

partly outside the body of the pile, but the distance between the line and pile shall be not more than 1/2 percent of the length of the pile or 3 inches, whichever is smaller.

Points for timber piles shall be steel or cast iron and of a shape that will allow a secure connection to the pile and will withstand driving.

Timber piles shall be branded prior to shipment with the supplier brand, year of treatment, species of timber and preservative treatment, retentions, class, and length. Brand symbols shall conform to the requirements of AWPA M6.

- (c) **Timber preservatives** shall be used according to their suitability for the condition of exposure to which they will be subjected and shall not be used interchangeably. Treatments shall conform to the following limitations:
1. Waterborne preservatives shall be used for timber where a clean surface is desirable. The moisture content of wood material shall be not more than 19 percent at the time of treatment.
 2. Pentachlorophenol may be used for timber that is not to be painted.
 3. Preservatives shall conform to the requirements of AASHTO M133 except that coal tar creosote solution will not be permitted.
 4. Pressure treatment shall conform to the requirements of AWPA C2 except for piles, which shall conform to the requirements of AWPA C3. Gage readings will be the criteria for acceptance except in cases involving referee testing, in which the assay method will be the determining computation.

SECTION 237—BEDDING MATERIAL AND BEARING PADS

237.01—Description.

These specifications cover material used under bearing devices of structures.

237.02—Detail Requirements.

- (a) **Elastomeric Bearing Pads:** The elastomer portion of pads shall be new neoprene compound. Pads shall be cast under heat and pressure and may be individually molded or cut from pressure-cast stock. Variations from the dimensions shown on the plans shall be not more than the following: thickness, $\pm 1/16$ inch; width, $-1/8$ to $+1/4$ inch; length, $-1/8$ to $+1/4$ inch. Tolerances, dimensions, finish and appearance, flash, and rubber-to-metal

bonding shall conform to the requirements of A 4-F3-T.063-B2, Grade 2, Method B, in accordance with the *RMA Rubber Handbook*. Pads shall be furnished in one piece and shall not be laminated unless otherwise specified. Pads shall be furnished in identifiable packages.

Adhesive for use with elastomer pads shall be an epoxy-resin compound, compatible with the elastomer, having a sufficient shear strength to prevent slippage between pads and adjacent bearing surfaces.

Laminated pads shall consist of alternate laminations of elastomer and hot-rolled steel sheets molded together as a unit. The bond between the elastomer and metal shall be such that failure shall occur in the elastomer and not between the elastomer and steel when tested for separation.

Material having a nominal durometer hardness of 70 and 50 shall be used for nonlaminated pads and laminated pads, respectively. Test samples will be prepared from finished pads. Samples of each thickness will be taken from 2 full-size pads from each shipment of 300 pads or less, with 1 additional pad for each additional increment of 300 pads or fraction thereof. When tested using the ASTM methods designated, samples shall comply with the following physical requirements.

1. **Original physical properties:** Test results for tear resistance, tensile strength, and ultimate elongation shall be not more than 10 percent below the following specified value:

	Nominal 50	Hardness 70
Min. tear resistance, ASTM D624, Die C (lb/in of thickness)	180	200
Hardness, ASTM D2240 (points)	50 ± 5	70 ± 5
Min. tensile strength, ASTM D412 (average psi of longitudinal and transverse)	2,500	2,500
Min. ultimate elongation (%)	400	300

The compressive deflection tested in accordance with the requirements of ASTM D575, Method A, shall be as follows:

- a. **Laminated pads:** The maximum compressive deflection shall be 7 percent of the total rubber thickness at the total load given in the plans. The maximum shear resistance shall be 50 pounds per square inch of the plan area at 25 percent shear deformation at -20 degrees F. Test pads shall be subjected to a compressive load of 1.5 times the maximum design load without visible damage.

b. **Nonlaminated pads:** When loaded within 300 to 800 pounds per square inch, material shall show a compressive deflection within 20 percent of that given in the charts of VTM-23, interpolating for actual measured hardness.

2. **Changes in original physical properties:** When pads are oven aged 70 hours at 212 degrees F in accordance with the requirements of ASTM D573, changes shall be not more than the following:

Property	Value
Hardness (points change)	0 to +15
Tensile strength (% change)	±15
Ultimate elongation (% change)	-40

3. **Extreme temperature characteristics:** Compression set under constant deflection, ASTM D395, Method B, 22 hours at 212 degrees F, shall be not more than 35 percent. With the low temperature brittleness test, ASTM D746, breaks shall not occur above -20 degrees F.
4. **Ozone cracking resistance:** Upon exposure to 100 parts per million of ozone in air by volume at a strain of 20 percent and a temperature of 100 ± 2 degrees F in a test otherwise in accordance with the requirements of ASTM D1149, cracks shall not develop within 100 hours. Samples shall be wiped with solvent before the test to remove traces of surface impurities.
5. **Oil swell:** The volume change shall be not more than +120 percent when tested in accordance with the requirements of ASTM D471 with ASTM Oil No. 3, 70 hours at 212 degrees F.

(b) **TFE Bearing Surfaces:**

1. TFE resin shall be virgin material conforming to the requirements of ASTM D1457. The specific gravity shall be 2.13 to 2.19. The melting point shall be 623 ± 2 degrees F.
2. Filler material shall be milled glass fibers, carbon, or other approved inert filler materials.
3. Adhesive material shall be an epoxy resin conforming to FS MMM-A-134, FEB film or equal, as approved by the Engineer.
4. When tested in accordance with the requirements of ASTM D1457, finished unfilled TFE sheets shall have a tensile strength of at least 2,800 pounds per square inch and an elongation of at least 200 percent.

5. Filled TFE sheets shall contain inert filler material uniformly blended with TFE resin. Finished filled TFE sheets containing glass fiber or carbon shall conform to the following:

	ASTM Method	15% Glass Fibers	25% Carbon
Min. tensile strength	D1457	2,000 psi	1,300 psi
Min. elongation	D1457	150%	75%
Min. specific gravity	D792	2.20	2.10
Melting point	D1457	327 ± 10°C	317 ± 10°C

6. Fabric containing TFE fibers shall be manufactured from oriented multifilament TFE fluorocarbon fibers and other fibers as required by specific designs. When tested in accordance with the requirements of ASTM D2256, the tensile strength of TFE fibers shall be at least 24,000 pounds per square inch and the elongation shall be at least 75 percent.
7. Where TFE sheets are to be epoxy bonded, one surface of the sheet shall be factory treated by an approved manufacturer using the sodium naphthalene or sodium ammonia process.
8. Stainless steel mating surfaces shall be at least 16 gage in thickness and shall conform to the requirements of ASTM A240, Type 304. The mating surface shall be a true plane surface with a Brinell hardness of at least 125 and a surface finish of at least No. 8 mirror finish in accordance with the requirements of ASTM A480. Stainless steel mating surfaces shall be polished or rolled as necessary to conform to the friction requirements specified herein. The stainless steel shall be attached to the sole plate by means of a seal weld around the entire perimeter of the facing material.
9. The coefficient of friction for the completed bearing assembly shall be not more than the following:

Material	Bearing Pressure		
	500 psi (3.447 MPa)	2,000 psi (13.790 MPa)	3,500 psi (24.132 MPa)
Unfilled TFE, fabric containing TFE fibers, TFE perforated metal composite	.08	.06	.04
Filled TFE	.12	.10	.08
Interlocked bronze and filled TFE structures	.10	.07	.05

- (c) **Sheet Lead and Common Desilverized Bedding Material:** Material shall conform to the requirements of ASTM B749 and shall be furnished in single sheets of the specified thickness.
- (d) **Preformed Fabric Bedding Material:** Material shall be composed of multiple layers of 8-ounce cotton duck impregnated and bound with high-quality natural rubber or its equivalent and equally suitable materials compressed into resilient pads of uniform thickness. The number of plies shall be such as to produce the specified thickness after compression and vulcanizing. Finished pads shall withstand compression loads perpendicular to the plane of the laminations of at least 10,000 pounds per square inch without a detrimental reduction in thickness or extrusion.

SECTION 238—ELECTRICAL AND SIGNAL COMPONENTS

238.01—Description.

These specifications cover conduits, conductors, junction boxes, traffic signal components, and necessary fittings to complete a described electrical or traffic signal system.

238.02—Detail Requirements.

- (a) **Metal Conduit and Fittings:** Conduit shall conform to the requirements of, and be galvanized in accordance with the requirements of UL-6. Fittings for metal conduit shall conform to the requirements of, and be galvanized in accordance with the requirements of UL-514. Conduit for use in underground installations, concrete encasements, or corrosive environments shall also be coated on the outside with an asphalt mastic in accordance with the requirements of AASHTO M243 or shall have a PVC coating of 40 mils or another approved coating.
- (b) **PVC Conduit and Fittings:** Conduit shall be heavy wall conduit conforming to the requirements of UL-651. Fittings for PVC conduit shall conform to the requirements of UL-514. Exposed PVC conduit shall be UL listed or ETL Testing Laboratories, Inc. listed for use in direct sunlight. Each section of conduit shall be marked with the letters UL or ETL. Solvent cement used for joining shall conform to the requirements of ASTM D2564. Protective shields shall be galvanized sheet steel of commercial quality with an ASTM A525 coating designation of G115 and a thickness of 0.0625 in.
- (c) **Fiberglass Reinforced Epoxy Resin Conduit and Fittings:** Conduit and fittings shall conform to the requirements of NEMA TC-14. Conduit shall be standard wall except when the conduit diameter is 3 inches or less or