3321
Gray Iron Castings

3321.1 SCOPE
This Specification covers gray iron castings for drainage or structural use. The castings are classified according to tensile strength, but provisions are made for acceptance of drainage castings and other ornamental or non-stress bearing castings on the basis of flexural tests.

3321.2 REQUIREMENTS
Castings furnished under this Specification shall conform to AASHTO M 105 for the class specified in the Contract. The castings shall be supplied by foundries that have been approved by the State Materials Engineer, subject to the additional requirements or modifications set forth hereinafter.

A Class Designation
Where no strength class is specified in the Contract, castings shall be furnished in accordance with the following:
(1) Class 40C, or better, shall be furnished for all stress bearing castings such as bridge rockers, bolsters, and sliding shoes.
(2) Class 35B, or better, shall be furnished for all bridge rail posts, light standard bases, drainage and manhole castings, and other castings subject to vehicle impact or vehicle loading.

B Special Requirements
For all drainage castings, the metal shall have a Brinell Hardness Number within the range of 190 to 265.
The lid-to-frame surfaces on all round casting assemblies shall be machine milled to provide true bearing around the entire circumference.

C Test Specimens
Three test bars shall be cast for each heat or tap. When alloys are added in the ladle, three test bars shall be cast for each ladle. Where continuous furnace pouring practice is used, two test bars shall be cast for the beginning and two for the end of cast.
For bridge bearing castings, not less than one test bar shall be cast for each casting, and unless the test bars are cast as an integral part of the bearing castings, the castings and test bars shall be poured in the presence of the Engineer's representative.
Each test bar shall be separately and properly identified to the corresponding castings by the use of symbols, letters or numbers cast on the test bar and casting.
When proper identification of castings and corresponding test bars cannot be established, the Engineer may require that test specimens be cut from selected castings representative of a lot and make tests on those samples to determine acceptability of the castings.

D Foundry Control
Before casting is started, the manufacturer and the Engineer shall establish, in conference, a control procedure for the purpose of correlating casting operations, arranging for foundry inspection, and establishing an approved identification system. Unless otherwise agreed upon by the Engineer, the manufacturer shall identify all castings as follows:
(1) Each casting shall bear an identification mark correlating the casting with test bars by the use of a system of heat numbers or a calendar date and tap number, using numerals not over 13 mm (**½ inch**) in size.
(2) Each casting shall bear an identification mark indicating the source of manufacture, which mark shall either be a symbol not over 38 mm (**1 ½ inches**) in greatest dimension or in letter form no greater than 19 mm (**¾ inches**) in height and 50 mm (**2 inches**) in length.
(3) Each casting shall bear the Department's type or style number shown in the Plans, in the size and location indicated.
On all castings of sufficient size, the above described identification marks shall be formed in the casting during manufacture. If the casting size is not sufficient for all marks, stamped metal tags wired to the castings shall be used for those markings that are not formed in the castings. The location of identification marks shall be subject to approval by the Engineer and shall be such that they will not interfere with assembly of parts and will not be removed during any machine finishing operations required. No manufacturer shall place its name on any casting in any other manner than specified above.

E Casting Details
All castings shall conform to the dimensions shown in the Plans. Draft shall be provided by increasing the net dimensions. A tolerance of 3 mm (**1/8 inch**) in the overall general dimensions will be permitted, except that the tolerance in dimensions of grates and covers for drainage casting assemblies, and the openings into which they fit, will be limited to 1.5 mm (**1/16 inch**). In no case shall the thickness of metal be less than 1.5 mm (**1/16 inch**) less than the thickness shown in the Plans

All castings shall have a density of at least 95 percent of the theoretical density of that type [based on 7080 kg/m^3 (**442 pounds/foot^3**)] cast to the exact dimensions shown in the Plans. All castings shall be poured in closed molds with proper gating, feeders, risers and sprues. They shall completely fill the molds and shall not be removed from the molds until properly cooled. Chilling the castings will not be permitted. On all castings, the inside and re-entrant corners shall be boldly filleted and the outside corners and edges shall be rounded to a radius of not less than 3 mm (**1/8 inch**). For bridge bearings, a 13 mm (**½ inch**) fillet shall be used except where interference may result in an assembly.

F Workmanship and Finish

All attachments of gates, risers, and sprues shall be carefully removed from the castings and any extensions remaining shall be ground flush to the casting surface. Castings damaged through careless removal of attachments will be rejected. No repairs will be permitted by welding. All castings shall be free from sponginess, cracks, blow holes, warping, sand inclusions, cold shuts, chilled iron shrinks, and any other defects affecting the strength and value of the casting for the purpose intended. All contact surfaces between different castings in an assembly shall present a firm and even bearing, without rattling or rocking. All castings shall be thoroughly cleaned of all foundry sand, rust, scale, and other foreign matter.

3321.3 INSPECTION AND TESTING

The manufacturer shall cast the required number of test bars and machine finish all tension test specimens to the specified dimensions. Unless otherwise established by agreement with the Engineer, the manufacturer shall deliver all test specimens to the Materials Laboratory where testing will be done.