

**16 MARCH 1994**

**Civil Engineering**

**STANDARDS FOR MARKING AIRFIELDS**



**COMPLIANCE WITH THIS PUBLICATION IS MANDATORY**

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Supersedes AFR 88-16, 1 October 1988.

Pages: 9  
Distribution: F

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This instruction implements AFR 32-10, *Installations and Facilities*. It provides US Air Force standards for marking airfield pavements and obstructions. It gives the minimum level of marking necessary for USAF runways, taxiways, and obstructions. It does not apply to US Air Force Reserve and Air National Guard facilities operating at municipal airports or jointly used airfields. Air Force tenant organizations on civil airports should use these standards to the extent practicable, otherwise, Federal Aviation Administration (FAA) criteria apply. Use this instruction in conjunction with the layout criteria provided in Engineering Technical Letter (ETL) 94-1, pending publication of a US Air Force and US Army joint-publication for airfield and heliport markings.

**SUMMARY OF REVISIONS**

This is the first publication of AFI 32-1042, substantially revising AFR 88-16. It explains how installation commanders waive the obstruction marking requirements for objects penetrating the imaginary surfaces of airfields; clarifies functional responsibilities; updates information needed for obtaining waivers; and adds a new section, "related documents," for reference. Updates on this instruction also include approved materials for marking airfields, color and retroreflective requirements, and changes in the type of reflective beads required for taxiway markings. This instruction also gives allowances for marking runway/runway-hold positions for simultaneous operations on intersecting runways; simplifies guidance for applying striated markings; gives dimensional tolerances for applying airfield markings; and adopts the FAA criteria for applying obstruction-marking colors and patterns.

**1. Background:**

1.1. This instruction uses standards developed from:

- FAA Advisory Circulars.

- North Atlantic Treaty Organization (NATO) Standardization Agreements (STANAG).
- Air Standardization Coordinating Committee (ASCC) Air Standards.
- Annex 14 of the International Civil Aviation Organization Convention on International Aviation.

## 2. Responsibilities:

2.1. Major command (MAJCOM) commanders approve or disapprove waiver requests for marking deviations required for 180 days or less.

2.1.1. MAJCOM civil engineers:

- Ensure compliance with this instruction.
- Recommend approval or disapproval of temporary and permanent waiver requests.
- Provide technical guidance to base level personnel.

2.1.2. The MAJCOM civil engineer staff must coordinate permanent waiver requests with flight safety and operations before sending to:

HQ AFCESA/DMP  
139 Barnes Drive, Suite 1  
Tyndall AFB FL 32403-5319

To expedite processing, send information copies of permanent waiver requests to:

HQ AFSA/SEF  
9700 Ave G SE Suite 273C  
Kirtland AFB NM 87117-5671  
AFFSA/XOI/XVR  
1535 Command Drive, Suite D305/D308  
Andrews AFB MD 20331-2007

2.2. Installation commanders may authorize the toning down of pavement markings as described within NATO STANAG 3111 and ASCC Air Standard 65/31. Obtain these from the Defense Printing Service Detachment Office (DPSDO) at:

DPSDO - Customer Service  
Standardization Documents Order Desk  
700 Robbins Avenue  
Philadelphia PA 19111-5094  
Facsimile: Commercial (215) 697-2978 (DSN 442-2978)

They also may exempt objects penetrating the airfield's imaginary surfaces from the requirements in paragraph 11. *EXCEPTION:* Installation commanders may not exempt obstructions at jointly used airfields. For this instruction, a jointly used airfield is defined as: An installation where written agreement between the military department and a local government agency authorize use of the military runways for a public airport. These airfields are certified under Federal Aviation Regulation Part 139. Part 139.331 states; "Each certificate holder shall ensure that each object in each area within its authority which exceeds any of the heights or penetrates the imaginary surfaces described in Part 77 of this chapter is either removed, marked, or lighted. However, removal, marking and lighting is not required if it is determined to be unnecessary by an FAA aeronautical study."

### 2.3. The base civil engineer:

#### 2.3.1. Ensures that standard airfield markings:

- Comply with this instruction.
- Facilitate aircraft operations for the appropriate weather minimums (see paragraph 7.).
- Clearly mark closed and hazardous areas.

#### 2.3.2. Schedules maintenance and remarking.

#### 2.3.3. Prepares, coordinates, and submits requests for temporary and permanent waivers.

- 2.3.3.1. Coordinates requests for waivers with flight safety and operations before sending them to the MAJCOM.

### 3. Related Documents:

3.1. AFMAN 32-8008, volume 3, *Airfield and Heliport Planning and Design Criteria* (formerly AFR 86-14), describes an airfield's imaginary surfaces, defining the protected airspace surrounding the airfield.

3.2. AFI 32-1044, *Visual Air Navigation Systems* (formerly AFR 88-14), gives information on lighted signs required for:

- Runway/runway, taxiway/runway, and instrument hold positions.
- Aircraft arresting system warning markings.

3.3. Corps of Engineers Guide Specification 02580, *Pavement Markings*, supplies guidelines for drafting contract documents for airfield-marking projects. You may obtain a copy from HQ AFC-ESA/DMP.

3.4. FAA Advisory Circular 70/7460-1, *Obstruction Marking and Lighting*, outlines the requirements for marking and lighting hazards to air navigation. To order a free copy, send a request to:

DOT, M-443.2

General Services Section

Washington DC 20590

3.5. USAF Technical Order 36-1-3, *Painting, Marking, and Lighting Requirements for USAF Vehicles*, provides guidance for marking and lighting vehicles used in and around airfields.

### 4. Materials. Mark your pavements with:

4.1. Lead free pavement-marking paints, available under Federal Specification TT-P-1952, *Paint, Traffic and Airfield Marking, Waterborne*. Select Type I, "Ten Minute No Pick-up Time" or Type II, "Fast Dry, High Humidity Formula." Apply at 12 to 14 mils for coverage of 121 (plus or minus 6) square feet per gallon (2.96 m<sup>2</sup> per liter [plus or minus 165 mm<sup>2</sup> per liter]).

4.2. Glass beads, available under Federal Specification TT-B-1325, *Beads, Retroreflective*. Apply to painted or extruded markings using eight to nine pounds per gallon of paint, or 121 square feet (3.6 to 3.9 kg per 11.24 m<sup>2</sup>).

4.2.1. Use Type I, gradation A beads, which have a refraction index of 1.5, for all taxiway and apron markings that must be reflective.

4.2.2. Use type III, gradation A beads, which have a refraction index of 1.9, for all runway and helipad markings.

4.3. You may use preformed materials such as thermoplastics and retroreflective tapes on helipads, taxiways and aprons or for temporarily displaced threshold markings. **Do not** use these materials on runways.

4.4. Other materials if they conform with, or exceed these requirements.

## 5. Colors of Markings and Retroreflective Requirements:

5.1. Use black paint to hide extraneous markings that can not be removed without damaging the pavement. You can also use black paint to outline markings on light colored pavements. This makes them more prominent. Mark obstructions in contrasting colors to make them more conspicuous to pilots during daylight hours.

5.2. Use the following color chip numbers from Federal Standard 595, *Colors*, when ordering or specifying paint for airfield applications:

5.2.1. Pavements:

- White - 37925.
- Yellow - 33538.
- Red - 33136.
- Black - 37038.

5.2.2. Obstructions:

- White - 17875
- Orange - 12197

5.3. Use retroreflective white for all runway markings. *EXCEPTIONS*: Use retroreflective yellow on:

- Displaced threshold arrowheads and chevrons.
- Aircraft arresting system warning markings.

5.3.1. Runway shoulder markings (deceptive surfaces) and closed runway markings are nonreflective yellow.

5.4. Use retroreflective white for helipad markings. *EXCEPTION*: Use red for the letter "H" and the optional borders around the cross and boundary markings on hospital helipads.

5.5. Use retroreflective yellow for all primary taxiway and taxi-lane markings. *EXCEPTION*: You don't have to use retroreflective beads on:

- Secondary taxiways and apron markings.
- Overrun chevrons.
- Closed pavement markings.
- Shoulder markings (deceptive surfaces).

**6. Using Striated Markings.** You may paint striated markings 3 feet (0.9 meter) and wider on all runways except those in instrument categories II and III. To do this paint multiple longitudinal stripes 6-inches (15 cm) wide with gaps from 4 (10 cm) to 6 inches (15 cm) wide.

## **7. Runway Markings:**

7.1. Consult with the airfield manager to determine the level of markings needed for each runway.

7.1.1. Determine the extent of runway markings based on the level of operations planned during instrument meteorological conditions (IMC). Also consider the available electronic navigation and visual approach lighting aids.

7.1.2. Closed runways must also be marked to reflect their nonoperational status.

7.1.3. The installation commander may authorize additional markings.

7.1.4. For a basic runway, mark, at minimum:

- A centerline.
- Designation numbers.
- Aircraft-arresting-system warning markings.
- Runway/runway hold positions (when the runway is used as a taxiway or is approved for simultaneous operations with an intersecting runway).
- Overruns.
- Fixed distance markings (required on runways 4,000 feet (1,200 meters) or longer that are used by jet aircraft).

7.1.5. For an instrument (nonprecision) approach runway, also mark thresholds and expand the centerline width to 3 feet (0.9 meter).

7.1.6. For a precision approach runway, mark for all weather operations. In addition to the instrument (nonprecision) approach and basic requirements, provide edge stripes, touchdown zone markings, and instrument hold lines.

7.1.7. Use edge stripes on all runways if you cannot distinguish the paved runway shoulders (non-load bearing pavements) from the operational surface. You may also need shoulder markings (deceptive surface markings) if the area is wider than the standard dimension required by the design criteria in AFMAN 32-8008, volume 3.

7.1.8. For runways that intersect or share a common end, interrupt or adjust markings on the runway with the lower priority. Give precedence in this order:

7.1.8.1. Precision Approach Runway Markings:

- Category III.
- Category II.
- Category I.

7.1.8.2. Instrument (Nonprecision) Approach Runway Markings.

7.1.8.3. Basic Runway Markings

## **8. Taxiway Markings:**

8.1. Mark taxiways and aprons to guide aircraft movement and parking, and vehicular traffic supporting airfield operations. Use, at minimum, markings for:

- The centerline.
- Holding positions.
- Closed pavement.

8.1.1. Use taxiway edge stripes if you can't distinguish paved taxiway shoulders (nonload bearing pavements) from operational surfaces. You may also need shoulder markings (deceptive surface) if the area is wider than the standard dimension required by the design criteria in AFMAN 32-8008, volume 3.

8.1.1.1. The installation commander may authorize additional markings.

8.2. Runway and holding position markings have precedence over other taxiway markings. Interrupt the taxiway stripe 3 feet (0.9 meter) from either side of these markings.

8.2.1. Where taxiway centerline markings meet threshold marking or numbers, interrupt the taxiway markings 5 feet (1.5 meters) short of the higher priority marking.

8.2.2. Where taxiways cross, intersect the taxiway stripes.

8.2.3. Where a taxiway crosses a runway, interrupt the taxiway stripe at all runway markings as described in paragraph **8.2**.

## **9. Helipad Markings:**

9.1. Install helipad perimeter and identification markings to accommodate the overall length of the largest helicopter operating out of the facility.

## **10. Marking Dimension Tolerances:**

10.1. Apply mandatory markings in standard dimensions.

10.1.1. New markings may deviate a maximum of 10 percent above the standard dimension.

10.1.2. The maximum deviation allowed when painting over an old marking is up to 20 percent larger than the standard dimension.

10.1.3. You may not use less than standard dimensions.

## **11. Marking Obstructions:**

11.1. Use the following references for guidelines to mark any object or structure, manufactured or natural, fixed or moving, which penetrates an airfield's imaginary surfaces as described in AFMAN 32-8008, volume 3:

- FAA AC 70/7460-1, *Obstruction Marking and Lighting*.
- USAF Technical Order 36-1-3, *Painting, Marking, and Lighting Requirements for USAF Vehicles*.

11.2. Do not mark obstructions shielded by surrounding objects if you've marked the surrounding objects.

11.2.1. Partial marking of obstructions such as storage tanks and chimneys is adequate when the lower portion is hidden by surrounding objects or terrain, or the size of the upper portion is significantly larger than the supporting structure.

11.2.2. Do not paint critical surfaces on obstructions, such as radar-sensitive surfaces.

11.2.3. Do not mark control towers. They already stand out because of their shape, size, and location.

JAMES E. McCARTHY,, Maj General, USAF  
The Civil Engineer

## Attachment 1

### GLOSSARY OF ABBREVIATIONS, ACRONYMS, AND TERMS

#### *Abbreviations and Acronyms*

**AC**—Advisory Circular  
**AFCESA**—Air Force Civil Engineering Support Agency  
**AFFSA**—Air Force Flight Standards Agency  
**AFMAN**—Air Force Manual  
**AFPD**—Air Force Policy Directive  
**AFR**—Air Force Regulation  
**AFSA**—Air Force Safety Agency  
**ASCC**—Air Standardization Coordinating Committee  
**DOT**—Department of Transportation  
**DPSDO**—Defense Printing Service Detachment Office  
**ETL**—Engineering Technical Letter  
**FAA**—Federal Aviation Administration  
**IMC**—Instrument Meteorological Conditions  
**kg**—Kilograms  
**MAJCOM**—Major Command  
**m**—Meters  
**mm**—Millimeters  
**NATO**—North Atlantic Treaty Organization  
**STANAG**—Standardization Agreements

#### *Terms*

**Instrument Meteorological Conditions (IMC).**—Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minima specified for visual meteorological conditions (IMC).

**Retroreflective.**—The property of a material that indicates its ability to reflect light so that the paths of the rays are returned to the source on a plane parallel to the incident rays.

**Runway/runway hold position.**—An aircraft holding position designated on a runway which intersects with another runway. It is used to protect against incursions on the primary runway when the intersecting secondary runway is used for taxiing or "land and hold short" operations.

**Visual Flight Rules (VFR).**—Rules that govern the procedures for conducting flight under visual conditions. This term is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements.