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REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF RESEARCH AND STANDARDS
EDSA, QUEZON CITY

NOV 05 2013

DEPARTMENT ORDER)
No. 103)
Series of 2013 11.18.13)

SUBJECT: **DPWH Standard Specification for Item 612 – Reflective Thermoplastic Stripping Materials (Solid Form) with Performance Requirements**

In view of the updates prescribed under AASHTO M 249-12 and AASHTO M 247-09 Standard Specification for **White and Yellow Reflective Thermoplastic Stripping Materials (Solid Form) and Glass Beads Used in Pavement Markings** respectively, the existing specification under **Item 612 – Reflective Thermoplastic Stripping Materials (Solid Form) with Performance Requirements** of the DPWH Standard Specification for Highways, Bridges and Airports, Volume II, 2012 Edition is hereby revised in order to be consistent with the latest edition of the above-mentioned AASHTO standards.

As such, it is hereby directed that the attached modified standard specification for Item 612 - Reflective Thermoplastic Stripping Materials (Solid Form) with Performance Requirements shall be adopted effective immediately. In no case should any white and yellow thermoplastic stripping materials be used in the project without conforming to the material and performance requirements as prescribed herein.

For strict compliance.

ROGELIO L. SINGSON
Secretary

Department of Public Works and Highways
Office of the Secretary
WIN3U00815

DPWH STANDARD SPECIFICATION FOR

Item 612 - Reflective Thermoplastic Stripping Materials (Solid Form) with Performance Requirements

612.1 Description

This standard specifies the requirement for reflectorized thermoplastic pavement stripping material with performance requirements conforming to AASHTO M 249-12 that is applied to the road surface in a molten state by mechanical means with surface application of glass beads and will produce an adherent reflectorized stripe of specified thickness and width capable of resisting deformation by traffic.

612.2 Materials Requirements

a. Reflectorized Thermoplastic Pavement Material shall be homogenously composed of pigment, filler, resins and glass reflectorizing spheres. The thermoplastic material shall be available to both white and yellow.

b. Glass Reflectorizing Sphere (Glass Beads). Premix beads shall be uncoated and conform to AASHTO M 247-09:

i. Gradation. The beads minimum gradation requirements shall be Type 1 in accordance with AASHTO M-247-09 given in Table 1.

ii. Roundness. The beads shall have minimum of 90 percent true sphere.

iii. Refractive Index. The beads shall have minimum refractive index of 1.50.

Table 1- Gradation of Glass Beads

Sieve Designation, mm	Type I AASHTO M-247-09
1.18	100
1.00	-
0.850	95-100
0.710	-
0.600	75-95
0.425	-
0.300	15-35
0.180	0-5
0.150	0-5

612.3 General Requirements

Shall be in accordance with the requirements given in Table 2.

Table 2 - Requirements

Property		**White**	**Yellow**
Specific Gravity, maximum		2.15	
Composition			
Resin	Binder, minimum	18.0	18.0
Glass Reflectorizing Sphere	Glass Beads	30-40	30-40
Filler	Calcium carbonate and inert fillers, maximum	42.0	See note
Pigment	Titanium dioxide, minimum	10.0	-
	Yellow, minimum	-	See note
Physical Characteristics:			
Color after heating for four (4) hours ± 5min. @ 218 ± 2°C, Daylight reflectance @ 45° - 0°, Minimum		75%	45%
Drying time, minutes, maximum Air Temp. 10 ± 2°C Air Temp. 32 ± 2°C		2.0 10.0	
Cracking Resistance @ Low Temperature – after heating for four (4) hours ±5 min. @ 218 ± 2°C		No cracks	
Impact Resistance - after heating for four (4) hours ±5 min @ 218 ± 2°C and forming test specimens, Minimum		115.0 mm/kg	
Softening Point – after heating for four (4) hours ±5 min @ 218 ± 2°C		102.5 ± 9.5°C	
Flowability – after heating for four (4) hours ±5 min @ 218 ± 2°C, maximum		18%	21%
Yellowness index, maximum		0.12	-
Flowability – Extended Heating - after heating for four (4) hours ±5 min @ 218 ± 2°C, maximum		28%	
Bond Strength to Portland Cement Concrete – after heating for four (4) hours ±5 min @ 218 ± 2°C, maximum		1.24 MPa	
Storage Life		1 year	

Note: Amount of Yellow Pigment, calcium carbonate, and inert fillers shall be at the option of the manufacturer, providing all other requirements of AASHTO M 249-12 are met.

612.4 Performance Requirements

The in-place thermoplastic pavement material shall be capable of maintaining the minimum retroreflectance value in accordance with Table 3 when tested according with the testing procedures specified in Subsection 612.7.2.

Table 3 - Performance Requirements

Performance Period (After Installation)	Minimum Retroreflectance Value (mcd / m^2 / lux)			
	DRY		CONTINUOUS WET	
	White	Yellow	White	Yellow
7 days	325	200	100	50
6 months	200	100	75	
1 year	150	75	50	

612.5 Application Properties

The thermoplastic material shall readily extrude at a temperature of 211 $\pm$ 7°C, from approved equipment to produce a line with a minimum thickness of 3.2 mm which shall be continuous and uniform in shape having clear and sharp dimensions.

The material shall not exude fumes which are toxic, obnoxious or injurious to persons or property when heated during application.

The rate of application and size of glass beads for drop-on methods shall be at the option of the manufacturer/applicator, provided that all the performance requirements are met.

The applied thermoplastic pavement markings shall have a minimum of two (2) years of longevity/durability.

612.5.1 Application Method

a) **Preparation of Road Surface** - The materials should be applied only on the surface which is clean and dry. It shall not be laid into loose detritus, mud or similar extraneous matter, or over an old paint markings, or over an old thermoplastic marking which is faulty. In the case of smooth, polished surface stones such as smooth concrete, old asphalt surfacing with smooth polished surface stones and/or where the method of application of the manufacturer of the thermoplastic

materials shall be recommended, and with the approval of the Engineer.

b) **Preparation of Thermoplastic Materials** – The materials shall be melted in accordance with the manufacturer's instruction in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic and such the local overheating shall be avoided. The temperature of the mass shall be within the range specified by the manufacturer and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer. The molten material shall be used as expeditiously as possible and for thermoplastics which have natural resin binders or otherwise sensitive to prolong heating the materials shall not be maintained in a molten condition for more than 4 hours.

c) **Laying** – Center lines, lane lines and edges lines shall be applied by approved mechanical means and shall be laid in regular alignment. Other markings may be applied by hand-screed, hand propelled machine or by self-propelled machine approved or directed by the Engineer. After transfer to the laying apparatus the materials shall be maintained within the temperature ranges specified by the manufacturer and stirred to maintain the right consistency for laying.

Road markings of a repetitive nature, other center lines, lane lines, etc., shall unless otherwise directed by the Engineer be set out with stencils which comply with the size and spacing requirements shown on the Plans.

d) **Re-use of Thermoplastic Materials** – At the end of the day's as much as possible the material remaining in the heater and /or laying apparatus shall be removed. This may be broken and used again provided that the maximum heating temperature has not been exceeded and that the total time during which it is a molten condition.

612.5.2 Defective Materials or Workmanship

Materials which are defective or have been applied in an unsatisfactory manner or to incorrect dimensions or in a wrong location shall be removed, the road pavement shall be made good and materials replaced, reconstructed and/or properly located, all at the Contractor's expense and to the satisfaction of the Engineer.

612.5.3 Protection of the Traffic

The Contractor shall protect pedestrians, vehicles and other traffic adjacent to the working area against damage or disfigurement by construction equipment, tools and materials or by spatters, splashes and smirches or paint or other construction materials and during the course of the work, provide and maintain adequate signs and signals for warning and guidance of traffic.

612.6 Sampling

A minimum weight of 10 kg. of Reflectorized Thermoplastic paint shall be taken for every 100 bags or fraction thereof.

612.7 Testing

612.7.1 Materials Testing – The material shall be tested in accordance with AASHTO T 250 or with the appropriate method in ASTM designation.

612.7.2 Performance Testing.

a) Testing Method

1. *Measurement of Dry Pavement Marking Retroreflectivity.* The installed pavement markings shall be tested in accordance with ASTM E1710.

2. *Measurement of Continuously Wetted Pavement Marking (During Rain).* The installed pavement markings shall be tested in accordance with ASTM E2832.

3. *Handheld Sampling Protocol.* The installed pavement markings shall be tested in accordance with ASTM D7585/D7585M
   a. Nighttime Visual Inspection.
   b. Standard Evaluation Protocol
   c. Referee Evaluation Protocol

b) *Testing Equipment.* A Portable Retroreflectometer that is in accordance with the requirement of the abovementioned testing methods.

612.8 Packaging and Marking

The material shall be packaged in a suitable container to which it will not adhere during shipment and storage. The blocks of cast thermoplastic material shall be approximately 300 x 915 by 51 mm and shall weigh approximately 23 kg. Each container label shall designate the color, manufacturer's name, batch number and date of manufacture. Each batch manufactured shall have its own separate number. The laber shall warn the user that the material shall be heated to 211 $\pm$ 7°C during application.

612.9 Method of Measurement

The quantity of pavement markings to be paid for shall be the area as shown on the Plans of painted traffic line of the stated width and the area as shown on the plans of symbols, lettering, hatching and the like, completed and accepted.

The quantity shown in the Bill of Quantities represents the approximate quantity in square meter of pavement markings, with width as shown applied at the centerline of the road pavements to which may be increased or decreased depending on the Engineer's decision whether to require additional markings or delete parts of it. Other markings representing symbols, lettering, hatching and others in locations where they may be required by the Engineer shall, likewise, be implemented by the Contractor using reflectorized thermoplastic pavement markings as approved and directed.

612.10 Basis of Payment

The quantities measured as determined in Section 612.9, Method of Measurement, shall be paid for at the appropriate contract unit price for the Pay Items shown in the Bid Schedule which price and payment shall constitute full compensation for furnishing and placing all materials, sampling and packing, for the preparation of the surface, retroreflective readings as determined in Section 612.4, and for all labor, equipment, tools and incidentals necessary to complete the Item.

Pay Item Number	Description	Unit of Measurement
612(1)	Reflectorized Thermoplastic Pavement Markings (White)	Square Meter
612(2)	Reflectorized Thermoplastic Pavement Markings (Yellow)	Square Meter