# Type B Certifications


**April 2014**

# Table of Contents

**916.02(b) Type B**

Type B certification shall be prepared by the manufacturer. It shall show the limits of test values for the specified tests and shall certify that the materials furnished comply with the specifications. The applicable specification shall be referred to in the certification. The tests may be conducted in the laboratory of the manufacturer or in another qualified laboratory.

**916.03(c) Sample Type B Certification Form**

INDIANA DEPARTMENT OF TRANSPORTATION
TYPE B CERTIFICATION OF COMPLIANCE

CONTRACTOR NUMBER _____
PROJECT NUMBER _____
CONTRACTOR'S NAME _____
MANUFACTURER'S NAME _____
B/L or INVOICE NUMBER _____
MATERIAL DESTINATION _____

This is to certify that for the contract described above, the materials supplied are as follows:

| **Material Name | Quantity |
|---|---|
| _____ | _____ |
| _____ | _____ |

***Conform to: _____

The materials listed above comply with the following Test Methods and are within the acceptable limits of said Test Methods:

| TEST METHOD | LIMITS OF TEST VALUE |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

_____ _____
Date Company of Manufacture

_____
*Signature of Company Official/Title

* This Certification shall be prepared by the manufacturer of the material being supplied for this contract.
** Identifying information such as Alloy, Grade, Type, Class, or other similar designation shall also be shown when appropriate.
*** Applicable material specification reference shall be listed.

# Concrete Admixture
# Latex Modifier

**Certification:** Type B

**Frequency Manual Reference:** REF. # 12, 02 of 02

**Specification:** 912.04

**Requirements:** Latex modifiers are an admixture to be added to the concrete mixture at the continuous mixer. The latex shall be one of the latex modifiers in the list of approved Admixtures for Portland Cement Concrete.

The formulated latex admixture shall be a non-toxic, film forming, polymeric emulsion in water to which all stabilizers have been added at the point of manufacture and shall be homogeneous and uniform in composition.

Physical properties of the latex modifier shall be in accordance with the following:

| PHYSICAL PROPERTY | TYPE or LIMITS of TEST VALUES |
|---|---|
| Polymer Type | Styrene Butadiene |
| Stabilizers | Anionic and Nonionic Surfactants |
| Antifoaming Agent | Polydimethylsiloxane |
| Percent Solids, % by Mass | 46.0 Minimum |
| Mass Per Gallon | 8.4 lb at Minimum |
| pH (as shipped) | 9.0 - 11.0 |
| Freeze/Thaw Stability | 5 Cycles, -15° to 25°C |
| Shelf Life | 2 Years, Minimum |
| Color | White |

# Crack and Joint Filler
# Polychloroprene Joint Membrane and Adhesive

**Certification:** Type B

**Frequency Manual Reference:** REF. # 17, 05 of 08

**Specification:** 906.02(a)3 and 906.02(b)

**Requirements:** Polychloroprene joint membrane shall be general purpose, heavy duty polychloroprene sheeting with nylon fabric reinforcement. The sheeting shall be in accordance with the following:

| Property | Test Method | Requirement |
|---|---|---|
| Thickness | ASTM D 751 | 0.094 in. $\pm$ 0.01 in. |
| Breaking Strength, Grab Test, minimum | ASTM D 751 | 700 lbf x 700 lbf (Longitudinal x transverse) |
| Adhesive Strip, 1 in. by 2 in. | ASTM D 751 | 9 lbf (minimum) |
| Burst Strength | ASTM D 751 | 1,400 psi (minimum) |
| Heat Aging, 70 h, 212°F | ASTM D 2136 | 180° bend with no cracking of coating |
| Low Temp. Bend Test, 1h, 40°F | ASTM D 751 | Bend around a 1/4 in. mandrel with no cracking of coating |

# Crack and Joint Filler
# Preformed Joint Filler for Concrete

**Certification:** Type B

**Frequency Manual Reference:** REF. # 17, 07 of 08

**Specification:** 906.01

**Requirements:** Joint fillers shall be preformed materials intended to be used in PCCP and bridge joints or as otherwise specified. Joint fillers shall be in accordance with AASHTO M 213.

Compression: The load required to compress the test specimen to 50 percent of its thickness before test shall be not less than 690 kPa and not more than 5200 kPa. If the nominal thickness of the specimen is less than 13 mm, a maximum load of 8600 kPa will be permitted. The sample after compression shall not show a loss of more than 3 percent of its original mass.

Extrusion: The test specimen shall be compressed to 50 percent of its thickness before the test with three of its edges restrained. The amount of extrusion of the free edge shall not exceed 6 mm.

Recovery: The test specimen shall be compressed to 50 percent of its thickness before the test. The load shall be released immediately after application. At the end of the 10 minutes after the release of application of the load, the specimen shall have recovered to at least 70 percent of its thickness before test.

Density: For fiber joint only, oven dry the specimen at 104 ± 3ºC for 2 hours or at a constant weight. After oven drying, cool the specimen to room temperature in a covered desiccators and weight to the nearest 0.1 g. The density of air-dried filler material shall not be less than 304 kg/m³. The density of oven dried fiber filler shall not be less than 288 kg/m³.

Water Absorption; A standard expansion joint filler test specimen with four square cut edges, when submerged horizontally under 25 mm of water at 21 ± 3ºC, shall absorb not more than 15 percent by volume in 24 hours for nominal thickness of 13 mm and over, and 20 percent by volume for all other thicknesses.

Asphalt Content: At least 35 percent by mass of the finished product shall be asphalt uniformly distributed throughout the cross-section of the material.

# Delineator Posts (Metal)

**Certification:** Type B

**Frequency Manual Reference:** REF. # 81, 07 and 08 of 10

**Specification:** 910.15

**Requirements:** The tensile strength shall be determined by either the standard Rockwell Hardness test, Brinnel Hardness test, or by actual tensile test. The Rockwell Hardness shall be a minimum of B 91. The yield strength shall be determined by the manufacturer by actual test. Tensile and yield strengths and chemical composition shall be determined by the average from the three latest test results the manufacturer has available at the time of shipment. These test results need not be made on the materials from which the posts were made. However, the tests must have been made within 90 days of shipment. Posts, except those used for temporary construction signs, temporary traffic signs, and temporary panel signs, shall be certified by a type B certification in accordance with 916. The certification shall include the above three test results and the elastic section modulus value in accordance with 910.14(a) 3.

Posts shall conform to the following table and to deflection tests required in 910.14(a) 2.

| Type | Minimum Elastic Section Modulus | Loading |
|---|---|---|
| A | .200 | 1,500 lb |
| B | .400 | 3,500 lb |
| C | .560 | 4,600 lb |
| Abb* | .670 | ** |
| Bbb* | 1.190 | ** |

* Back to Back

** Back to Back post shall be tested singly for deflection prior to assembly.

Note: The elastic section modulus values shall be included in the type B certification.

Posts shall be in accordance with 910.14(a) 1.

Physical requirements for the finished delineator posts shall be:

Width of flange face..... 2 to 2 3/8 in.
Width of back..... 3/4 to 7/8 in.
Depth from face of flange to back ..... 7/8 to 1 1/8 in.
Length ..... 7.0 ft ± 1 in.
Weight..... 1.0 to 1.5 lb/ft

Delineator posts shall be punched with a minimum of twenty-four 1/4 in. holes on the centerline spaced on 1 in. centers beginning 1 in. from the top.

# Elastomeric Bearing Pads (BR)

**Certification:** Type B

**Frequency Manual Reference:** REF. # 6, 01 of 01

**Specification:** 915.04

**Requirements:** Polyisoprene, or Natural Rubber, Quality Control Tests

| PHYSICAL PROPERTIES | TEST METHOD | LIMITS OF TEST VALUE |
|---|---|---|
| Ultimate Tensile Strength, Min., ksi (MPa) | ASTM D 412 | 2.25 (15.5) |
| Ultimate Elongation, Min. % | ASTM D 412 | 425 |
| Hardness | ASTM D 2240 | 55 ± 5 |
| Change in Tensile Strength, Max. % when over aged | ASTM D 412 AND D 573 | -25 |
| Change in Ultimate Elongation, Max. % when over aged | ASTM D 412 AND D 573 | -25 |
| Change in Hardness, Max. % when over aged | ASTM D 2240 AND D 573 | 10 |
| Compression Set (22 h @ 158ºF, Max. %) | ASTM D 395, Method B | 25 |
| Ozone Resistance | ASTM D 1149 | No cracks |
| Adhesion | ASTM D 429, Method B | Bond strength at least 40 lb/in and adhesion failure R*- 80 |
| Brittleness | ASTM D 746, Procedure B | No Failure |
| Compressive Strain | 915.04(e)1 | Shall not exceed 7% at 800 psi (5.5MPa) average unit pressure or at design dead load plus live load pressure |
| Shear Resistance | 915.04(e)2 | Shall not exceed 40 psi (276 kPa) for 55 durometer |

R* indicates failure in the rubber

Polychloroprene, or Neoprene, Quality Control Tests:

| PHYSICAL PROPERTIES | TEST METHOD | LIMITS OF TEST VALUE |
|---|---|---|
| Ultimate Tensile Strength, Min., ksi (MPa) | ASTM D 412 | 2.25 (15.5) |
| Ultimate Elongation, Min. % | ASTM D 412 | 375 |
| Hardness | ASTM D 2240 | 55 ± 5 |
| Change in Tensile Strength, Max. % when over aged | ASTM D 412 AND D 573 | -15 |
| Change in Ultimate Elongation, Max. % when over aged | ASTM D 412 AND D 573 | -40 |
| Change in Hardness, Max. % when over aged | ASTM D 2240 AND D 573 | 15 |
| Compression Set (22 h @ 158ºF, Max. %) | ASTM D 395, Method B | 35 |
| Ozone Resistance | ASTM D 1149 | No cracks |
| Adhesion | ASTM D 429, Method B | Bond strength at least 40 lb/in and adhesion failure R*- 80 |
| Brittleness | ASTM D 746, Procedure B | No Failure |
| Compressive Strain | 915.04(e)1 | Shall not exceed 7% at 800 psi (5.5MPa) average unit pressure or at design dead load plus live load pressure |
| Shear Resistance | 915.04(e)2 | Shall not exceed 75 psi (517 kPa) for 55 durometer |

R* indicates failure in the rubber

# Elastomeric Seals

**Certification:** Type B

**Frequency Manual Reference:** REF. # 63, 07 of 07

**Specification:** 907.27

**Requirements:** Elastomeric seals for joining plastic pipe shall be in accordance with ASTM F 477. The results of the following tests shall be provided on the type B certification.

Physical Requirements for Elastomeric Seals for Plastic Pipe:

| PHYSICAL PROPERTIES | TEST METHOD | LIMITS OF TEST VALUE | |
|---|---|---|---|
| | | Low-Head Application (Below 150 kPa or 50-ft Head) | High-Head Application (150 kPa or 50-ft Head and Above) |
| Tensile strength Min., psi | ASTM D 412 or D 1414 | 1200 | 2000* |
| Ultimate elongation, Min., % | ASTM D 412 or D 1414 | 325 | 400 |
| Hardness | ASTM D 2240 or D 1414 | 40 to 60 | 40 to 60 |
| Low-Temperature Hardness | ASTM D 2240 or D 1414 | 15 | 15 |
| Compression Set (22 h @ 158ºF, Max. %) | ASTM D 395 Method B, or D 1414 | 25 | 20 |
| Accelerated Aging- change in tensile strength | ASTM D 573 | -15 | -15 |
| Accelerated Aging- change in tensile strength | ASTM D 573 | -20 | -20 |
| After Water Immersion: change in Volume max %) | ASTM D 471 | 5 | 5 |
| Ozone Resistance | ASTM D 1149 | No cracks | No cracks |

*For EPDM and nitrile seals, tensile strength min. psi is 1500

Physical Requirements for Thermoplastic Elastomeric Seals for Plastic Pipe:

| PHYSICAL PROPERTIES | TEST METHOD | LIMITS OF TEST VALUE | |
|---|---|---|---|
| | | Low-Head Application (Below 150 kPa or 50-ft Head) | High-Head Application (150 kPa or 50-ft Head and Above) |
| Tensile strength Min., psi (MPa) | ASTM D 412 or D 1414 | 435 (3.0) | 500 (3.5) |
| Ultimate elongation, Min., % | ASTM D 412 or D 1414 | 350 | 350 |
| 100% Modulus, min, psi (MPa) | ASTM D 412 or D 1414 | 200 (1.4) | 280 (1.9) |
| Hardness | ASTM D 2240 or D 1414 | 40 to 70 | 40 to 70 |
| Low-Temperature Hardness | ASTM D 2240 or D 1414 | 10 | 10 |
| Compression Set (22 h @ 158ºF, Max. %) | ASTM D 395 Method B, or D 1414 | 25 | 20 |
| Accelerated Aging-change in tensile strength | ASTM D 573 | -15 | -15 |
| Accelerated Aging-change in tensile strength | ASTM D 573 | -15 | -15 |
| After Water Immersion: change in Volume max %) | ASTM D 471 | 4 | 4 |
| Ozone Resistance | ASTM D 1149 | No cracks | No cracks |
| Force Delay (Stress Relaxation) | ASTM F 913 | 40 | 50 |

# Expansion Joints
# Type M

**Certification:** Type B

**Frequency Manual Reference:** REF. #7, 02 of 03

**Specification:** 906.07b

**Requirements:** Elastomer shall be neoprene in accordance with ASTM D 3542 and meet the following requirements:

| PHYSICAL PROPERTIES | TEST METHOD | LIMITS OF TEST VALUE |
|---|---|---|
| Tensile strength Min., psi | ASTM D 412 | 2000 |
| Ultimate elongation, Min., % | ASTM D 412 | 250 |
| Hardness | ASTM D 2240 | 55 ± 5 |
| Oven-age tensile reduction, of original (70 h @ 212ºF) | ASTM D 573 or D 412 | -20 |
| Oven-age elongation reduction, of original (70 h @ 212ºF) | ASTM D 573 or D 412 | -20 |
| Oven-age Hardness change, of original (70 h @ 212ºF) | ASTM D 573 or D 412 | 0 to +10 |
| Oil Swell, IRM 903 (70 h @ 212ºF, weight change, max. %) | ASTM D 471 | 45 |
| Ozone Resistance (20 % strain, 300 pphm in air,70 h at 104°F (wiped with toluene to remove surface contamination) | ASTM D 1149 | No cracks |

# Expansion Joints
# Type SS

**Certification:** Type B

**Frequency Manual Reference:** REF. #7, 01 of 03

**Specification:** 906.07a

**Requirements:** The elastomer shall be neoprene in accordance with ASTM D 5973 except that the physical requirements in Table 1 for low temperature recovery, high temperature recovery, and compression-deflection properties will not apply.

| PHYSICAL PROPERTIES | TEST METHOD | LIMITS OF TEST VALUE |
|---|---|---|
| Tensile strength, Min., psi | ASTM D 412 | 2000 |
| Ultimate elongation, Min., % | ASTM D 412 | 250 |
| Hardness | ASTM D 2240 | 60 ± 5 |
| Oven-age tensile reduction, of original (70 h @ 212ºF) | ASTM D 573 or D 412 | -20 |
| Oven-age elongation reduction, of original (70 h @ 212ºF) | ASTM D 573 or D 412 | -20 |
| Oven-age Hardness change, of original (70 h @ 212ºF) | ASTM D 573 or D 412 | 0 to +10 |
| Compression Set (70 h @ 212ºF, Max. %) | ASTM D 395 Method B | 35 |
| Oil Swell, IRM 903 (70 h @ 212ºF, weight change, max. %) | ASTM D 471 | 45 |
| Ozone Resistance (20 % strain, 300 pphm in air,70 h at 104°F) | ASTM D 1149 | No cracks |

# Herbicide

**Certification:** Type B

**Frequency Manual Reference:** REF. 45, 01 of 01

**Specification:** RSP 624-M-024

**Requirements:** The herbicide to be applied shall consist of a specified formulation. Such mixture shall consist of 1 unit of the specified formulation. A pre-mixed formula containing specified minimum acid equivalents may be used. The rate of application shall be 1 unit of mixture per 1 ac for the formulation specified.

Tests of the herbicide material will not be required. However, a type B certification in accordance with 916.01 and 916.02(b) shall be provided. All herbicide material to be used shall be in accordance with the requirements of the Indiana Herbicide Law. Such material shall be registered with the Indiana State Chemist located at the Purdue University Department of Biochemistry, West Lafayette. All containers shall be factory sealed when delivered to the project site. A specimen label and a Material Safety Data sheet for each chemical shall be present on the spray truck at all times.

# High Density Bearing Strip

**Certification:** Type B

**Frequency Manual Reference:** N/A*

**Specification:** 906.08

**Requirements:** The strip shall be nontoxic multipolymer plastic in accordance with the following requirements:

| Property | Test Method | Requirement |
|---|---|---|
| Compressive Strength | ASTM D 695 | 8,000 to 9,000 psi |
| Coefficient of Linear Expansion | ASTM D 696 | $7.62 \times 10^{-4}$ mm/mm/ºC to $1.27 \times 10^{-3}$ mm/mm /ºC |

*This item will appear in the 2015 Frequency Manual.

# Joint Membrane System for Precast Concrete Box Culverts

**Certification:** Type B

**Frequency Manual Reference:** REF. # 67, 01 of 01

**Specification:** 907.07

**Requirements:** The Contractor may elect to use an approved self-adhering membrane system instead of the detail shown on the plans.

Joint membrane systems shall be in accordance with the following requirements:

| PHYSICAL PROPERTIES | TEST METHOD | LIMITS OF TEST VALUE |
|---|---|---|
| Thickness | ASTM D 3767 Procedure A | 59 mil Min. |
| Tensile Strength | ASTM D 4632,<br>Grab Tensile Strength | 650 N Min. |
| Elongation | ASTM D 4632,<br>Grab Tensile Strength | 20 % Min. |
| Bursting Strength | ASTM D 3786,<br>Mullen Burst | 290 psi Min. |
| Peel Strength | ASTM D 903 | 850 N/m Min. |
| Permeance | ASTM E 96, Water Method | 1.05 Perm Max |

The membrane system shall be supplied in roll widths of at least 12 in. The membrane shall be a composite sheet material composed of a non-woven fabric and a polymer membrane material. The membrane shall be protected by a release paper.

# Mastic Pipe Joint Sealers

**Certification:** Type B

**Frequency Manual Reference:** REF. # 66

**Specification:** 907.11

**Requirements:** Material for sealing the joints of bell and spigot or tongue and groove concrete or clay pipe or culverts furnished under this specification shall not contain asbestos fibers, and shall be in accordance with one of the following:

Preformed Flexible Joint Sealants

Joint sealants shall be either bitumen or butyl rubber in accordance with ASTM C 990. The results of the following tests shall be shown on the type B certification.

| PROPERTY | Test Method |
|---|---|
| Hydrocarbon Blends | ASTM D 4 (bitumen) or D 297 (butyl) |
| Ash-Inert Mineral Matter | AASHTO T 111 |
| Volatile Matter | ASTM D 6 |
| Specific Gravity @ 77°F | ASTM D 71 |
| Ductility @ 77°F | AASHTO T 51 or ASTM D 113 |
| Flash Point | ASTM D 92 |
| Fire Point | ASTM D 92 |
| Softening Point | ASTM D 36 |
| Compression Index@ 77°F & 32°F | ASTM C 972 |
| Cone Penetration @ 77°F & 32°F, 150 g, 5 s, mm/10 | ASTM D 217 |
| Chemical Resistance | ASTM C 990 |

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Bituminous Mastic Sealant

A cold applied, mineral filled, bituminous joint sealing compound that can be applied to the joints with a trowel when the air temperature is between 20° and 100° F. The bituminous material shall adhere to the concrete or clay pipe so as to make a watertight seal and shall not flow, crack, or become brittle when exposed to the atmosphere.

The mastic shall also be in accordance with the following.

| PROPERTY | Minimum | Maximum |
|---|---|---|
| Grease cone penetration unworked, 77°F, 150 g, 5 s, ASTM D 217, mm/10 | 125 | 275 |
| Non-Volatile, 10 g, 220°-230°F, 24 hr | 75% | |
| Loss on Heating, 325°F, 5 hr, 50 g | | 20% |
| Inorganic Content (complete burn, 1200° to 1400°F) | 15% | 45% |
| Flash Point, ASTM D 92 or D 1310 | 100°F | |
| Fire Point, ASTM D 92 or D 1310 | 150°F | |
| High Temperature Resistance to Flow | No sag | |
| Cold Temperature Flexibility | No cracks | |

# Bearing Assemblies with Polytetrafluoroethylene, PTFE, Sliding Surfaces

**Certification:** Type B

**Specification:** 915.05

**Requirements:** A copy of the manufacturer's design manual shall be submitted for approval when directed.

All steel components shall be in accordance with ASTM A 709, grade 36 unless otherwise shown on the plans. Where these assemblies are to be used in conjunction with a self-weathering steel bridge, the steel components shall be in accordance with ASTM A 709, grade 50W. Stainless steel mating surfaces shall be 14 gage minimum ASTM A 240, type 304 sheets with a maximum surface roughness of 20 Rms.

The PTFE shall be 100% virgin unfilled polymer or 15% glass filled and etched on the bonding side. The properties of the PTFE shall be in accordance with the following:

| REQUIREMENT | TEST METHOD | VALUE |
|---|---|---|
| Tensile Strength, Min. | ASTM D 638 | 2,500 psi |
| Elongation, % Min. | ASTM D 638 | 200 |
| Specific Gravity | ASTM D 792 | 2.1 to 2.3 |

PTFE, where required, shall be bonded to grit blasted steel. The PTFE guides shall be bonded and mechanically fixed into place. The bonding compound used to bond PTFE or elastomeric pads to steel plates shall be in accordance with ASTM D 429, Method B.

All steel surfaces exposed to the environment shall be zinc metalized and shall be 7 mils thick in accordance with SSPC-CS 23.00, or painted in accordance with 619.09(a). The finish coat for painted steel shall be in accordance with 909.02(d). The color shall be in accordance with Federal Standard 595, color No. 20045.

# Rubber Type Gaskets (Ring)

**Certification:** Type B

**Frequency Manual Reference:** REF. # 65, 01 of 01

**Specification:** 907.13

**Requirements:** Ring gaskets for pipe shall be in accordance with ASTM C 1619, class C. The results of the following tests shall be provided on the type B certification:

| PHYSICAL PROPERTIES | TEST METHOD | LIMITS OF TEST VALUE |
|---|---|---|
| Tensile strength, Min., psi | ASTM D 412 | 1200 |
| Ultimate elongation, Min., % | ASTM D 412 | 350 |
| Hardness | ASTM D 2240 | 40-60 |
| Oven-age tensile reduction, of original | ASTM D 573 and D 412 | -15 |
| Oven-age elongation reduction, of original | ASTM D 573 and D 412 | -20 |
| Compression Set (22 h @ 158ºF, Max. %) | ASTM D 395 Method B | 25 |
| Water absorption, max % weight increase | ASTM D 471 | 10 |
| Ozone Resistance | ASTM D 1149 | No cracks |
| Splice Strength Classification | ASTM D 2527 | Class 3 |

# Sign Posts (Steel)

**Certification:** Type B

**Frequency Manual Reference:** REF. # 81, 05 of 10

**Specification:** 910.14a, b and e

**Requirements:** The minimum yield strength shall be 60,000 psi and the minimum tensile strength shall be 90,000 psi. The tensile strength shall be determined by either the standard Rockwell Hardness test, Brinnel Hardness test, or by actual tensile test. The Rockwell Hardness shall be a minimum of B 91.

| Type | Minimum Elastic Section Modulus | Loading |
|---|---|---|
| A | 0.200 | 1,500 lb (6,672 N) |
| B | 0.400 | 3,500 lb (15,569 N) |
| C | 0.560 | 4,600 lb (20,462 N) |
| Abb* | 0.670 | ** |
| Bbb* | 1.190 | ** |

* Back to Back
** Back to Back post shall be tested singly for deflection prior to assembly.
Note: The elastic section modulus values shall be included in the Type B certification

# Snowplowable Raised Pavement Markings

**Certification:** Type B

**Frequency Manual Reference:** REF. # 95, 01 of 01

**Specification:** 921.02d

**Prismatic Reflectors Requirements:** Snowplowable raised pavement marker shall consist of a cast metal base to which is attached a replaceable prismatic reflector for reflecting light longitudinally along the pavement from a single or from opposite directions. Both ends of the casting shall be shaped to deflect a snowplow blade upward. The prismatic reflectors and cast metal bases shall be in accordance with ASTM D 4383. Only prismatic reflectors and cast metal bases from the Department's list of approved snowplowable pavement markers shall be used.

Coefficient of Luminous Intensity, R:

| **Entrance Angle β2** | **Observation Angle** | **Minimum Value R, mcd/lx** | | | | |
|---|---|---|---|---|---|---|
| | | **White** | **Yellow** | **Red** | **Green** | **Blue** |
| 0º | 0.2º | 279 | 167 | 70 | 93 | 26 |
| + 20º/-20º | 0.2º | 112 | 67 | 28 | 37 | 10 |
| Entrance Angle β2 | Observation Angle | Minimum Value R, cd/fc | | | | |
| | | White | Yellow | Red | Green | Blue |
| 0º | 0.2º | 3.0 | 1.8 | 0.75 | 1.0 | 0.28 |
| + 20º/-20º | 0.2º | 1.2 | 0.72 | 0.30 | 0.40 | 0.11 |

| **PHYSICAL PROPERTIES** | **TEST METHOD** | **LIMITS OF TEST VALUE** |
|---|---|---|
| Lens Impact Strength | ASTM D 4383 (10.4.2) | Face of lens shall show no more than two radial cracks longer than 6.4 mm (0.25 in) |
| Temperature Cycling | ASTM D 4383 (10.4.3) | No cracks or delamination |
| Adhesive Bond Strength | Field tests | Test marker required to experience no more than 1.5 times as great an adhesion failure rate as the controls |
| Compressive Strength | ASTM D 4383 (10.5) | Able to support 26700 n (2270 kgf, 6000 lbf) |
| Ramp Hardness of Holders | ASTM D 4383 (10.6) | 51-55 HRC |

Adhesive requirements**:** The epoxy adhesive shall be in accordance with AASHTO M 237, type IV, Table 3 with respect to composition and performance.

Chemical Composition of Type IV Epoxy

| **Component A** | **Parts by Mass** |
|---|---|
| Epoxy Resin Epon 828, Shell (or equal) | 100.00 |
| Titanium Dioxide (TT-P-442, Type III, Class A) | 7.68 |
| Talc #13 (or equal) | 36.64 |
| **Component B** | |
| N-Aminoethyl Piperazine Jefferson (or equal) | 25.10 |
| Nonylphenol | 50.03 |
| Talc Fiberene C-400, Sierra (or equal) | 69.28 |
| Molacco Black (or equal) | 0.23 |
| Cabasil* | 0.50 |

*Cabasil was added to inhibit setting

Performance of Type IV Epoxy

| **PHYSICAL PROPERTIES** | **LIMITS OF TEST VALUE** |
|---|---|
| Bond Strength to Concrete at 25 ± 1ºC (77 ± 2ºF), max | 210 (maximum time, minutes to reach 1380 kPa) |
| Slant Shear Strength (24 hr at 25 ± 1º C) kPa (psi), min | 13,790 |
| Slant Shear Strength (24 hr at 25 ± 1º C, plus water soak) kPa (psi), min | 10,342 |

# Steel Pipe

**Certification:** Type B

**Frequency Manual Reference:** REF. # 73

**Specification:** 715.02 (j)

**Requirements:** Pipe with a 4 in. outside diameter and in accordance with ASTM A 513, type 5, may be used as an alternate to the 4 in. outside diameter pipe specified. The pipe used as an alternate shall have a minimum wall thickness of 5/16 in. and a minimum yield strength of 50,000 psi. Steel tube of 4 in. by 4 in. by 3/8 in., and in accordance with ASTM A 500, Grade B, will also be allowed as an alternate to the 4 in. outside diameter pipe specified.

The results of the wall thickness measurement, outside diameter measurement, and the yield strength test shall be provided on the type B certification.

# Temporary Turbidity Curtain

**Certification:** Type B

**Frequency Manual Reference:** N/A

**Specification:** RSP 205-C-231

**Requirements:** Materials shall be in accordance with the following:

| | |
|---|---|
| Ballast | minimum 0.7 lbs/ft enclosed 1/4 in. galvanized chain |
| Curtain fabric material type | impermeable vinyl-nylon laminate |
| Flotation | 6 in. diameter marine quality expanded polystyrene |
| Grab tensile strength | minimum 300 lbs, in accordance with ASTM D 4632 |
| Net buoyancy | 13 lbs/ft |
| Top load carrying components | fabric only |
| Weight of fabric | 18 oz/sq yd |

The materials shall be a bright color and shall be installed and maintained per the manufacturer's recommendations.