SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 DESCRIPTION

This specification covers the application of painted markings onto the pavements, both airfield and non-airfield, at Tinker AFB.

1.2 REFERENCES

1.2.1 The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Unless specifically noted, the current edition of the reference shall be used.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 247	Standard Specification for Glass Beads Used in Pavement Markings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 711	Standard Test Method for No-Pick-Up Time of Traffic Paint
ASTM D 792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D 823	Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels.
ASTM D 4280	Standard Specification for Extended Life Type, Nonplowable, Raised, Retroreflective Pavement Markers

ASTM E 28	Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring and Ball Apparatus
UNITED STATES GENERAL SERVICES ADMINISTRATION (GSA)	
CID A-A-2886	Paint, Traffic, Solvent Based
FED-STD-595	Colors Used in Government Procurement
FS TT-B-1325	Beads (Glass Spheres) Retro-Reflective
FS TT-P-1952	Paint, Traffic and Airfield Markings, Waterborne

1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.3.1 SD-03 Product Data

1.3.1.1 Reflective media

a. Manufacturer’s Data

b. Current MSDS Sheet

1.3.1.2 Paints

a. Manufacturer’s Data

b. Current MSDS Sheet

1.3.1.3 Equipment

a. Submit a list of all proposed equipment.

b. The list shall include the name, make, model, and an accurate description of each piece of equipment.

1.3.2 SD-06 Test Reports

1.3.2.1 Submit certified copies of the test reports, prior to the use of the materials at the jobsite.

1.3.2.2 Testing shall be performed by the approved independent laboratory identified in the Contractors Quality Control Plan.

1.3.2.3 Submit tests reports on the following:

a. Reflective media

b. Paints

1.3.3 SD-07 Certificates

1.3.3.1 Volatile Organic Compound (VOC)

a. Submit certifications that all proposed pavement marking materials meet all applicable Federal, State, and Local VOC regulations.

1.3.4 SD-08 Manufacturer's Instructions

1.3.4.1 Submit all manufacturers’ information not included in section 1.3.1 for the safe and proper handling, storage, use, and application of all proposed pavement marking materials and equipment.

1.4 SYSTEM EQUIPMENT

1.4.1 All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition.

1.4.2 Equipment operating on base and airfield pavements shall display low speed traffic markings and traffic warning lights.

1.4.3 All mobile equipment shall be rubber tired.

1.4.4 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.

1.4.5 Marking Application Equipment

1.4.5.1 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines

a. Paint Application

(1) The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results.

(2) The machine shall have a speed during application not less than 5 mph.

(3) The machine shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph 3.2; APPLICATION, and of even uniform thickness with clear-cut edges.

b. Binder Application

(1) The equipment used to apply the paint binder to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with an arrangement of atomizing nozzles capable of applying a line width at any one time in multiples of 6 inches, from 6 inches to 36 inches.

c. Application equipment shall have reservoirs or tanks of sufficient capacity and suitable gauges to supply materials in accordance with requirements specified.

(1) Tanks shall be equipped with suitable air-driven mechanical agitators.

d. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator.

e. Strainers shall be installed in supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns.

f. Application equipment shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use.

1.4.5.2 Hand-Operated, Push-Type Machines

a. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small areas.

(1) The machine shall be equipped with the necessary tanks and spraying nozzles, and shall be capable of applying materials uniformly at the coverage specified.

(2) Application equipment for water-based materials shall be equipped with non-stick coated hoses.

(3) The metal parts in contact with marking materials shall be stainless steel, grade 302, 304, 316, or an approved equal.

1.4.5.3 Hand held pneumatic spray guns shall be provided for application of materials in areas where the mobile application equipment cannot be used.

1.4.5.4 Reflective Media Dispenser

a. The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism.

b. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION, at all operating speeds of the applicator to which it is attached.

1.4.6 Thermoplastic Application Equipment

1.4.6.1 Thermoplastic Material

a. Thermoplastic material shall be applied to the primed pavement surface either by spray or extrusion.

b. The material shall be applied with equipment that is capable of providing continuous uniformity in the dimensions of the stripe.

1.4.6.2 Application Equipment

a. Application equipment shall provide continuous mixing and agitation of the material.

b. All mixing and conveying parts up to and including the extrusion shoes or spray guns shall maintain the material at the required temperature.

c. All conveying parts of the equipment between the reservoir and the extrusion shoes or spray guns shall prevent accumulation and clogging.

d. All parts of the equipment that come into contact with the material shall be easily accessible for cleaning and maintenance.

e. The application equipment shall be constructed to ensure continuous uniformity in the dimensions of the stripe. The applicator shall provide a means for cleanly cutting off stripe ends squarely and shall provide a method of applying "skiplines".

f. The equipment shall be capable of applying varying widths of traffic markings.

g. The applicator shall be equipped with a drop-on type bead dispenser capable of uniformly dispensing reflective glass spheres at controlled rates of flow. The bead dispenser shall be automatically operated and shall begin flow prior to the flow of composition to assure that the strip is fully reflectorized.

1.4.6.3 Mobile and Maneuverable

a. 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.

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

1.4.6.4 Mobile Application Equipment

a. 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 unit shall be equipped to apply the thermoplastic marking material at temperatures exceeding 375 degrees F, at widths varying from 3 to 12 inches and in thicknesses varying from 0.040 to 0.200 inch and shall have an automatic drop-on bead system. The mobile unit shall be capable of operating continuously and of installing a minimum of 20,000 lineal feet of longitudinal markings in an 8-hour day.

b. The mobile unit shall be equipped with a melting kettle which holds a minimum of 6000 pounds of molten thermoplastic material. The kettle shall be capable of heating the thermoplastic composition to temperatures of 375 to 425 degrees F. A thermostatically controlled heat transfer liquid shall be used. Heating of the composition by direct flame shall not be allowed. Oil and material temperature gauges shall be visible at both ends of the kettle. The mobile unit shall be equipped with either:

(1) 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 375 to 425 degrees F; and shall be capable of extruding a line of 3 to 8 inches in width; and at a thickness of not less than 0.120 inch, but not more than 0.190 inch, and of uniform cross section.

or

(2) 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. The spray system shall be surrounded (jacketed) with heating oil to maintain the molten thermoplastic at a temperature of 375 to 425 degrees F; and shall be capable of spraying a stripe of 3 to 12 inches in width, and in thicknesses varying from 0.060 inch to 0.098 inch, and of uniform cross section.

c. The mobile unit shall be equipped with an electronic programmable line pattern control system. The control system shall be capable of applying skip or solid lines in any sequence, through any and all of the extrusion shoes, or the spray guns, and in programmable cycle lengths. In addition, the mobile unit shall be equipped with an automatic counting mechanism capable of recording the number of lineal feet of thermoplastic markings applied to the pavement surface with an accuracy of 0.5 percent.

1.4.6.5 Portable Application Equipment

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

b. The portable applicator shall be capable of applying thermoplastic pavement markings by the extrusion method.

c. The portable applicator shall be loaded with hot thermoplastic composition from the melting kettles on the mobile applicator.

d. The portable applicator shall be equipped 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 between 375 and 425 degrees F, of extruding a line of 3 to 12 inches in width, at a thickness between 0.120 and 0.190 inches, and of uniform cross section.

1.5 SPECIAL AIRFIELD REQUIREMENTS

1.5.1 All work on the airfield shall conform to the requirements of SECTION 00 80 05; SPECIAL PROVISIONS FOR WORKING ON OR NEAR THE AIRFIELD AT TINKER AIR FORCE BASE

1.5.2 Radio Communication

1.5.2.1 No personnel or equipment will be allowed on the runway until radio contact has been made with the Control Tower and permission is granted by the Control Tower.

1.5.2.2 A radio for this purpose will be made available by the Airfield Manager.

1.5.2.3 The Contractor shall be in contact with the Control Tower at all times during the work.

1.5.3 Emergency Landings or Takeoffs

1.5.3.1 Emergencies shall take precedence over all other operations.

1.5.3.2 Upon notification from the Control Tower of an emergency landing or imminent takeoff, all operations shall cease immediately.

1.5.3.3 All personnel and equipment shall be evacuated to an area not utilized for aircraft traffic which is at least 200 feet away from the nearest point on the runway’s edge.

1.5.3.4 Equipment shall be capable of clearing the runway within 15 minutes.

1.5.4 Schedule of Work

In addition to the requirements of section 1.8, the following shall apply:

1.5.4.1 Submit a schedule of work to the Contracting Officer for transmittal to the Operations Officer 21 days prior to the expected start of work.

1.5.4.2 Describe the work to be accomplished; noting the location of the work, distances from the ends of runways, taxiways, intersections, buildings, and other identifiable features.

1.5.4.3 Schedule the work to conform to aircraft operating schedules.

1.5.4.4 Notify the CO of any changes to the schedule at least 10 working days prior to the requested change.

1.5.4.5 Changes to the schedule on the airfield shall not be implemented until approved by the CO and the Operations Officer.

1.5.5 Maintenance of Traffic

1.5.5.1 Coordinate the operation of all equipment and the performance of all work on the airfield with both the Contracting Officer and the Operations Officer.

1.5.5.2 Neither equipment nor personnel shall use any portion of the airfield without authorization from both of these officers.

1.5.5.3 Maintain verbal communications with the Control Tower before and during all work on the airfield.

1.5.5.4 The Control Tower shall be notified when work is complete each day.

1.5.6 Night Work

1.5.6.1 All night work requires the approval of the CO and the Airfield Manager.

1.5.6.2 All necessary lighting, safety equipment, and personnel shall be provided by the contractor.

1.5.6.3 Lights shall be shielded or directed to prevent interference with aircraft, the control tower, and other airfield operations.

1.6 ENVIRONMENTAL CONDITIONS

1.6.1 Do not perform work:

1. When the pavement surface temperature is 50 degrees F. or below;

2. When the pavement surface temperature is 100 degrees F. or higher;

2. When lightning is within five miles of Tinker AFB;

3. When it is raining or during thunderstorms;

4. When the pavement is covered with snow or ice.

1.6.2 The Contractor shall comply with the environmental requirements of Section 00 72 00; ENVIRONMENTAL REQUIREMENTS FOR WORKING ON TINKER AIR FORCE BASE.

1.7 SAFETY

1.7.1 The Contractor shall comply with the safety requirements of Section 00 71 00; GENERAL SAFETY REQUIREMENTS FOR WORKING ON TINKER AIR FORCE BASE.

1.8 SCHEDULE

1.8.1 Schedule of Work

1.8.3.1 Submit a schedule of work to the Contracting Officer at least seven working days prior to the expected start of work.

1.8.3.2 Describe the work to be accomplished; noting the location of work, distances from intersections, buildings, and other identifiable feature.

1.8.3.3 Indicate dates and times during which the work will be accomplished.

1.8.3.4 Keep the approved schedule of work current and notify the Contracting Officer of any changes to the schedule at least two working days prior to the requested change.

1.8.3.5 Changes to the schedule shall not be implemented until approved by the CO.

1.9 QUALITY ASSURANCE

1.9.1 Contractor Quality Control shall meet the requirements of Section 01 45 01; CONTRACTOR QUALITY CONTROL.

1.10 NIGHT WORK

1.10.1 All night work requires prior approval from the Contracting Officer.

1.10.2 All lights, traffic control equipment, safety equipment, and personnel shall be supplied by the Contractor.

1.10.3 Lights shall be shaded or directed to prevent interference with traffic or base operations.

1.10.4 The Government reserves the right to accept or reject work performed at night on the following day.

1.11 DELIVERY, STORAGE, AND HANDLING

1.11.1 Deliver and store all materials in their original, sealed manufacturer’s container.

1.11.2 All materials shall be clearly and plainly labeled.

a. The label shall show:

(1) Name of Manufacturer,

(2) Date of manufacture,

(3) Product name,

(4) Formula,

(5) Specification number,

(6) Batch number,

(7) Color, and

(8) Instructions for use.

b. The label shall be legible at the time of use.

1.11.3 The Contractor shall provide secure storage, in an area approved by the Contracting Officer, capable of maintaining the materials within the range of temperatures specified by the manufacture.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months.

2.1.2 Paints shall conform to FS TT-P-1952, color as indicated.

2.1.3 Reflective media for use on airfield pavements shall conform to FS TT-B-1325, Type I, Gradation A.

2.1.4 Reflective media for use on non-airfield pavements shall conform to FS TT-B-1325, Type I, Gradation B.

2.1.5 Thermoplastic Compound

2.1.5.1 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.

a. Composition Requirements

(1) The binder component shall be formulated as a hydrocarbon resin.

(2) The pigment, beads and filler shall be uniformly dispersed in the binder resin.

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

Component	Minimum Percent by Weight	
	White	Yellow
Binder	17	17
Titanium Dioxide	10	-
Glass Beads	20	20
Calcium Carbonate and Inert Fillers	49	*
Yellow Pigment	-	*
(*) Amounts of Calcium Carbonate, Inert Fillers and Yellow Pigment shall be at the option of the manufacturer, providing the other composition requirements are met.		

2.1.5.2 Physical Properties

a. Drying time: When installed at 70 degrees F and in thicknesses between 0.120 and 0.190 inch, 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 194 degrees F when tested in accordance with ASTM E28.

c. Specific gravity: The specific gravity of the composition shall be between 1.9 and 2.2 as determined in accordance with ASTM D792.

2.1.5.3 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 70 degrees F and 60 percent relative humidity. A wet film thickness of 0.005 inch, plus or minus 0.001 inch, 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.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 General

3.1.1.1 Thoroughly clean surfaces to be marked before application of the pavement marking material.

3.1.1.2 Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required.

3.1.2 New Pavement

3.1.2.1 New pavement surfaces shall be allowed to cure for a minimum of 30 calendar days prior to the application of pavement markings.

3.1.3 Rubber / Existing Markings

3.1.3.1 Rubber deposits and existing paint shall be removed in accordance with Section 32 01 11; RUBBER/PAINT REMOVAL FROM PAVEMENT, AIRFIELD AND NON_AIRFIELD.

3.1.4 Oil Contamination

3.1.4.1 Areas of pavement affected with oil or grease shall be scrubbed with several applications of tri-sodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application.

3.1.4.2 After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint.

3.1.3 Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking.

3.1.4 Surfaces shall be re-cleaned, when work has been stopped due to rain, snow, or ice.

3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

3.2.1 Painting

3.2.1.1 Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 50 degrees F and less than 100 degrees F.

3.2.1.2 New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint.

3.2.1.3 Paint shall be applied pneumatically with approved equipment at the rate of coverage specified.

3.2.1.4 Provide guide lines and templates as necessary to control paint application.

3.2.1.5 Special precautions shall be taken in marking numbers, letters, and symbols.

3.2.1.6 Manually paint numbers, letters, and symbols.

3.2.1.7 Edges of markings shall be sharply outlined.

3.2.2 Reflective Media

3.2.2.1 Application of reflective media shall immediately follow the application of paint.

3.2.2.2 Accomplish drop-on application of the glass spheres to ensure even distribution at the specified rate of coverage.

3.2.2.3 Should there be malfunction of either paint applicator or reflective media dispenser, discontinue operations until deficiency is corrected.

3.2.3 Thermoplastic Compound

3.2.3.1 Place thermoplastic pavement markings upon dry pavement.

3.2.3.2 Place thermoplastic pavement markings on pavement that is at or above 50 degrees F.

3.2.3.3 Thermoplastics, as placed, shall be free from dirt or tint.

3.2.3.4 Apply all centerline, skipline, edgeline, and other longitudinal type markings with a mobile applicator.

3.2.3.5 Place all special markings, crosswalks, stop bars, legends, arrows, and similar patterns with a portable applicator, using the extrusion method.

3.2.4 Rate of Application

3.2.4.1 Reflective Markings

a. Paint shall be evenly applied to the pavement area to be coated at a rate between 100 and 110 square feet per gallon.

b. Apply glass spheres uniformly to the wet paint on airfield pavement at a rate between 9 1/2 and 10 1/2 pounds of glass spheres per gallon of paint.

c. Apply glass spheres uniformly to the wet paint on non-airfield pavement at a rate between 5 1/2 and 6 1/2 pounds of glass spheres per gallon of paint.

3.2.4.2 Non-reflective Markings

a. Paint shall be evenly applied to the pavement area to be coated at a rate between 100 and 110 square feet per gallon.

3.2.5 Drying

3.2.5.1 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.

3.2.5.2 If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.2.6 Thermoplastic Compound

3.2.6.1 After surface preparation has been completed, prime the asphalt or concrete pavement surface with spray equipment.

3.2.6.2 Allow primer materials to "set-up" prior to applying the thermoplastic composition.

a. Allow the asphalt concrete primer to dry to a tack-free condition.

b. Allow the Portland cement concrete primer to dry in accordance with the thermoplastic manufacturer recommendations.

c. Apply asphalt concrete primer to all asphalt concrete pavements at a wet film thickness of 0.005 inch, plus or minus 0.001 inch.

d. Apply Portland cement concrete primer to all concrete pavements (including concrete bridge decks) at a wet film thickness of between 0.04 and 0.05 inch.

e. After the primer has "set-up", apply the thermoplastic at a temperature between 375 and 425 degrees F at the point of deposition.

f. Immediately after installation of the marking, apply drop-on reflective glass spheres mechanically at the rate of one pound of spheres per 20 square feet of marked surface such that the spheres are held by and imbedded in the surface of the molten material.

g. Apply all extruded thermoplastic markings at the specified width and at a thickness between 0.125 inch and 0.190 inch.

h. 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 between 0.085 and 0.095 inches, and edgeline markings at a wet thickness between 0.055 and 0.065 inches.

3.3 TRAFFIC CONTROL

3.3.1 Airfield

1.3.1.1 Maintain airfield traffic in accordance with section 1.5.5 and this section.

3.3.2 Non-Airfield

3.3.1 Protect the work area and personnel from damage or injury by traffic.

3.3.2 Provide sufficient warning signs and barricades to prevent traffic from entering the work area.

3.3.3 Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces.

3.3.4 Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

3.3.3 Warning signs and barricades shall meet the requirements of MUTCD.

3.3.4 Do not remove traffic control signs and barricades until the work is complete.

3.3.5 Remove all traffic control signs and barricades within 24 hours after final project acceptance by the CO.

- End of Section -