
NAVFAC IGS-02761 (SEPTEMBER 2002)

Preparing Activity: LANTNAVFACENGCOM Based on NFGS-02761E

ITALIAN GUIDE SPECIFICATIONS

Use for ITALIAN projects only

SECTION 02761

PAVEMENT MARKINGS

09/02

NOTE: This guide specification is issued by the Atlantic Division, Naval Facilities Engineering Command for regional use in Italy.

NOTE: This guide specification covers new markings and remarking requirements for airfields, roads, streets, and parking areas by means of painting. Where curbs, obstructions, and other appurtenant structures are included in the work, the same general requirements will apply but hand application with pneumatic spray guns will be used in these areas.

Criteria and standard requirements for pavement markings are provided in the following publications:

1. American National Standards Institute (ANSI)
D6.1d-1986 - Uniform Traffic Control Devices for Streets and Highways
2. Naval Air System Command Publication:
NAVAIR 51-50AAA-2 - Shorebased Airfield Marking and Lighting.
3. International Civil Aviation Organization (ICAO):
ICAO Annex 14 for airfield markings.

NOTE: On the project drawings, show location, width, type, and color of the paint markings to be used.

Comments and suggestion on this specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4280 (1996) Extended Life Type, Nonplowables, Prismatic, Raised, Retroreflective Pavement Markers

ITALIAN NATIONAL ASSOCIATION FOR UNIFICATION OF STANDARDS (UNI)

NOTE: A UNI Norm is a technical normative recognized as Italian Law, submitted by a private organization "Ente Nazionale Italiano di Unificazione" for Italy and is available only in the Italian language. It is the National Standard.

UNI 8149/FA-128 (1980;R 1983) Non-metallic expansive agents for cement mixings - Density determination

UNI 9381 (1989) Paints and varnishes - Determination of the percentage of glass spheres employed in paints for horizontal traffic signals

UNI 9597 (1990) Paints and varnishes - Particle size determination of glass spheres applied into horizontal traffic signals paints

ITALIAN/EUROPEAN HARMONIZATION STANDARDS (UNI EN)(UNI ENV)(CEI EN)

 NOTE: A UNI EN, UNI ENV, CEI EN, UNI EN ISO or UNI ISO is a European Standard with a coincident Italian National Standard or International Standard. The two standards are identical, with most (but not all) EN's available in the English language and the UNI available only in the Italian language.

UNI EN 1436 (1998) Road marking materials - Road marking performance for road users

ITALIAN LAWS AND NORMS (D.M.)(LAW)(CIRC.)

 NOTE: Italian laws and normatives are the legislative regulations and decrees issued by the Italian government in the form of laws, norms, decrees, circulars, and letters. These Laws and Decrees concur together with Norms and Standards in forming the governing directives for construction.

D.P.R. 495/92 Norms for implementation of the New "Roads Code" (Published on "Gazzetta Ufficiale" n. 303 of 28/12/1992 - General Series) and following revisions and amendments

1.2 SUBMITTALS

 NOTE:
 Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item is required.
 A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.
 For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority.

Recommended codes for Army projects are "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-03 Product Data

Reflective media

Paints

Thermoplastic compounds and primer

Raised Pavement Markers and Adhesive

SD-06 Test Reports

Reflective media

Paints

Thermoplastic compounds and primer

Raised Pavement Markers and Adhesive

Report from sampling and testing made in accordance with paragraph entitled "Sampling and Testing."

SD-07 Certificates

Reflective media

Paints

Thermoplastic compounds and primer

Construction equipment list

SD-08 Manufacturer's Instructions

Paints

Thermoplastic compounds and primer

Submit manufacturer's Material Safety Data Sheets.

1.3 DELIVERY AND STORAGE

Deliver paints, paint materials and thermoplastic compound materials in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the job site for maintaining materials at temperatures recommended by the manufacturer. [Make available paint stored at the project site or segregated at the source for sampling not less than 30 days prior to date of required approval for use to allow sufficient time for testing. Notify the Contracting Officer when paint is available for sampling.]

1.4 WEATHER LIMITATIONS

Apply paint to clean, dry surfaces, and unless otherwise approved, only when air and pavement temperatures are above 5 degrees C for oil-based materials, 10 degrees C for water-based materials, and less than 35 degrees C. Maintain paint temperature within these same limits.

1.5 EQUIPMENT

NOTE: Where pavement marking is limited to small street and parking areas, use first paragraph entitled "Paint Applicator."

Machines, tools, and equipment used in the performance of the work shall be approved by the Contracting Officer and maintained in satisfactory operating condition. Submit construction equipment list approval by the Contracting Officer.

1.5.1 Paint Applicator

NOTE: Select the applicable paragraph(s) from the following:

[Provide hand-operated push-type applicator machine of a type commonly used for application of paint to pavement surfaces. Paint applicator machine shall be acceptable for marking small street and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified.]

[Provide self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. Provide machine having a speed during application capable of applying the stripe widths indicated at the paint coverage rate specified herein and of even uniform thickness with clear-cut edges.

[Provide equipment used for marking streets and highways capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines, or a combination of solid and intermittent lines using a maximum of three different colors of paint as specified.] [The equipment for applying the paint for airfield pavements will be a self-propelled or mobile-drawn pneumatic spraying machine with an arrangement of atomizing nozzles capable of applying a width of line at any one time in multiples of 150 mm, from 150 to 900 mm.] Provide paint applicator with paint reservoirs or tanks of sufficient capacity and suitable gages to apply paint in accordance with requirements specified. Equip tanks with suitable air-driven mechanical agitators. Equip spray mechanism with quick-action valves conveniently located, and include necessary pressure regulators and gages in full view and reach of the operator. Install paint strainers in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Provide pneumatic spray guns for hand application of paint in areas where the mobile paint applicator cannot be used.]

1.5.2 Reflective Media Dispenser

Attach dispenser for applying the reflective media to the paint dispenser and operate automatically and simultaneously with the paint applicator through the same control mechanism. Use dispenser capable of adjustment and designed to provide uniform flow of reflective media over the full width of the stripe at the rate of coverage specified herein at all operating speeds of the paint applicator to which it is attached.

1.5.3 Thermoplastic Application Equipment

Application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

The equipment used for the placement of thermoplastic pavement markings shall be of two general types: mobile applicator and portable applicator.

1.5.3.1 Mobile Application Equipment

The mobile applicator shall be defined as a truck-mounted, self-contained pavement marking machine that is capable of hot applying thermoplastic by either the extrusion or spray method. The mobile unit shall be capable of operating continuously and of installing a minimum of 6000 mm of longitudinal markings in a 8-hour day. Equip the mobile unit with a melting kettle of such capacity as to hold a minimum of 2700 kg of molten thermoplastic material. The kettle shall be capable of heating the thermoplastic composition to temperatures of 190 to 218 degrees C. The heating mechanism shall be by means of a thermostatically controlled heat transfer liquid. Heating of the composition by direct flame shall not be allowed. Oil and material temperature gages shall be visible at both ends of the kettle. [Equip the mobile unit with a minimum of two extrusion shoes located one on each side of the truck, and shall be capable of marking simultaneous edgeline and centerline stripes. Each extrusion shoe shall be a closed, oil-jacketed unit; shall hold the molten thermoplastic at a temperature of 190 to 218 degrees C; and shall be capable of extruding

a line of 75 to 200 mm in width; and at a thickness of not less than 3 mm nor more than 5 mm, and of generally uniform cross section.] [Equip the mobile unit with a spray gun system. The spray system shall consist of a minimum of four spray guns, located two on each side of the truck, and shall be capable of marking simultaneous edgeline and centerline stripes. Surround the spray system (jacketed) with heating oil so as to maintain the molten thermoplastic at a temperature of 190 to 218 degrees C; and shall be capable of spraying a stripe of 75 to 300 mm in width, and in thickness varying from 1.5 to 2.5 mm, and of generally uniform cross section.]

1.5.3.2 Portable Application Equipment

The portable applicator shall be defined as hand-operated equipment, specifically designed for placing special markings such as crosswalks, stopbars, legends, arrows, and short lengths of lane, edge and centerlines.

The portable applicator shall be capable of applying thermoplastic pavement markings by the extrusion method. It is intended that the portable applicator will be loaded with hot thermoplastic composition from the melting kettles on the mobile applicator. Equip the portable applicator with all the necessary components, including a materials storage reservoir, bead dispenser, extrusion shoe, and heating accessories, so as to be capable of holding the molten thermoplastic at a temperature of 190 to 218 degrees C, of extruding a line of 75 to 300 mm in width, and in thickness of not less than 3 mm nor more than 5 mm and of generally uniform cross section.

PART 2 PRODUCTS

2.1 SOURCE MANUFACTURERS

2.1.1 Paints

The following manufacturers provide pavement marking paint and reflective paint materials that generally comply with these specifications:

COLORIFICIO SAMMARINESE
47031 Republica di San Marino
Tel: 0549/905515
Fax: 0549/908453

MaxMeyer S.p.A.
Via Comasina, 121
20161 Milano
Italia
Tel: 02-6404.1
Fax: 02-64042363

Paulin
32032 Feltre
Seren del Grappa (Belluno)
S. Lucia, Italy
Tel: 0439/44241
Fax: 0439/448028

2.1.2 Raised Pavements

3M ITALIA S.p.A.
Via S. Bovio 3
Loc, San Felice - 20090 - Segrate (MI)
Tel: 02-70351
Fax: 02-7035338

S.I.S. Segnaletica Industriale Stradale
Via Tasso n. 12
Loc. Mantignana - 20090 (PG)
Tel: 075.605195/075.605192
Fax: 075.6053981

2.2 MATERIALS

Provide materials conforming to the requirements specified herein.

2.2.1 Paints

UNI EN 1436, color as [indicated] [selected].

2.2.2 Reflective Media

UNI 9597 and UNI 9381.

2.2.3 Thermoplastic Compounds

The thermoplastic reflectorized pavement marking compound shall be extruded or sprayed in a molten state onto a primed pavement surface. Following a surface application of glass beads and upon cooling to normal pavement temperatures, the marking shall be an adherent reflectorized strip of the specified thickness and width that is capable of resisting deformation by traffic.

2.2.3.1 Composition Requirements

The binder component shall be formulated as a hydrocarbon resin. The pigment, beads and filler shall be uniformly dispersed in the binder resin.

The thermoplastic composition shall be free from all skins, dirt, and foreign objects and shall comply with the following requirements:

| <u>Component</u> | <u>Percent by Weight</u> | |
|-------------------------------------|--------------------------|---------------|
| | <u>White</u> | <u>Yellow</u> |
| Binder | 17 min | 17 min |
| Titanium dioxide | 10 min | - |
| Glass beads | 20 min | 20 min |
| Calcium carbonate and inert fillers | 49 min | * |
| Yellow pigments | - | * |

*Amount and type of yellow pigment, calcium carbonate and inert fillers shall be at the option of the manufacturer, providing the other composition requirements of this specification are met.

2.2.3.2 Physical Properties

- a. Drying time: When installed at 21 degrees C and in thicknesses between 3 and 5 mm, the composition shall be completely solid and shall show no damaging effect from traffic after curing 15 minutes.
- b. Softening point: The composition shall have a softening point of not less than 90 degrees C when tested in accordance with UNI EN 1436.
- c. Specific gravity: The specific gravity of the composition shall be between 1.9 and 2.2 as determined in accordance with UNI 8149/FA-128.

2.2.3.3 Primer

- a. Asphalt concrete primer: The primer for asphalt concrete pavements shall be a thermosetting adhesive with a solids content of pigment reinforced synthetic rubber and synthetic plastic resin dissolved or dispersed in a volatile organic solvent. The solids content shall not be less than 10 percent by weight at 21 degrees C and 60 percent relative humidity. A wet film thickness of 0.13 mm, plus or minus 0.03 mm, shall dry to a tack-free condition in less than 5 minutes.
- b. Portland cement concrete primer: The primer for portland cement concrete pavements shall be an epoxy resin primer. The primer shall be of the type recommended by the manufacturer of the thermoplastic composition.

2.2.4 Raised Pavement Markers

Either metallic or nonmetallic markers of the button or prismatic reflector type may be used. Markers shall be of permanent colors as specified for pavement marking, and shall retain the color and brightness under the action of traffic. Button markers shall have a diameter of not less than 100 mm. Button markers shall have rounded surfaces presenting a smooth contour to traffic and shall not project more than 19 mm above level of pavement. Pavement markers and adhesive epoxy shall conform to ASTM D 4280.

PART 3 EXECUTION

3.1 TEMPORARY PAVEMENT MARKINGS

Where overhead power lines are present, temporary markings that contain foil backed material are prohibited.

3.2 SURFACE PREPARATION

NOTE: Newly laid flexible and rigid pavements require aging prior to painting in order to obtain satisfactory paint performance. If practicable, all

new pavement surfaces should be at least 30 days old before application of marking materials. When earlier application of paint is necessary because of operations requirements, the maximum period practicable should be specified.

Removal of rubber is generally accomplished by water blasting. Few approved chemical are effective and sandblasting is not permitted by air pollution regulations at some locations. Mechanical abrasion generally causes damage to the pavement.

Detailed procedures for conducting rubber and paint removal from airfield pavements are contained in Section 02981, "Rubber and Paint Removal from Airfield Pavements."

Allow new pavement surfaces to cure for a period of not less than [30] [_____] days before application of marking materials. Thoroughly clean surfaces to be marked before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Remove [rubber deposits,] [existing paint markings,] [residual curing compounds,] and other coatings adhering to the pavement by waterblasting. Scrub affected areas, where oil or grease is present on old pavements to be marked, with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinse thoroughly after each application. After cleaning oil-soaked areas, seal with shellac or primer recommended by the manufacturer to prevent bleeding through the new paint. Do not commence painting in any area until pavement surfaces are dry and clean.

3.3 APPLICATION

3.3.1 Rate of Application

3.3.1.1 Reflective Markings

Apply paint evenly to the pavement area to be coated at a rate of 2.5 plus or minus 0.10 square meter per liter. Apply glass spheres uniformly to the wet paint [on airfield pavement at a rate of 1198] [on road and street pavement at a rate of 719] plus or minus 60 kg of glass spheres per cubic meter.

3.3.1.2 Nonreflective Markings

Apply paint evenly to the pavement surface to be coated at a rate of 2.5 plus or minus 0.10 square meter per liter.

3.3.1.3 Thermoplastic Compound

After surface preparation has been completed, prime the asphalt or concrete pavement surface with spray equipment. Allow primer materials to "set-up"

prior to applying the thermoplastic composition. [Allow the asphalt concrete primer to dry to a tack-free condition, usually occurring in less than 10 minutes.] [Allow the portland cement concrete primer to dry in accordance with the thermoplastic manufacturer recommendations. To shorten the curing time of the epoxy resins, an infrared heating device may be used on the concrete primer.] [Apply asphalt concrete primer to all asphalt concrete pavements at a wet film thickness of 0.13 mm, plus or minus 0.03 mm 6.5 to 10.0 square meters per liter.] [Apply portland cement concrete primer to all concrete pavements (including concrete bridge decks) at a wet film thickness of between 1.0 to 1.3 mm 7.8 to 10.0 square meters per liter.]

After the primer has "set-up", apply the thermoplastic at temperatures no lower than 191 degrees C nor higher than 218 degrees C at the point of deposition. Immediately after installation of the marking, apply drop-on reflective glass spheres mechanically at the rate of 0.24 kg per square meter such that the spheres are held by and imbedded in the surface of the molten material. Apply all extruded thermoplastic markings at the specified width and at a thickness of not less than 3 mm nor more than 5 mm.

Apply all sprayed thermoplastic markings at the specified width and the thickness designated in the contract plans. If the plans do not specify a thickness, apply centerline markings at a wet thickness of 2.3 mm, plus or minus 0.13 mm, and edgeline markings at a wet thickness of 1.5 mm, plus or minus 0.13 mm.

3.3.2 Painting

Apply paint pneumatically with approved equipment at rate of coverage specified herein. Provide guidelines and templates as necessary to control paint application. Take special precautions in marking numbers, letters, and symbols. Manually paint numbers, letters, and symbols. Sharply outline all edges of markings. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the markings until cause of the slow drying is determined and corrected.

3.3.3 Reflective Media

Application of reflective media shall immediately follow the application of paint. Accomplish drop-on application of the glass spheres to ensure even distribution at the specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, discontinue operations until deficiency is corrected.

3.3.4 Thermoplastic Compound

Place thermoplastic pavement markings upon dry pavement. At the time of installation the pavement surface temperature shall be a minimum of 5 degrees C and rising. Thermoplastics, as placed, shall be free from dirt or tint. Apply all centerline, skipline, edgeline, and other longitudinal type markings with a mobile applicator. Place all special markings, crosswalks, stop bars, legends, arrows, and similar patterns with a portable applicator, using the extrusion method.

3.3.5 Raised Pavement Markers

Prefabricated markers shall be aligned carefully at the required spacing or as directed and permanently fixed in place by means of epoxy adhesives. To ensure good bond, areas where markers will be set shall be thoroughly cleaned by water blasting and use of compressed air prior to applying adhesive.

3.4 FIELD TESTING AND INSPECTION

3.4.1 Sampling and Testing

NOTE: The material specifications do not provide for obtaining certified production data, and the importance of verification testing for each batch where appreciable quantities are involved is emphasized. Only when the factors of time, value of material, and its application versus cost of testing and end use of the material justify a waiver of testing will certification be acceptable.

For projects 3500 square meters in painted surface area, requirements for Contractor's testing should be used. For small projects, use Government test option.

As soon as the paint [and reflective] [and thermoplastic] materials are available for sampling, obtain by random selection from the sealed containers, two quart samples of each batch in the presence of the Contracting Officer. Accomplish adequate mixing prior to sampling to ensure a uniform, representative sample. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Clearly identify samples by designated name, specification number, batch number, project contract number, intended use, and quantity involved. [Test samples by an approved laboratory. If a sample fails to meet specification, replace the material in the area represented by the samples and retest the replacement material as specified above. Submit copy of the test results to the Contracting Officer. Include in the report of test results a listing of any specification requirements not verified by the test laboratory.] [At the discretion of the Contracting Officer, additional samples provided may be tested by the Government for verification.]

3.4.2 Inspection

NOTE: The material specifications do not provide for obtaining certified production data, and the importance of verification testing for each batch where appreciable quantities are involved is emphasized. Only when the factors of time, value of material, and its application versus cost of testing and end use of the material justify a waiver of

testing will certification be acceptable.

For projects 3500 square meters in painted surface area, requirements for Contractor's testing should be used. For small projects, use Government test option.

Examine material at the job site to determine that it is the material referenced in the report of test results or certificate of compliance. A certificate of compliance shall be accompanied by test results substantiating conformance to the specified requirements.

3.4.2.1 Surface Preparations and Application Procedures

Surface preparations and application procedures will be examined by the Contracting Officer to determine conformance with the requirements specified. Approve each separate operation prior to initiation of subsequent operations.

3.5 TRAFFIC CONTROL AND PROTECTION

Place warning signs near the beginning of the work site and well ahead of the work site for alerting approaching traffic from both directions. Place small markers along newly painted lines to control traffic and prevent damage to newly painted surfaces. Mark painting equipment with large warning signs indicating slow-moving painting equipment in operation.

-- End of Section --