

PN 527 - 04/15/2005 - ITEM 515 - HIGH EARLY STRENGTH KEYWAY GROUT FOR PRESTRESSED/POST-TENSIONED CONCRETE MEMBERS

The high early strength keyway grout, specified in Standard Drawing PSBD-1-93, sheet 1 of 4, mortar alternate 2, shall meet the requirements of this specification.

Grout shall be approved by the Laboratory based on the results of the certified test data submitted by the manufacturer. The manufacturer shall have an independent testing laboratory perform the required tests in this specification and submit the certified test results to the Laboratory for review and approval.

The approved grout shall meet the following requirements:

Minimum Compressive Strength. ASTM C109 (modified) grout material only - no aggregate - at 72 °F (22 °C)

6-hour 4000 psi (27.6 MPa)

1-day 5000 psi (34.5 MPa)

3-day 6000 psi (41.4 MPa)

28-day 7500 psi (51.7 MPa)

Minimum Flexural Strength. ASTM C78 (modified) grout material only - no aggregate

1 day 500 psi (3.4 MPa)

Modulus of Elasticity. ASTM C109 (modified) grout material only - no aggregate - at 72 °F (22 °C)

4.5 to 5.5 x 10⁶ psi (31 050 to 37 950 MPa)

Coefficient of Thermal Expansion. CRD-C 39-81

6.5 to 7.5 x 10⁻⁶ /°F (11.7 to 13.5 x 10⁻⁶ /°C)

Setting Times. Gilmore ASTM C266 (modified)

Initial 10 minutes minimum

Final 12 minutes minimum

Shrinkage. Maximum = 0.025 Tested in conformance to ASTM C157

LABORATORY KEYWAY TESTS

The independent testing laboratory shall perform application tests of the grouting material to simulate the actual performance of the shear key in the field.

SHEAR KEY SAMPLES

Concrete shear key sample halves shall be cast to match the Department's 4 inch (100 mm) and 6 inch (150 mm) shear key designs as detailed on Standard Drawing PSBD-1-93, sheet 3 of 4. Detail sketches of the required sample configurations are available from the Laboratory's concrete engineer.

The concrete for the shear key sample halves shall be of the following mix:

Cement Type III	(701.05)	650 lb/yd ³ (385 kg/m ³)
Coarse Aggregate (#8)	(703.02)	1650 lb/yd ³ (978 kg/m ³)
Fine Aggregate	(703.02)	1300 lb/yd ³ (770 kg/m ³)
Total water		270 lb/yd ³ (160 kg/m ³)
Air Content		5 +/- 1%

Slump

5-1/2 +/- 1 inch (140 +/- 25 mm)

Before the actual grout material tests, the shear key sample halves shall have obtained a minimum compressive strength of 6000 psi (41.4 MPa). Cylinder tests of the concrete shall be performed and reported to validate the 6000 psi (41.4 MPa) requirement.

The keyway surfaces of the sample halves shall be thoroughly cleaned of all dirt, dust and other foreign matter by sandblasting and high pressure washing. The keyway surfaces shall be tested for carbonation. Any carbonation found shall be removed by re-blasting and re-washing. Dryness of the keyway surface before grouting shall be as per the manufacturers recommendation.

The sample halves shall be supported so the joint at the bottom, between sample halves, is 1/4 inch +/- 1/16 inch (6 mm +/- 1.5 mm). The joint spacing at the top of the sample halves shall conform with the detail sketches from the Laboratory. The bottom 1/4 inch (6 mm) joint between shear key halves shall be packed with jute or a backing rod so that no grout can enter. A dam should be built around the sides and the bottom of the shear key samples to contain the grouting material during installation, consolidation and curing. The grouting material shall be installed, consolidated and cured as per manufactures recommendations.

The following tests shall be performed on seven day old shear key samples:

1. Horizontal (Lateral) Shear Test

Two shear key samples each for the 4 inch (100 mm) and 6 inch (150 mm) keyways shall be tested for ultimate horizontal(lateral) shear load and the results given in pounds (Newtons). The samples shall be sized and tested as detailed in the Laboratory furnished detail sketches. The test values shall be reported.

2. Vertical Shear Test

Two shear key samples each for the 4 inch (100 mm) and 6 inch (150 mm) keyways shall be tested for ultimate vertical shear load and the results given in pounds (Newtons). The samples shall be sized and tested as detailed in the Laboratory furnished detail sketches. The test values shall be reported.

3. Tensile Shear Test

Two shear key samples each for the 4 inch (100 mm) and 6 inch (150 mm) keyway shall be tested for ultimate tensile shear load and the results given in pounds (Newtons). The samples shall be sized and tested as detailed in the Laboratory furnished detail sketches. The test values shall be reported.

Minimum test values are as follows:

Horizontal (Lateral) Shear – 10,000 lb (44 500 N)

Vertical Shear – 12,000 lb (53 400 N)

Tensile Shear – 4000 lb (17 800 N)

The independent testing laboratory shall submit a report containing the following:

1. All test results.
2. A step by step description of the procedure used to cast, construct, cure and test the shear key samples to include:
 - a. The concrete mix
 - b. The grout installation procedure
 - c. The grout curing procedure
 - d. The trimming and handling of the samples

e. The actual testing procedure of the samples

3. A chemical analysis of the grout material shall also be included in the report along with MSDS sheets for the grout material.

Three copies of the report shall be submitted to the Office of Materials Management, 1600 West Broad Street, Columbus, Ohio 43223, for review. The Laboratory will issue results of their review within 20 days of receipt of the report. If approved, the material will be added to an approved list of materials retained by the Laboratory.

FIELD APPLICATION

Approved high early strength keyway grout shall be delivered to the field as pre-packaged material requiring only the addition of water.

Mixing water shall be the maximum specified by the manufacturer.

The procedure for grout application and installation and curing requirements shall conform to the procedure submitted to the Laboratory. The grout manufacturer and/or Contractor shall furnish a copy of the approved grout installation procedure to the Project Engineer at least 3 days before installation of any grout.