Bureau of Materials and Physical Research
Illinois Laboratory Test Procedure
Effective Date: January 1, 2007
Revised Date: October 29, 2012

Standard Method of Test
for
Shear Strength of Bonded Polymer Concrete

This test procedure applies to Check Sheet #17, Special Provision for Polymer Concrete, of the Supplemental Specifications and Recurring Special Provisions (January 1, 2012).

Reference Test Procedure(s):

1. ASTM C 884, Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay

2. ASTM C 672 (Illinois Modified), Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals

3. Brookhaven National Laboratory Guillotine Shear Test

4. SSPC SP 5/NACE No. 1, White Metal Blast Cleaning

To maintain brevity in the text, the following will apply:
Example: ASTM C 672 (Illinois Modified) will be designated "C 672."

1. GENERAL

This test is used to determine the compatibility and bond strength between polymer concrete and portland cement concrete and steel in terms of the shear strength of the bond according to the Brookhaven National Laboratory (BNL) Guillotine Shear Test Method. This test method also determines the ability of polymer concrete to maintain its bond to concrete and steel while being subjected to temperature changes that may occur in the field.

A layer of polymer concrete is applied to cylindrical blanks of cured and dried portland cement concrete and to cylindrical blanks of steel. After the polymer concrete has cured, half of the samples are subjected to five cycles of temperature change between 158 °F (70 °C) and -20 °F (-29 °C). After cycling is completed, shear strengths are determined utilizing the guillotine apparatus.

2. EQUIPMENT

a. *Molds*, cylindrical mold of 4 in. (101.6 mm) diameter and height to accommodate the concrete or steel blanks plus a 1 in. (25 mm) overlay of polymer concrete. Molds shall be made of nonabsorbent material capable of holding their shape and dimensions.

b. *Tamping Rod*, a round, straight, steel rod 5/8 in. ± 1/16 in. (16 mm ± 2 mm) in diameter and at least 12 in. (300 mm) in length, having the tamping end or both ends rounded to a hemispherical tip, the diameter of which is 5/16 in. (8 mm).

c. *Freezer*, in conformance with C 672, except that the freezer shall be able to maintain a temperature of -20° ± 4°F (-29° ± 2°C).

d. *Oven*, possessing an area of sufficient size to hold the specimens and the capacity to raise the temperature of the specimens to 158° ± 4°F (70° ± 2°C) within 16 to 18 hours, and the ability to maintain this temperature with a full load of specimens.

e. *BNL guillotine shear tester*.

f. *Loading apparatus*, a compression tester or universal testing machine with a minimum capacity of 67,500 lbs (300 kN).

3. MATERIAL

a. Test blanks will be 4 ± 1/8 in. (101.6 ± 3.2 mm) in diameter and a minimum of 3 in. (76 mm) in length. There shall be twelve test blanks, six steel and six concrete. The steel blank bonding surface shall be dry abrasive blasted to a White Metal finish with a 25-75 microns (1-3 mil) blast profile according to SSPC-SP 5 (The Society for Protective Coatings Surface Preparation). The concrete blank bonding surface shall be free of all oil contaminants, and shall be blasted using glass beads.

b. A nonreactive release agent shall be used to coat the entire mold. The concrete and steel test blanks shall be inserted into the molds. Use a prime coat according to manufacturer's recommendations. Mix a sufficient amount of the components in the proportions and in the manner specified by the manufacturer of the materials. Place a total of 1 in. (25 mm) thick layer polymer concrete on the prepared surface. Fill the mold in one lift and tamp 20 times with the tamping rod. Strike off excess material even with the top of the mold.

c. Cure the test specimens for at least 3 days at 73° ± 4°F (23° ± 2°C).

4. PROCEDURE

a. Measure the specimen diameter to the nearest 0.01 in. (0.2 mm). The specimen will be rejected if the average of two measurements made at right angles to each other in the shear area of the specimen is greater than 4.07 in. (103.2 mm).

b. After curing, the 3 concrete and 3 steel test specimens each shall be conditioned according to the following:

   i. Stable conditioning period—continue to subject 3 concrete and 3 steel specimens to a constant temperature of 73° ± 4°F (23° ± 2°C) for 11 days until testing.

   ii. Cycling conditioning period—place the remaining 3 concrete and 3 steel specimens into the oven at 158° ± 4°F (70° ± 2°C) for 22 hours. Remove them from the oven, and let them cool at a constant temperature of 73° ± 4°F (23° ± 2°C) for 2 hours. Then put them directly into the freezer at -20° ± 4°F (-29° ± 2°C) for 22 hours. Remove them from the freezer, and let them warm at a constant temperature of 73° ± 4°F (23° ± 2°C) for 2 hours. This is one test cycle. Continue for four additional cycles. At the end of the fifth cycle, leave the specimens at 73° ± 4°F (23° ± 2°C) for a minimum of 24 hours.

c. After conditioning, all specimens shall be tested in the guillotine apparatus at 73° ± 4°F (23° ± 2°C). Orient the specimens so the bond interface lines up at the shear plane of the guillotine apparatus. Load the ram at a head speed of 0.20 to 0.25 in/min (5.1 to 6.4 mm/min) through a spherical bearing block. Record the maximum load.

d. Average the maximum recorded loads separately for the four groups of the specimens: concrete cycled, steel cycled, concrete stable, and steel stable.

e. Failure shall result from any of the four concrete groups' average maximum loads being less than the specified minimum of 3100 lbs (13.8 kN).

5. REPORT

a. Complete material identification and date,

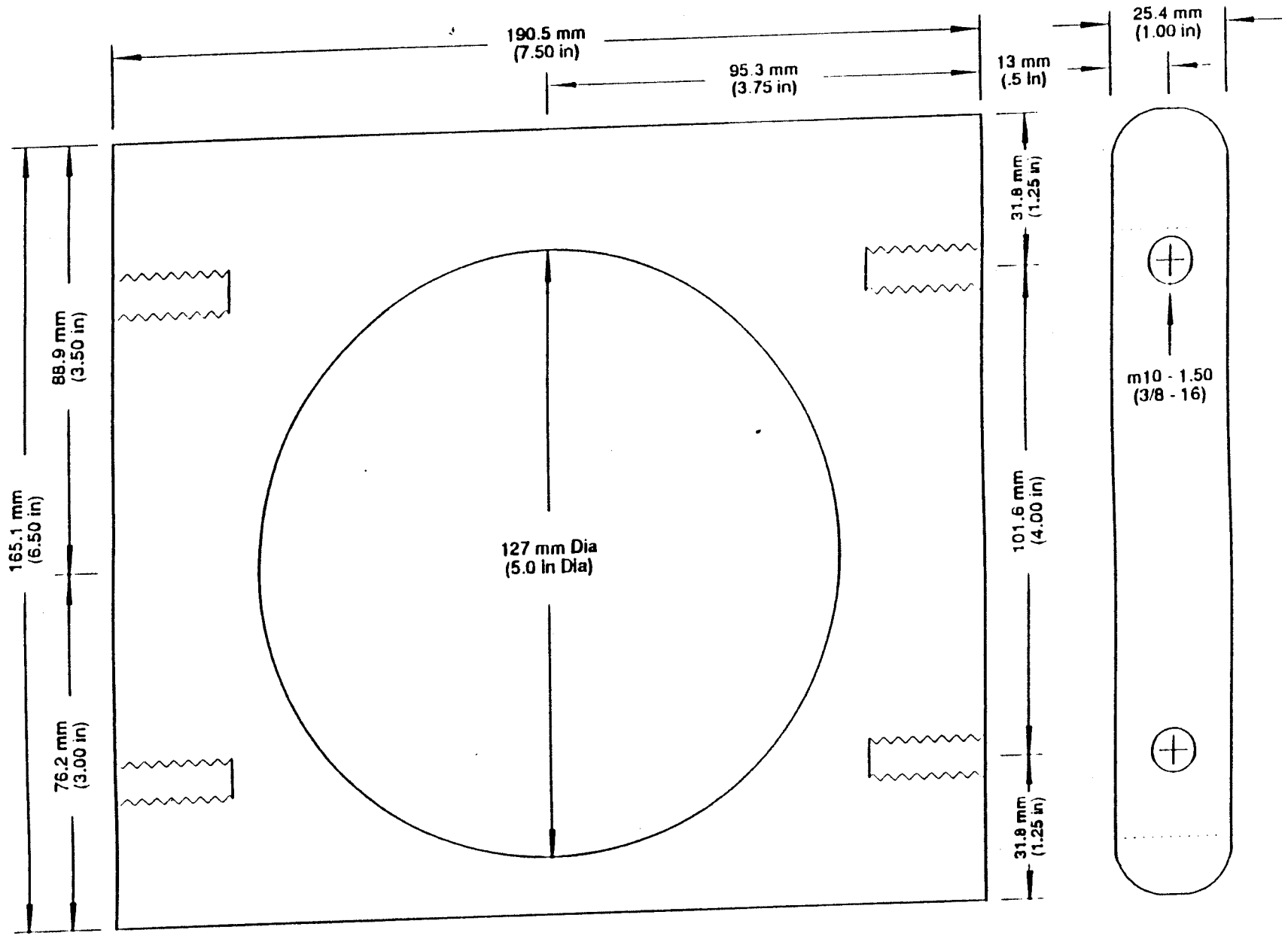
b. Specimen cross-sectional area,

c. Defects in specimens,

d. Maximum load indicated by testing machine, and

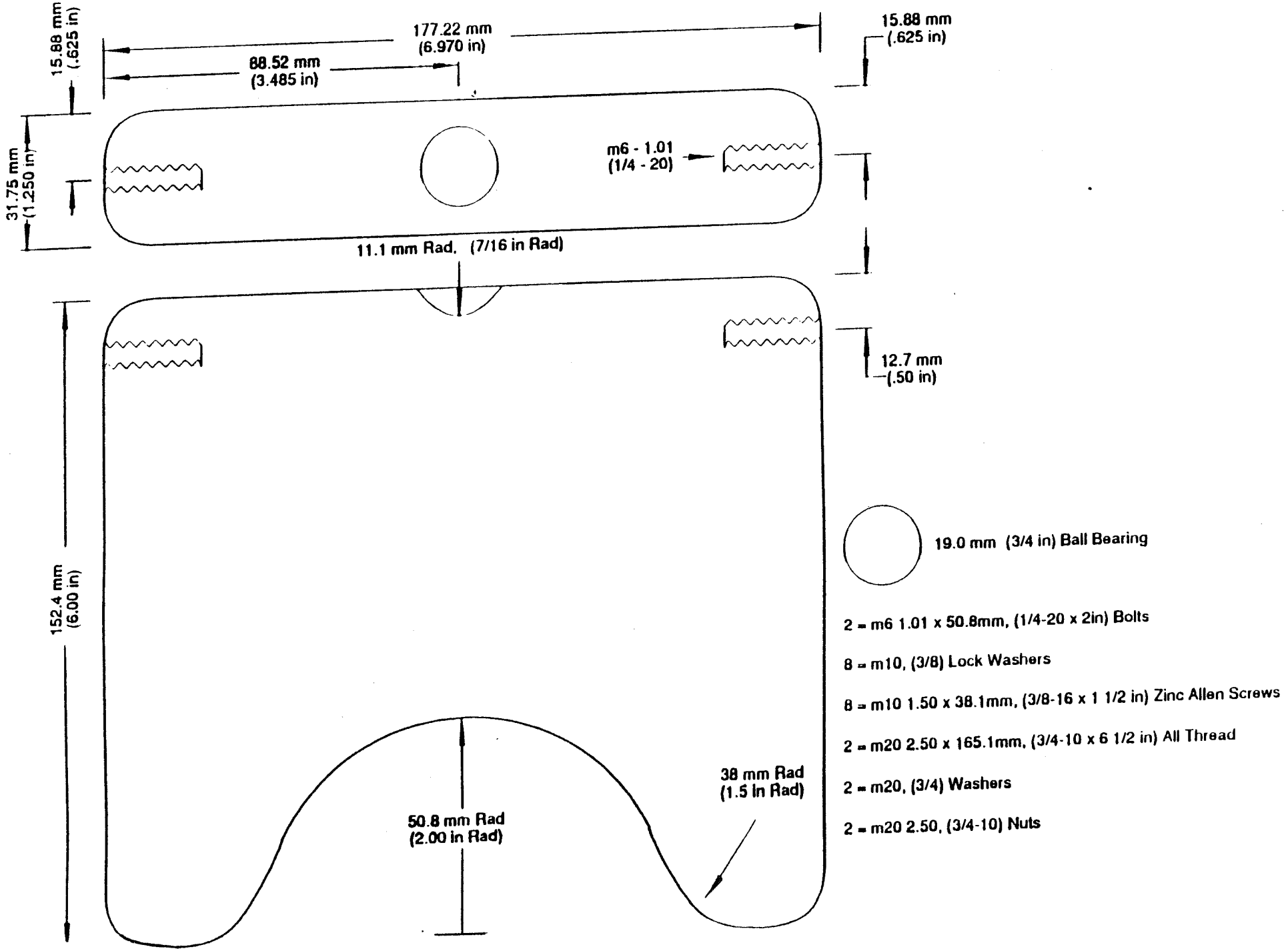
e. Average maximum load values for concrete cycled, steel cycled, concrete stable, and steel stable.

Brookhaven National Laboratory (BNL) Shear Tester

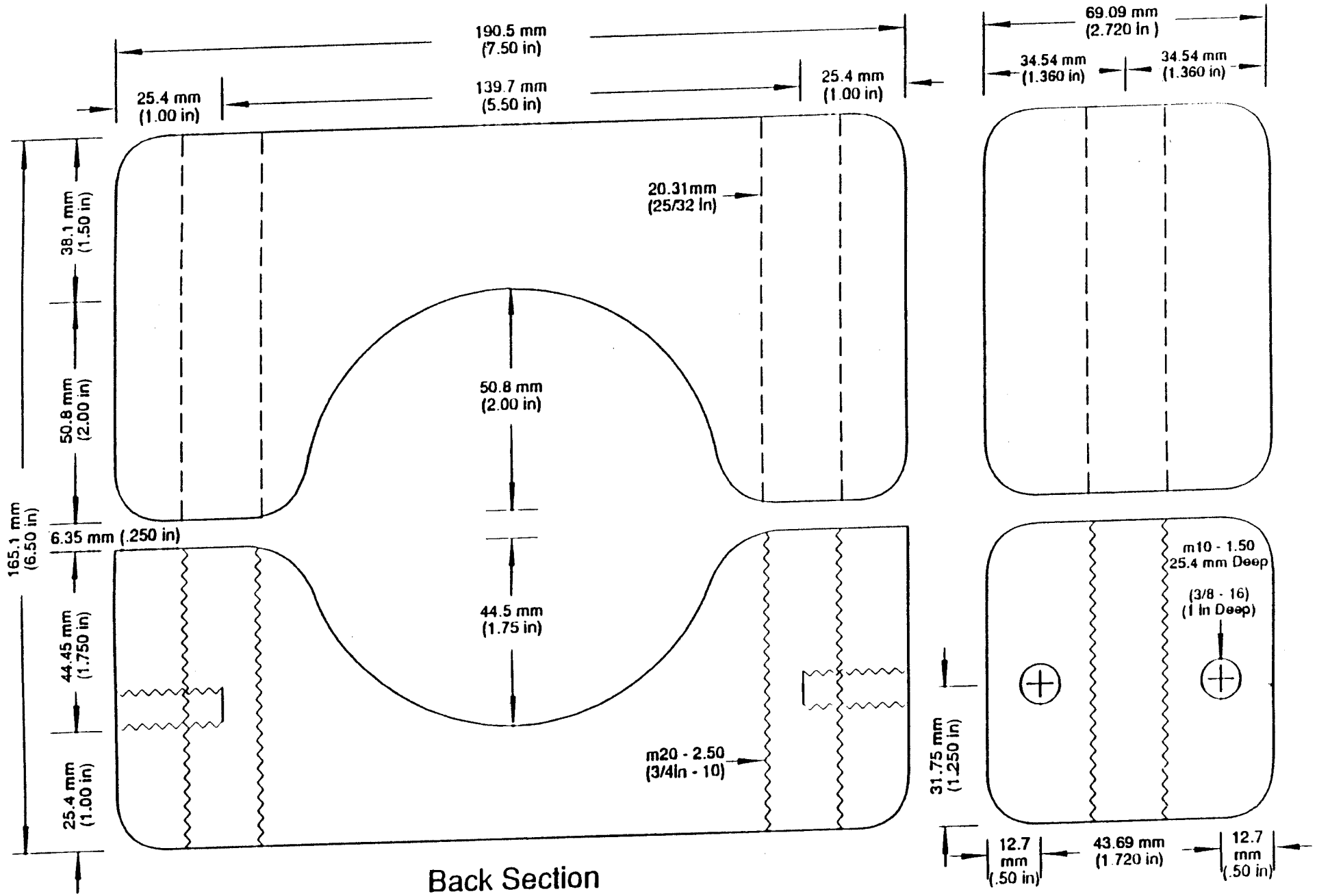


Front Plate

Brookhaven National Laboratory (BNL) Shear Tester

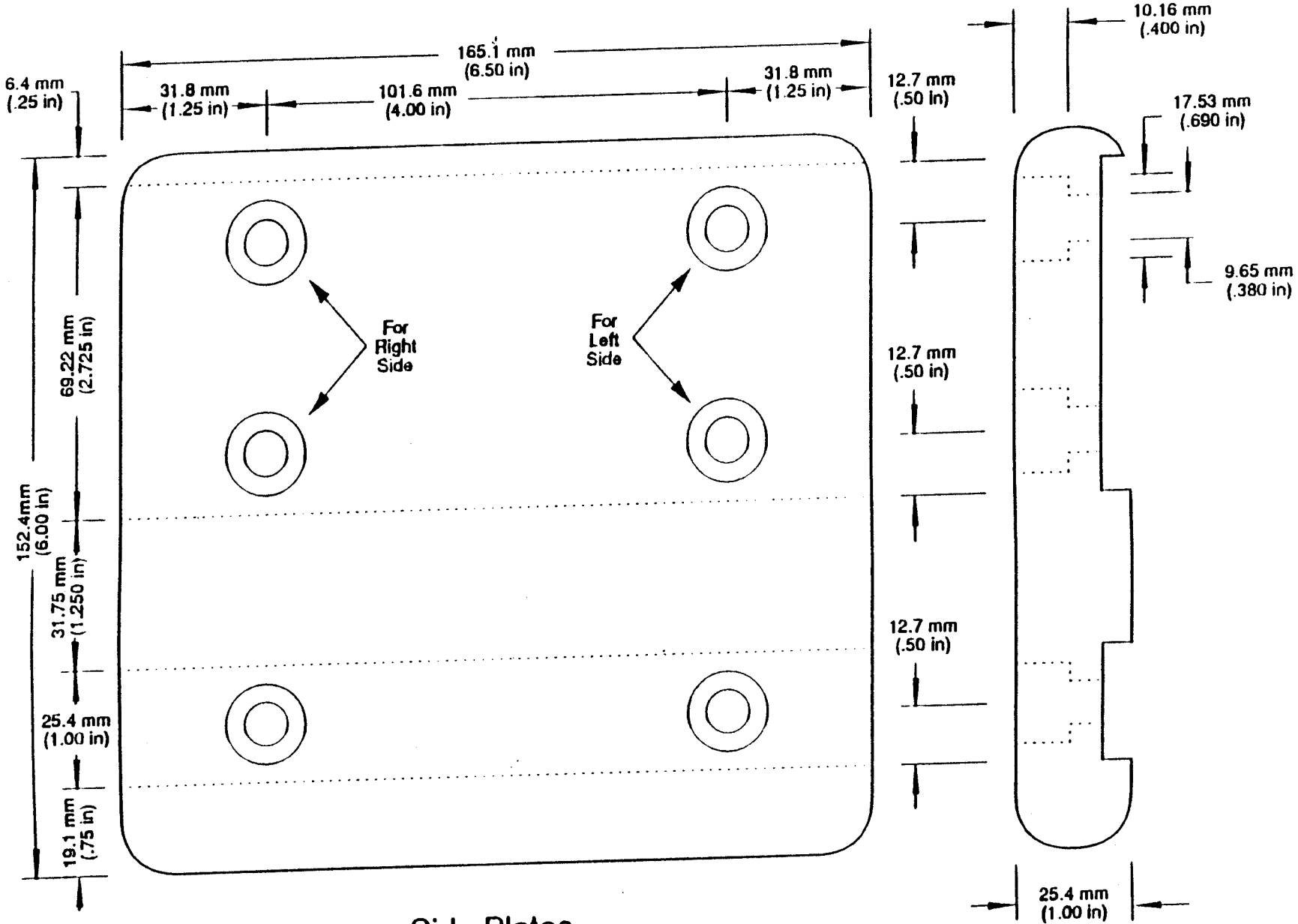


Brookhaven National Laboratory (BNL) Shear Tester



Back Section

Brookhaven National Laboratory (BNL) Shear Tester



Side Plates
(1 Left, 1 Right)