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Documentation The producer of the structural precast units shall keep accurate records of aggregate gradations, concrete batching, testing, curing, and inspection activities to verify that forms, reinforcing and unit dimensions conform to these requirements. Copies of reports shall be furnished to the Resident when requested.

Marking The date of manufacture, the production lot number, and the type of unit shall be clearly and indelibly scribed on a rear, unexposed portion of each unit.

Handling, Storage and Shipping All units shall be handled, stored, and shipped in such a manner as to eliminate the danger of chipping, cracks, fracture, and excessive bending stresses. Any units found damaged upon delivery, or damaged after delivery, shall be subject to rejection.

## SECTION 713 - STRUCTURAL STEEL AND RELATED MATERIAL

713.01 Structural Steel Highway bridge steel shall meet the requirements of AASHTO M 270M/ M 270 (ASTM A 709/ A 709M). The grade of steel shall be as specified on the plans.

Main load-carrying components subject to tensile stresses or stress reversal shall meet the notch toughness requirements in AASHTO M 270M/ M270, Supplementary Requirement S5, Table 9, Zone 2, for non-fracture critical steel or S6, Table 10, Zone 2 for fracture critical steel, (ASTM A 709/A 709M, S83 or S84 TABLE S1.2 or S1.3, Zone 2). Frequency of tension tests shall comply with the requirements of S1. Fracture critical material shall also comply with the supplementary requirements of S7 and S9

Impact test sampling and testing procedures shall be in accordance with AASHTO T 243M/ T 243 (ASTM A 673/A 673M).

Steel for ancillary bridge products and steel structures shall conform to AASHTO M 270M/ M 270 (ASTM A 709/A 709M) or one or more of the following:

ASTM A 36/A 36M

ASTM A 572/A 572M

ASTM A 588/A 588M

ASTM A 53

ASTM A 500

ASTM A 595 Grade C

ASTM A 786/A 786M

ASTM A 847

ASTM A 992/992M

Ancillary bridge products shall be as described below:

- (a) bearings
- (b) drainage components
- (c) expansion devices (gland seal, compression seal, finger joint)
- (d) modular expansion devices
- (e) steel bridge rail
- (f) catwalks and inspection walkways

713.02 High Strength Bolts Bolts shall conform to the requirements of AASHTO M164M/M164 (ASTM A325M/A325), Type 1 or Type 3. Type 3 bolts shall be supplied for all structures utilizing unpainted AASHTO M270M/M270 (ASTM A709/A709M) weathering steel.

Nuts shall meet the requirements of AASHTO M291M/M291 (ASTM A563M/A563) or AASHTO M292M/M292 (ASTM A194M/A194).

Circular and beveled washers shall conform to the requirements of AASHTO M293M/M293 (ASTM F436/F436M).

Direct Tension Indicators (DTI'S) shall conform to the requirements of ASTM F959/F959M. DTI's for use with painted steel shall have a plain "as fabricated" finish. DTI's for use with unpainted steel shall be galvanized to the requirements of AASHTO M298 (ASTM B695 Class 50, Type I) and have a fusion-bonded epoxy coating. DTI's used with galvanized steel, metalized steel and steel coated with a zinc-rich primer shall be galvanized to the requirements of AASHTO M298 (ASTM B695 Class 50, Type I).

"Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies shall meet the requirements of ASTM F1852. They shall meet the chemical and mechanical requirements of AASHTO M164M/M164 (ASTM A325/A325M).

Bolts, nuts and washers specified to be galvanized may be galvanized by either hot dip galvanizing to the requirements of AASHTO M232M/M232 (ASTM A153/A153M) Class C or mechanically galvanized to the requirements of AASHTO M298 (ASTM B695), Class 50, Type I).

All fastener (bolts and nuts), whether black or galvanized, shall be coated with a suitable lubricant. Galvanized nuts shall be lubricated with a lubricant containing a visible dye.

Each lot of bolts, nuts, washers and DTI's shall be tested by the manufacturer in accordance with the tests tabulated in Table 1 - Test Schedule. The testing frequency for bolts, nuts and washers from each shipping lot of fasteners shall be as specified in the applicable AASHTO/ASTM Standard Specifications. The testing frequency for each production lot of DTI's shall be as specified in ASTM F959/F959M.

TABLE 1 - TEST SCHEDULE\*

Bolts	Tensile Strength (Wedge Test)	ASTM F606/F606M
	Proof Load	ASTM F606/F606M
	Hardness	ASTM F606/F606M
	Coating Thickness	ASTM A153/A153M, ASTM B695
Nuts	Proof Load	ASTM F606/F606M
	Hardness	ASTM F606/F606M
	Coating Thickness	ASTM A153/A153M, ASTM B695
Washers	Hardness	ASTM F606/F606M
	Coating Thickness	ASTM A153/A153M, ASTM B695
DTI's	Coating Thickness	ASTM B695
	Compression Load	ASTM F959

\*The supplier(s) shall submit test reports for all testing required in this Table. Test reports shall contain, in addition to the test results, the name and address of the testing agency, the manufacturer, lot tested, and Mill Test Reports for all steel used in the manufacture of the fastener assemblies and DTI's.

The supplier shall perform, or cause to be performed a Rotational Capacity Test (RCT) for every production lot combination of bolts, washers and nuts. Each combination shall be designated with a unique RCT lot number. The test results shall be furnished to the Engineer.

713.03 Preformed Pads Preformed pads shall be made with new unvulcanized rubber and unused fabric fibers and shall be approximately 3 mm [ $\bullet$  in] thick after compression and vulcanizing with a proportion of fiber content sufficient to maintain strength and stability. The surface hardness shall be 85 to 95 Shore A Durometer. The ultimate breakdown limit of the pad under compressive loading shall be no less than 70 MPa [10,000 psi].

713.04 Bronze or Copper-Alloy Bearing and Expansion Plates Bronze bearing and expansion plates shall conform to the requirements of AASHTO M107 (ASTM B22), Alloy No. 911 and copper alloy bearing and expansion plates shall conform to the requirements of AASHTO M108, (ASTM B100) Alloy No. 510 or 511, unless otherwise specified. The bearing surface(s) subject to sliding action shall be provided with trepanned recesses (not grooves) filled with a lubricating compound. The lubricating compound shall consist of graphite and metallic substances with a lubricating binder capable of withstanding the atmospheric elements. The compound shall be pressed into the recesses to form dense, non-plastic lubricating inserts.

The lubricating area shall comprise between 25% and 35% of the total area of the plate subject to sliding action. The sliding surface(s) shall be planed parallel to the prevailing direction of movement of the structure and subsequently polished, unless detailed otherwise.

713.05 Cold-finished Carbon Steel Shafting Cold-finished carbon steel shafting shall conform to the requirements of AASHTO M169 (ASTM A108). Grade Designation 1021-1030 inclusive, cold drawn, either semi-killed or fully-killed, shall be furnished unless otherwise specified.

713.06 Castings Gray iron castings shall conform to the requirements of AASHTO M105. Class Number 30 shall be furnished unless otherwise specified.

Malleable iron castings shall conform to the requirements of ASTM A47M/A47. Grade Number 22010 [Number 32510] shall be furnished unless otherwise specified.

Steel castings shall conform to Standard Specification for Steel Castings for Highway Bridges, AASHTO M192/M192M or mild-to-Medium Strength Carbon-Steel Castings for General Applications AASHTO M103/M103M (ASTM A27/A27M). The class 70 or grade 485 - 250 [70 - 36] of steel, respectively, shall be used unless otherwise specified.

Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other defects in positions affecting their strength and value for the service intended.

Castings shall be boldly filleted at angles and the arrises shall be sharp and perfect.

All castings must be sand blasted or otherwise effectively cleaned of scale and sand to present a smooth, clean, and uniform surface.

713.07 Metal Bin Type Retaining Wall The metal for bin type retaining wall members shall be galvanized and shall conform to the applicable requirements of AASHTO M36/M36M.

When fiberglass, aramid or carbon graphite fiber coating is specified, the galvanized metal sheets used to form the retaining wall, except the base plates and connecting channels, shall additionally be coated on both sides with a layer of fiberglass, aramid or carbon graphite fibers applied in sheet form by pressing it into the molten spelter. Immediately after the metallic bond has solidified the fibers shall be thoroughly saturated with a bituminous saturant conforming to the following requirements:

Penetration at 25°C [77 °F], 100g [3.5 oz], 5 sec. in]	3.5 - 4.5 mm [0.14 - .018 in]
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Loss on heating at 163°C [325°F], 50g [1.75 oz], 5hrs	Not more than 1.5%
Flash point (open cup) [440°F]	Not less than 226°C

Penetration at 25°C [77 °F], 100g [3.5 oz], 5 sec., of residue after heating at 163°C [325°F], as compared with penetration of asphalt before heating	Not less than 70%
Insoluble in carbon disulfide	Not more than 2%

Testing shall be in accordance with methods specified in AASHTO M20.

Whenever possible in the manufacture of the units, a minimum forming radius of 25 mm [1 in] is to be maintained. All units that are formed with less than 25 mm [1 in] radius shall be hot-dipped galvanized after forming.

Bolts shall conform to the requirements of ASTM F568 Class 4.6 (ASTM A307) and galvanized in accordance with ASTM A153.

713.08 Steel Extrusions Material for steel extrusions for expansion devices shall be ASTM A36/A36M, ASTM A588/A588M, or ASTM A242/A242M, except that ASTM A242/A242M shall not be used for extrusions that are to be welded.

## SECTION 714 - JOINT SEALS

714.01 Elastomer for Seal Elements The preformed elastomeric polychloroprene joint seal elements, both compression and gland type, shall conform to the requirements of AASHTO M297 (ASTM D3542).

714.02 Fabric for Seal Elements Fabric used for reinforcement in a seal element shall be a non-wicking fabric conforming to the requirement of ASTM D578.

714.03 Lubricant Adhesive The lubricant-adhesive shall be a 1 part, moisture curing, polyurethane and aromatic hydrocarbon solvent mixture and shall have the following physical properties:

Solids content	60-80% by weight
Service Range	-15°C [5°F] to 49°C [120°F] minimum
Film Strength (ASTM D412)	8.3 MPa [1200 psi] minimum
Elongation at Break	250% minimum

Each lot of lubricant-adhesive shall be delivered in sealed containers plainly marked with the manufacturer's name or trademark and the date of manufacture. Maximum shelf life shall not exceed 6 months.

714.04 Sealant The sealant shall be a one part, moisture curing, polyurethane base, non-sag, elastomeric product, conforming to the requirements of Federal Specification TT-S-0023OC(2), Type II, Class A or ASTM C920, Type S, Grade NS, Class 25.

Each lot of sealant shall be delivered in sealed containers plainly marked with the manufacturer's name or trademark and the date of manufacture. Maximum shelf life shall