

## SECTION 30

### CAST-IN-PLACE-CONCRETE

#### PART 1 - GENERAL

##### 1.01 SCOPE

- A. The work covered by this item shall consist of furnishing, erecting and removing concrete forms; furnishing, proportioning and mixing concrete ingredients; placing, curing and finishing plain and reinforced concrete masonry and all other work incidental thereto as required for the proper construction of the structures shown on the plans or specified herein.
- B. Steel reinforcement shall be incorporated in the concrete masonry as required on the plans but it shall be furnished, bent, set and placed in accordance with the provisions in the section entitled "Concrete Reinforcement" of these specifications.

##### 1.02 CLASSIFICATION AND DEFINITIONS

- A. Concrete shall be either Class A or Class B, as indicated on the plans. If the class is not otherwise indicated, the Contractor shall furnish class A concrete.
- B. In general, Class A concrete shall be used for reinforced concrete masonry cast in place in forms for piers, headwalls, tanks, walls, floors, manholes, pits and similar structures. Class B concrete shall be plain concrete and shall be used for pipe cradles, pipe protection, bedding, grade correction, anchors, collars, massive sections and similar works.
- C. The purpose of this specification is to obtain a dense concrete having not only the specified strength but also a mixture that will have the following characteristics: plasticity and cohesiveness to reduce the danger of honey comb and porosity; a minimum water-cement ratio to reduce shrinkage and bleeding and for maximum watertightness and strength. The requirements herein as to aggregate grading and cement content are given as methods of obtaining the above-mentioned characteristics. However, the Contractor may submit for approval other methods of modifications of the methods set forth herein for obtaining the desired results.

### 1.03 COMPOSITION

Concrete shall be composed of cement, fine aggregate, coarse aggregate, approved admixtures and water, so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements under this item and suitable for the specific conditions of placement.

### 1.04 SAMPLING AND TESTING CEMENT AND AGGREGATES

- A. The Contractor shall determine the source, kind and quality of the cement and aggregates to be used in the work well in advance of the time scheduled for starting the work and shall submit such information to the Engineer for approval before starting concrete operations.
- B. The cost of testing cement and aggregates shall be borne by the Contractor. Certified test report and certificates shall be submitted in duplicate to the Engineer and to such agencies for persons as he may designate. Reports or certificates indicating compliance of any shipment of cement or aggregate shall be placed in the hands of the Engineer prior to use of such materials.
- C. Where reputable cement and aggregate suppliers maintain regular recognized testing services, certified copies of such test will be accepted by the Engineer. However, in any case of doubt as to the accuracy and/or adequacy of such test, the Engineer may require that cement and aggregates be tested by a recognized commercial testing laboratory which has been selected by the Contractor and approved by the Engineer. The testing laboratory shall then test the cement and aggregates and prepare written reports showing the results of such tests on each shipment. The laboratory shall also certify that the materials covered by the report comply in all respects with these specifications. In general, cement and aggregates shall be tested at the mill but if untested shipments require sampling and testing after arrival at the site of the work, the Contractor shall be fully responsible for delays in the progress of the work due to delays in testing and reporting.
- D. No cement or aggregate which fails to meet the requirements shall be incorporated into the work. In case of emergency the Engineer may authorize the use of specific lots of cement which have satisfactorily passed the soundness test and the 7-day strength test only.

### 1.05 TESTING OF CONCRETE

- A. Before any concrete is poured the Contractor shall prepare and submit preliminary mix designs for approval for each class of concrete specified. Tests shall be made in accordance with ASTM Standard Method of Tests for Compression Strength of Concrete, C 39, to determine the proper mixes of cement, sand, coarse aggregate and water-cement ratios to be used in

connection with furnishing concrete for this project. Tests for the proposed mixes shall consist of making and breaking 9 standard cylinders for each mix, 3 of which shall be broken each at 7, 14, and 28-day ages. The results of these tests shall be furnished to the Engineer in triplicate and on completion of these tests, curves shall be prepared showing the strength of the concrete at the various ages. No separate payment will be made for furnishing concrete mix designs. All sampling, testing, making and breaking cylinders, etc., required for concrete mix design shall be done by the Contractor at his expense.

- B. During the progress of the work, slump tests and compression test cylinders shall be taken and the Cylinders broken in accordance with the ASTM Standard Specifications, Serial Designations C 143 and C 31, latest revision. Each test shall consist of 4 test cylinders, 2 to be broken in 7 days and 2 to be broken at 28 days. Mixes shall be subject to laboratory control and inspection at the mixer plant and cylinders will be taken at the place of concrete placement.
- C. The minimum number of specimens or cylinders to be taken is:

Structural Pours	1 to 4 Cubic Yards	4 Cylinders
Any Pours	4 to 100 Cubic Yards	4 Cylinders
Any Pours	101 to 200 Cubic Yards	8 Cylinders
Any Pours	201 to 300 Cubic Yards	12 Cylinders
Any Pours	Over 300 Cubic Yards	4 Cylinders/100Cu.Yd.

All testing and all concrete laboratory inspection, sampling and testing throughout the work shall be done by an approved independent testing laboratory and paid for by the Owner. However, all the materials and concrete for the mix design and concrete for all test cylinders taken during the progress of the work shall be furnished by the Contractor at his expense. All other materials for testing concrete placed in the work shall be furnished by the laboratory making the concrete tests.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. Cement

1. Cement shall be standard portland cement or high early strength portland cement, conforming to all of the requirements of ASTM Standard Specifications for Portland Cement, Type 1, Type 11, and Type 111, shall be used only when specifically authorized by the Engineer. No cement of dark color shall be used.

2. When weighed in the conventional manner, portland cement shall weigh not less than 94 pounds per standard sack.
3. Unless otherwise specified as shown on the plans, Type 1, portland cement shall be used in all concrete.

#### B. Fine Aggregate

1. Fine aggregate shall be natural siliceous sand, consisting of hard, clean, strong, durable and uncoated particles, conforming to the requirements of ASTM Standard Specifications for Concrete Aggregates, Serial Designation C 33, latest revision. The mortar strength developed in such test shall be 90 percent of the developed by standard Ottawa sand tested under identical conditions.
2. Fine aggregate shall have fineness modulus of 2.40 minimum and 3.00 maximum. The fineness modulus shall not vary more than 0.10 plus or minus from the sample initially approved. The grading should be within the following limits if practicable:

<u>Sieve No</u>	<u>Cumulative &amp; Retained</u>
4	0 to 5
8	10 to 25
16	20 to 50
30	40 to 75
50	70 to 95
100	92 to 99

If the available sources of fine aggregate will not yield the above grading, the Engineer will approve modifications in the grading which do not adversely affect the work. However, no individual size should exceed 35 percent and the amount passing the No. 50 sieve should be at least 15 percent.

#### C. Coarse Aggregate

1. Coarse aggregate shall consist of clean, natural, washed gravel or crushed stone suitably processed and conforming to the requirements of ASTM Standard Specifications for Concrete Aggregate, Serial Designation C 33, latest revision.
2. Coarse aggregate as delivered to the mixing plant shall be graded, or individual sizes shall be so combined as to fall within the following limitations:

Percentage by Weight Passing

Laboratory Sieves with Square Openings

Screen Size Inches	2" Max. (No.357)	1-1/2" Max. (No. 467)	1" Max. (No. 57)	3/4" Max. (No. 67)
2-1/2	100	-----	-----	-----
2	95-100	100	-----	-----
1-1/2	-----	95-100	100	-----
1	35-70	-----	95-100	100
3/4	-----	35-70	-----	95-100
1/2	10-30	-----	25-60	-----
3/8	-----	10-30	-----	20-55
No.4	0-5	0-5	0-10*	0-10*

\*Not more than 5 percent shall pass No. 8 Sieve

3. Coarse aggregate which fails to pass the soundness test, as specified, shall be used only with the approval of the Engineer who may, at his option, order that freezing-and-thawing test be made.
4. Unless otherwise shown on the plans or directed by the Engineer, the maximum size of aggregate shall no exceed:
  - a. One-fifth the dimension for nonreinforced members;
  - b. Three-fourths the clear spacing between reinforcing bars or between reinforcing bars and forms, or
  - c. One-third the depth of nonreinforced slabs on ground.

#### D. Water

Water used in mixing concrete shall be fresh, clean, potable water free from injurious amounts of oil, acid, alkali, vegetable, sewage and/or organic matter. Water shall be considered as weighing 8.33 pounds per gallon.

#### E. Admixtures

1. Except as herein specified, no curative or hardening admixtures shall be used.
2. An air entrainment agent capable of providing 3-6 percent air shall be used.
3. A workable admixture of "Pozzolith", "WRDS4A" or "Plastiment" as manufactured by Master Builders Company, W.R. Grace and Company and Sika Company, respectively, or approved equal, shall be used in recommended and approved proportions. When using "Pozzolith", "WRDA",

or "Plastiment", an air entrainment agent shall be added in proper proportions to secure 3-6 percent air.

## 2.02 VAPOR BARRIER

Vapor barriers shall be installed under concrete slabs on ground where shown on the drawings or as directed by the Engineer. Vapor barriers shall be constructed of .006 inch (6 Mil.) polyethylene sheets placed on a cushion of fine aggregate meeting the requirements of Section 3.06. All joints in polyethylene sheets shall be lapped 18 inches and taped.

## 2.03 STRENGTH

Concrete ingredients shall be selected, proportioned and mixed in such manner as will produce concrete which will develop the compressive strength started below in 28 days, when tested in accordance with the procedures set forth in the ASTM Standard Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field, Serial Designation C 31, latest revision, and in ASTM Standard Method of Test for Compressive Strength of Molded Concrete Cylinders, Serial Designation C39, latest revision:

<u>Class</u>	<u>Minimum Average 5 Consecutive Specimens</u>	<u>Minimum for Any One Specimen</u>
A	4000 pounds per sq. in.	3500 pounds per sq. in.
B	3000 pounds per sq. in.	2500 pounds per sq. in.

## PART 3 - EXECUTION

### 3.01 STORAGE OF CONCRETE MATERIALS

- A. Cement shall be shipped to the site of the mixer plant in bulk, paper or cloth bags, at the option of the Contractor. Upon arrival it shall be stored immediately in a thoroughly dry, weather-tight and properly ventilated building with adequate provisions for the prevention of absorption of moisture. It shall be stored in a manner that will permit easy access for inspection and identification of each shipment. Storage facilities shall be provided by and at the expense of the Contractor and approved by the Engineer prior to arrival of the first shipment.
- B. Sand and coarse aggregates shall be stored in separate stockpiles at points selected to provide maximum drainage and to prevent the inclusion of any foreign material during rehandling. Stockpiles of coarse aggregates shall be built in horizontal layers to avoid segregation and breakage. Where concrete volumes required batching of various aggregate sizes, a separate stockpile for each size shall be maintained.

3.02 PROPORTIONING

- A. Concrete materials shall be proportioned by weight to produce a workable mixture in which the water content and slump shall not exceed the maximum herein specified and the volume of cement shall not be less than herein specified.
- B. The exact proportions of concrete ingredients within the limits here specified shall be varied to conform to the varying quality of the ingredients. The Contractor shall provide all equipment necessary to determine positively and to control the actual amounts of all materials entering into the concrete. The proportions shall be changed whenever such changes become necessary to obtain the specified and desired workability, density, strength, and uniformity. The Contractor shall not be compensated for any such changes unless they involve the use of cement in excess of the maximum specified herein.
- C. Materials shall be measured by weight. The types of equipment and methods used for measuring material shall be subject to the approval of the Engineer.
- D. The following water cement ratios with proper proportioning of aggregate and with approved admixture shall be used to obtain concrete meeting these specifications.

<u>Class of Concrete</u>	<u>Aggregate Size</u>			
	<u>2"Max.</u>	<u>Max.</u>	<u>1-1/2"</u> <u>1"Max.</u>	<u>3/4"Max.</u>
<u>Class A</u>				
Min.cement per CY of Concrete	5.3 CF	5/8 CF	6.2 CF	6.6 CF

Max.water-cement ratio by weight	0.49	0.49	0.49	0.49
Max.water per CF of cement	5.5Gals.	5.5gals.	5.5Gals.	5.5Gals.

Class B

Min.cement per CY of Concrete	5.0 CF	5.5 CF	5.9 CF	6.3 CF
Max.water-cement ratio by weight	0.62	0.62	0.62	0.62
Max.water per CF of cement	7.0Gals.	7.0Gals.	7.0Gals.	7.0Gals.

- E. The amount of moisture carried on the surface of the coarse aggregate and sand particles shall be included in calculating the water content of each mix. The amount of water and cement used shall be the minimum amount necessary to produce a plastic mixture of the specified strength and of the desired workability. In general, the slump shall be between 1-1/2 inches and 4 inches, and in no case shall it be more than 5 inches, when determined in accordance with the ASTM Standard Method of Slump Test of Consistency of Portland Cement Concrete, Serial Designation C-143, latest revision.
- F. The total volume of aggregate to be used in each cubic yard of concrete shall be determined by recognized standards for designing concrete mixes, utilizing the actual screen analysis of the aggregates.
- G. Maximum size of aggregate in concrete for various portions of the work shall be designated by the Engineer based on thickness of section and clearance of reinforcement.

## 3.03 MIXING AND TRANSPORTING CONCRETE

- A. Concrete shall be mixed by one of three alternate methods, namely: (1) by the operation of one or more batch-type mixing plants, each with a rated capacity of 1.2 cubic yard or more, installed at the site of the work; (2) by the operation of a proportioning plant installed in the vicinity of the work and the use of transit mixers for mixing concrete and transporting it to the forms; and (3) by the use of ready-mixed concrete from a central mixing and proportioning plant. The method selected by the Contractor shall be subject to the approval of the Engineer.
- B. The mixing and proportioning plants shall be provided with adequate equipment and facilities for accurate measurement and control of the quantities of material and water used in the concrete, and for readily changing the proportions to conform to the varying conditions and requirements of the work.

- C. If ready-mixed concrete is to be used in lieu of concrete mixed at the site of the work, materials shall conform to requirements of paragraphs 2.01A through 2.01E, inclusive, of these specifications. Proportioning, mixing and transportation of concrete to the forms and the transit or truck mixers and operation of same all shall be in strict conformity with the requirements of the ASTM Standard Specification, latest revision, for Ready-Mixed Concrete, Serial Designation C 94.
- D. Stationary mixers shall be in accordance with the Concrete Mixer Standards adopted by the Mixer Manufacturer's Bureau of the Associated General Contractors of America. The mixer shall be rotated at the rate recommended by the manufacturer. The mixing time shall be as follows:

<u>Capacity of Mixer</u>	<u>Time in Minutes</u>
1/2 cubic yards	1-1/4
3/4 to 1-1/2 cubic yards	1-1/2
Larger than 1-1/2 cubic yards	2

The mixing time shall be measured from the time that all cement and aggregates and most of the water are in the mixer. Excessive overmixing, requiring additional water to preserve the required consistency will not be permitted.

- E. Chutes may be used to convey concrete only if the concrete slides without internal motion. Vertical drops shall not be greater than 5 feet. Pumped concrete is permissible. In general, concrete shall be positioned as close as possible to its final location to prevent segregation and this should be accomplished by using bottom dump buckets where possible.
- F. If transit or truck mixers are used, the concrete shall be delivered to the forms and discharge from the hauling container within a period of one hour and 30 minutes after the introduction of the mixing water to the cement and aggregates, or the cement to the water aggregates. During hot weather when the air temperature is above 90 degrees, the delivery time limit shall be reduced to 45 minutes. Prolonged mixing, even at agitating speed, shall be avoided where feasible by stopping the mixer and then agitation intermittently. When concrete cannot be delivered to the forms within the time limit specified, a water-reducing retarder, such as Daratard, as manufactured by Grace Construction Materials; Chemtard, as manufactured by Chem-Masters Corporation; or Pozzolite Retarder, as manufactured by Master Builders Company, may be used subject to the permission and approval of the Engineer. Such use of a water-reducing retarder will be permitted only as necessary to supplement (not to replace) other acceptable hot weather procedures. The admixtures used shall not interfere with strength development and other properties of the concrete and provided this use is carefully controlled by the concrete supplier. Before any such admixture is

permitted it shall be tested with job site materials under job conditions to determine its compatibility with the other materials and its ability under these conditions to produce the desired properties.

### 3.04 CONCRETE PLACEMENT

- A. Concrete shall be placed before initial set has occurred and in no event after it has contained its water content for more than one hour and 30 minutes. To prevent separation of the the mix, the concrete shall be deposited in batches by use of a crane and concrete bucket. The bucket shall be deposited in batches by use of a concrete surface and limited to a free drop of not over 5 feet, unless otherwise authorized by the Engineer. The concrete shall be deposited in walls by means of prefabricated rectangular tremies, constructed in short sections and spaced not over 5 feet apart. Placing techniques shall be followed to insure there will be on cold joints or plastic shrinkage cracking.
- B. Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces, free from water, and never upon soft mud, dry absorbent earth or rock, or upon fills that have not been subjected to approved tamping to provide ultimate settlement. No concrete pour shall be started until the condition of the form or place of pouring has been approved by the Engineer.
- C. After the concrete has been deposited it shall be distributed over the entire area within the forms in horizontal layers not more than 18 inches thick. It shall be compacted and worked into all corners and angles and around reinforcement and embedded fixtures in a manner to fill all voids, prevent honeycombing against the forms and avoid segregation of coarse aggregate. This operation shall be performed by the use of spade and internal vibrator. The operation shall be continuous and all concrete shall be in final position before initial set has started.
- D. Vibration shall be transmitted directly to the concrete and in no case shall it be transmitted through the forms. Vibrator driving mechanisms shall revolve at not less than 7000 rpm. The intensity of vibration shall be sufficient to cause settlement to the concrete into place. The vibration shall be of sufficient duration to accomplish the forms along exposed faces in order to secure smooth, dense, even surfaces. Vibrators shall not be used to transport concrete within the forms. Vibrators shall be kept in motion at all times to prevent excessive vibration in one spot.

### 3.05 FORMS

- A. Forms shall be of wood, steel or other approved material that will give a smooth unmarked finish. Unless otherwise specifically authorized, the sheeting for wood forms shall be tongue-and-groove lumber or plywood of sufficient thickness to secure desired rigidity.

- B. Forms shall be built true and conform to lines and grades shown on the plans and shall be cement mortar tight and sufficiently rigid to prevent displacement. Form surfaces shall be smooth and free from irregularities, dents, sags or holes. Bolts and rods used for internal ties shall be arranged so that when the forms are removed, no metal will be less than 2 inches from any concrete surface. Forms shall be constructed so they can be removed without hammering or prying against the concrete. Wire ties shall not be used. Through-form rods in walls shall be fitted with washers wedged to the rods as water stops. At least one side of a form shall be open above the construction joint to which a pour is about to be made.
- C. Unlined forms shall be coated with a nonstaining mineral oil that shall be applied shortly before the concrete is to be placed. Forms for unfinished surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used.
- D. All salient corners of beams, slabs, columns and walls shall be provided with a 1 inch by 1 inch (1.4 inch on the diagonal) chamfer formed by wood or metal strips.
- E. Forms shall not be removed without the approval of the Engineer. Removal shall be accomplished in a manner that will prevent injury to the concrete. In general and under average conditions, the Engineer will approve removal of forms as follows:
- |                 |         |
|-----------------|---------|
| Slabs           | 14 days |
| Monolithic Pipe | 7 days  |
| Columns         | 7 days  |
| Walls           | 2 days  |
| Other Concrete  | 2 days  |

### 3.06 FINISHING

- A. All permanently exposed surfaces shall be expected to be smooth and of uniform texture and appearance. All holes, pits or imperfections in the surface of the concrete shall be cleaned with a wire brush, thoroughly wetted and completely filled with damp cement mortar composed of 1 part cement to 2 parts concrete sand. The entire surface shall be left smooth and all lines or markings shall be smoothed over to obtain uniform appearance. In the event the Contractor fails to obtain a satisfactory appearance of the concrete in the opinion of the Engineer, the entire surface shall be thoroughly wetted down, kept wet continuously and rubbed with a No. 20 carborundum stone until all lines, markings and surplus materials have been removed from the surface and until the surface shows a uniform smooth finish. After rubbing is

completed the concrete surface shall be washed clean with water. Rubbing may be done either by hand or with power tools.

- B. No special concrete or cement mortar topping course shall be used for slab finish unless so shown on the plans. The base slabs shall be brought to a true and even finish by power or hand floating. Where a trowel finish is shown on the plans, it shall be made with steel trowels in such a manner as to produce a dense, smooth, impervious surface, free from blemishes. Care shall be taken that no excess water is present when the finish is made. All permanently exposed edges shall be chamfered with 3/4 inch approved edging tool unless other treatment is indicated on the plans. All slabs shall be finished carefully to the true surfaces shown on the plans so not water can stand on the surface.

### 3.07 CONSTRUCTION JOINTS

- A. Joints, either vertical or horizontal, shall be made only at the locations indicated on the plans unless permitted by the Engineer and then only at places designated by him. Water stops of type and size shall be used at location shown on the drawings or as directed by the Engineer.
- B. Keys shall be 1/3 the width of the walls in width and 1/6 the width of the walls in depth. All keys shall be continuous and none shall be smaller than 4 inches in width and 2 inches in depth.
- C. A jet of air and water shall be applied to the surface of horizontal construction joints to remove all laitance when the concrete has set sufficiently for the jet to expose the coarse aggregate without loosening same. Immediately prior to placing another lift, the surface shall be thoroughly cleaned and washed by water jet followed by air jet to remove standing water. The surface shall then be covered with a 1/2 inch thick layer of 1.3 cement-sand mortar evenly distributed and of the same water-cement ratio as the concrete to follow. No vertical construction joints in walls shall be used except by special permission.

### 3.08 EXPANSION AND CONTRACTION JOINTS AND WATER STOPS

- A. Expansion and contraction joints and water stops shall be constructed where shown on the plans. They shall be of type and detail indicated on the plans.
- B. Expansion joint materials and water stops shall be approved by the Engineer.

### 3.09 WATERTIGHT STRUCTURES

It is the intention of these specifications to provide impervious concrete. All pits below groundwater level and all structures for holding or carrying water must be watertight. A loss of not more than 1/4 inch depth in 24 hours will be permitted when water-holding structures are filled. All exposed surfaces of

waterholding structures and interior surfaces of pits below groundwater level shall be free from visible damp spots or seepage before acceptance. Repeated tests and repairs may be required by the Engineer to obtain watertight structures. All structures shall be drained at the completion of tests unless otherwise directed by the Engineer. The cost and expense of testing and providing watertightness in structures and of remedying defects shall be borne by the Contractor.

### 3.10 EMBEDDED ITEMS

- A. Wherever steel or cast iron pipe, fittings, valves, collars, sleeves, structural steel, electrical conduits, appurtenances and fixtures, equipment anchorages or castings are shown for embedment in the concrete, such items must be on hand before concrete is poured. They shall be set in place accurately and firmly braced before concrete is poured around them. No cutouts for future installation of these items shall be permitted.
- B. Before placing concrete the Contractor shall see that all embedded parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from any coating, rust, scale, oil or other foreign matter. The embedding of wood in concrete shall be avoided whenever possible. If wood is allowed it shall be thoroughly wetted before the concrete is placed.

### 3.11 WATERPROOFING

- A. The use of special admixtures or integral waterproofing compounds for concrete required to be watertight is not required but may be permitted, provided the materials and methods used are approved in writing by the Engineer.
- B. Membrane waterproofing shall be applied to all unexposed exterior surfaces of all building and structures where indicated on the plans except where concrete is poured against the neat lines of rock excavation without forms.
- C. Pitch shall conform to the requirements of Federal Specifications R.P. 381, Type II. Open-mesh, tar-saturated, waterproofing cotton fabric shall conform to the requirements of Federal Specifications HH-C-591.
- D. All surfaces on which the waterproofing is to be applied shall be firm, smooth, dry and free from loose material. The entire surface to be waterproofed shall be given a uniform priming coat of coal tar primer. Then a coat of hot pitch shall be applied to the surface and while still hot and starting at the bottom a layer of tarred cotton fabric shall be embedded into it running horizontally. Successive coating of hot pitch and cotton fabric shall be applied until there are 5 coatings of pitch and 4 layers of fabric. Each layer of fabric shall be thoroughly worked into the hot pitch to prevent wrinkles, buckles, pockets or

blisters. Both vertical and horizontal laps shall be 4 inches. Not less than 150 pounds of pitch shall be used per 100 square feet of completed surface and the pitch shall not be heated above 350 degrees F.

- E. At salient corners, 2 extra layers of fabric and pitch extending 1 foot each side of corner shall be applied.
- F. If waterproofing is not punctured by drains, pipes, etc., suitable provisions shall be made to prevent water from getting behind the waterproofing and between it and the surface waterproofed.
- G. Where waterproofing is punctured by drains, pipes, etc., suitable provisions shall be made to prevent water getting behind the waterproofing and between it and the surface waterproofed.
- H. The waterproofing shall be protected by backfilling immediately after completion. Care shall be exercised during backfill operations not to puncture the membrane.

**\*\* END OF SECTION \*\***