall be submitted to the Owner's Representative. Further trial mixes

Approval & Reception Procedure

DMC – Departamento de Materiais de Construção		
Grout for Prestressing Systems	Document no.	**ARP/DMC/22**
	Rev. no.	**A**
	Date:	**01.01.2014**
	Page no.	**6 of 6**

shall be made and further grouting trials shall be carried out unless otherwise permitted by the Owner's Representative.