



# AEROSPACE RECOMMENDED PRACTICE

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## Design of Aircraft Deicing Facilities

### RATIONALE

This document originally presents guidance material for the planning, design and construction of terminal area or remote deicing/anti-icing facilities and has been edited to revision C to cover and reflect latest developments in the globalization of standards. It is intended to provide the airport operator and deicing facility planner/designer an understanding of the issues and relevant information necessary to define the need for a deicing facility and identify factors influencing its size, location and operation, including airport and aircraft operational characteristics, physical site constraints, and environmental considerations and/or constraints. While this document does not recommend any specific type or configuration of deicing facility, it does present the general issues and concerns which should be addressed in assessing the need for and the planning/design of such facilities based on the combined knowledge of the authors. It should be recognized that due to the unique physical and operational characteristics of each airport, there may be unique considerations at a specific site that are not raised in this manual.

### FOREWORD

At airports where winter weather-related delays are prevalent, use of off-gate or near departure runway end deicing facilities may become an integral part of an air carrier's ground deicing/anti-icing program necessary to meet estimated holdover times.

Environmental runoff mitigation should be an integral part of deicing facilities. Storm water discharge regulations enacted by the State and local authorities, or other environmental regulatory agencies, can significantly change or limit the disposal options available for spent deicing/anti-icing fluids at most airports. In terms of environmental mitigation, off-gate deicing facilities may in some cases be the best option for collecting spent deicing/anti-icing fluids for proper treatment and disposal.

It is important to recognize that the determination of the need for deicing facilities rests with airports which serve aircraft that can develop frost or ice on critical surfaces even though the airport itself may not experience ground icing conditions. If the development of a deicing facility is determined necessary, appropriate and feasible based on analysis, close coordination of planning and design efforts with airport management, users, the country's aviation regulatory agency/authority or other appropriate stakeholders, Federal, State, and local environmental agencies, pilot groups, and the deicing facility operator(s) is strongly encouraged. To ensure development of a deicing facility capable of serving the needs of the airport and its users safely and efficiently, the formation of a deicing committee consisting of the listed representatives is recommended.

Proper planning, design, construction, and operation of deicing facilities requires the careful integration of numerous general issues and concerns. To facilitate the discussion of these parameters, this manual has been divided into the following sections:

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1. SCOPE
2. REFERENCES
3. SITING CONSIDERATIONS
4. DEICING FACILITY DESIGN AND CONSTRUCTION
5. ENVIRONMENTAL CONSIDERATIONS
6. OPERATIONAL CONSIDERATIONS

Each of these sections is further subdivided into subsections, as appropriate, to address specific issues. This manual has been developed by the SAE Committee for Aircraft Deicing Facilities.

## INTRODUCTION

The division of this manual is intended to consolidate related technical material into a structure that facilitates its use with respect to specific areas of interest or consideration. The sections have been assembled in an order that reflects one logical progression through the decision-making process, and ultimately through the deicing facility planning and design process. However, the manual's structure supports the review and use of discrete sections in those situations that do not require the comprehensive application of all the planning and design considerations contained in the manual.

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## 1. SCOPE

This document provides information and guidance material to assist in assessing the need for and feasibility of developing deicing facilities, the planning (size and location) and design of deicing facilities, and assessing environmental considerations and operational considerations associated with de-icing facilities.

The document presents relevant information necessary to define the need for a deicing facility and factors influencing its size, location, and operation. The determination of the need for deicing facilities rests with Airports.

Although this document intends to provide information to airport operator and deicing facility planner/designer, all stakeholders, including deicing service providers, should be involved in the development process.

## 2. REFERENCES

### 2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

#### 2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

|          |                                                                                              |
|----------|----------------------------------------------------------------------------------------------|
| AMS1424  | Fluid, Aircraft Deicing/Anti-icing, SAE Type I                                               |
| AMS1428  | Fluid, Aircraft Deicing/Anti-Icing, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV |
| AMS1431  | Compound, Solid Runway and Taxiway Deicing/Anti-Icing                                        |
| AMS1435  | Fluid, Generic, Deicing/Anti-Icing Runways and Taxiways                                      |
| ARP1971  | Aircraft Deicing Vehicle – Self-Propelled                                                    |
| ARP5660  | Deicing Facility Operational Procedures                                                      |
| AS5635   | Message Boards (Deicing Facilities)                                                          |
| AS6285   | Aircraft Ground Deicing/Anti-icing Processes                                                 |
| AS6286   | Training and Qualification Program for Deicing/Anti-icing of Aircraft on the Ground          |
| AS6286/6 | Deicing/Anti-icing Diagrams / No Spray Zones                                                 |
| AS6332   | Aircraft Ground Deicing/Anti-icing Quality Management                                        |

#### 2.1.2 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, [www.faa.gov](http://www.faa.gov).

|                |                                               |
|----------------|-----------------------------------------------|
| AC 120-57      | Surface Movement Guidance and Control System. |
| AC 150/5300-13 | Airport Design.                               |
| AC 150/5300-14 | Design of Aircraft Deicing Facilities         |

|                |                                                                          |
|----------------|--------------------------------------------------------------------------|
| FAR Part 77    | Objects Affecting Navigable Airspace                                     |
| FAR Part 139   | Certification and Operations: Land Airports Serving Certain Air Carriers |
| Order 6750.16B | Siting Criteria for Instrument Landing Systems                           |
| Order 8260.3B  | United States Standards for Terminal Instrument Procedures (TERPS)       |

### 2.1.3 ICAO Publications

Available from International Civil Aviation Organization, 999 University Street, Montreal, Quebec H3C 5H7, Canada, Tel: +1 514-954-8219, <http://www.icao.int/>.

|                    |                                                    |
|--------------------|----------------------------------------------------|
| Annex 6,           | Operation of Aircraft                              |
| Annex 14, Volume I | Aerodrome Design and Operations                    |
| Doc 9157           | Aerodrome Design Manual                            |
| Doc 9640-AN/940    | Manual of Aircraft Ground De/Anti-Icing Operations |

## 2.2 Definitions

As used in this document, the following terms are defined as follows:

### 2.2.1 AIRCRAFT DEICING FACILITY

An aircraft deicing facility is a facility where: frost, ice, slush, or snow is removed (deicing) from the aircraft in order to provide clean surfaces, and/or clean surfaces of the aircraft receive protection (anti-icing) against the formation of frost or ice and accumulation of snow or slush for a limited period of time.

#### 2.2.1.1 TERMINAL DEICING FACILITY

A deicing facility for one or several aircraft located at or near the terminal or other location where aircraft loading activity normally takes place.

#### 2.2.1.2 REMOTE DEICING FACILITY

A deicing facility for single or multiple aircraft located away from the terminal or other area where aircraft loading activities normally take place.

### 2.2.2 AIRCRAFT DEICING PAD

An aircraft deicing pad consists of two areas: an inner area for the parking of aircraft to receive deicing/anti-icing treatment and an outer area for maneuvering two or more mobile deicing vehicles. This outer area provides the "vehicle lane width" necessary for two or more mobile deicing vehicles to satisfactorily perform simultaneous and complete left and right side uniform fluid distribution techniques for removing deposits of frost, ice, slush, and snow from aircraft surfaces and for anti-icing operations. See Figure 1.

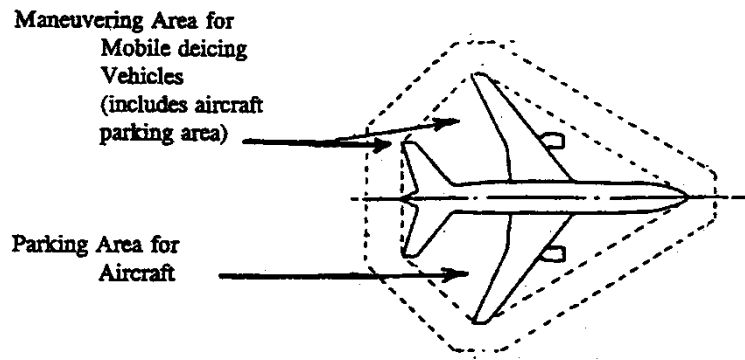


**Figure 1 – Aircraft deicing pad**

### 3. LOCATION CONSIDERATIONS

#### 3.1 Introduction

Thoughtful siting of deicing facilities is critical in order to maximize the benefits of the deicing/anti-icing process while minimizing the potential adverse impacts on airfield efficiency and operations. This section identifies considerations in siting deicing facilities to facilitate compliance with the "clean aircraft" concept. Foremost among such considerations is the need to site deicing facilities so that the maximum time interval between the start of the last step of the deicing/anti-icing process, subsequent taxiing and the start of takeoff does not exceed the estimated holdover times of the applied fluids. Other major considerations include the need to site deicing facilities so that aircraft, deicing facility structures, and mobile deicing vehicles or fixed deicing equipment do not penetrate the Obstacle Clearance Limits.

3.1.1 This section also addresses the need to site deicing facilities in consideration of typical winter meteorological conditions (3.3.3), so that they are accessible to users, promote efficient ground movement of aircraft, facilitate maintenance and integrity of both aircraft arrival and departure schedules, and provide for the safety of passengers, ground crews, and aircraft.

3.1.2 Finally, this section identifies considerations involved in siting deicing facilities with respect to integrating them into the existing and future airport infrastructure (3.5).

#### 3.2 Inventory

An inventory of existing and future airport facilities and conditions at an airport should be the first step in siting deicing facilities, as well as of physical and operational constraints. Existing and future airport conditions should include operational scenarios and characteristics.

##### 3.2.1 Physical Constraints

There are a number of areas on or near an airfield restricted to certain types of activity, or to no movement or object penetrations at all, which are defined by regulatory agencies to enhance the safety of aircraft movements and operations. Although common regulatory agency design standards and recommendations are addressed here, it is emphasized that considering the unique nature of every airport, there may be other requirements not listed that bear on the siting process. Below are relevant FAA clearance and separation standards. Comparable ICAO standards, that may use similar terminology, are contained in Annex 14, Volume I, Aerodrome and Operations, and other ICAO related service manuals.

##### 3.2.1.1 Clearance and Separation Standards

To help ensure safe airfield operations, the following clearance and separation design standards and recommendations found in the latest editions of FAA Advisory Circular (AC) 150/5300-13, in ICAO Annex 14, Volume I and ICAO Doc 9157, will impact the siting of deicing facilities. These areas cannot be compromised without an attendant impact on airport operations and potential reduction of the level of safety of aircraft operations.

#### 3.2.1.1.1 Object Clearing Criteria

The object clearing criteria subdivides the 14 CFR Part 77, Subpart C, airspace and object free area ground area by type rules and not by these criteria. Specific areas and their standard dimensions, as referenced in the latest edition of AC150/5300-13, are as follows:

- a. Object Free Area (OFA)
- b. Runway Safety Area (RSA)
- c. Taxiway Safety Area (TSA)
- d. Runway Obstacle Free Zone (OFZ)
- e. Threshold Siting Requirements
- f. Airway Facilities
- g. Runway Protection Zone (RPZ)

#### 3.2.1.1.2 Separation Standards

The physical separation standards between runways, taxiways, taxi lanes and from objects restrict the siting of deicing facilities. The separation standards may need to be increased with airport elevation to meet required standards. Noncompliance with these separation standards in siting a deicing facility can result in the need to utilize specific taxi routings which reduces aircraft operational efficiency and flexibility, or can impose other operating restrictions.

#### 3.2.1.2 Air Navigation Facilities

Deicing facilities should be sited so that airway facilities such as NAVAIDS, monitoring equipment, and communication shelters are at a sufficient distance from aircraft in the facility so as to minimize the impact of jet blast/exhaust and the potential accumulation of exhaust deposits on antennas. Deicing facilities and mobile vehicle staging or operating areas, as well as power lines, fences, metal buildings, etc., must be located to preclude any reflection, derogation or blockage of signals from existing NAVAIDS or areas planned to support future NAVAID installations. It should also be noted that the signals of certain vintage NAVAIDS may be more susceptible to interference or derogation than newer generation equipment. This should be considered where applicable. Typical siting considerations include, but are not limited to:

- a. Localizer antenna
- b. Glide slope antenna
- c. Azimuth antenna
- d. Elevation antenna
- e. Distance measuring equipment (DME)
- f. Marker beacons
- g. Nondirectional beacon
- h. Very high frequency omnirange (VOR)
- i. Airport surveillance radar (ASR)
- j. Airport Surface Detection Equipment (ASDE) antenna
- k. Microwave communication paths for fixed systems

Some airports may have further requirements for the installation of additional communications equipment because of the assignment of operating frequencies to meet the operating needs of the deicing facility. Additional communications equipment installations may result from increased ground control frequencies necessary for air traffic control to provide safe flow of airport ground traffic and for ground deicing personnel to conduct safe deicing operations.

#### 3.2.1.3 Air Traffic Control Tower (ATC TWR) Line-of-Sight Limitations

One siting objective relative to ATC is a clear line-of-sight to and through the deicing facility. Even though deicing facilities may be in nonmovement areas, line-of-sight from the ATC TWR should always be maintained. The deicing facility should also be sited to allow ATC a clear view of movements and activity in the area of the deicing facility. This capability enables ATC to hand-off aircraft to the deicing facility and pick up departing aircraft from the facility. An exception can be considered for a potential site where the deicing facility located in a no movement area interferes with line-of-sight, but there is adequate line-of-sight for the hand-off and pickup points. Potential line-of-sight obstructions to existing or future airfield components resulting from aircraft utilizing the facility should also be evaluated. Additionally, to maintain visual contact from the ATC TWR, aircraft being deiced/anti-iced should not shadow active runway ends or their entrance taxiways. To minimize shadows, aircraft in use (or planned) with the largest surfaces (i.e., wingspan, tail height, etc.) to be treated should be evaluated.

Consideration should also be given to the evaluation of line-of-sight considerations associated with movement areas from future ATC TWR cab positions to the extent these areas are planned or relevant.

#### 3.2.1.4 Other Physical Constraints

In addition to the requirements set by a regulatory agency and airport operators, a prudent facility siting approach dictates appropriate consideration of other factors as necessary. These can include, but are not limited to:

- a. Environmental runoff mitigation alternatives
- b. Engine exhaust wake (jet blast/prop wash) impacts on adjacent aircraft, personnel and facilities
- c. Existing airfield complexity, topography and drainage
- d. Adjacent land use considerations
- e. Results of detailed airspace analysis
- f. Local building requirements

#### 3.2.2 Operational Constraints

This section underscores how the intended use of a facility, the dispensed fluid types, and aircraft types to be treated can influence the size and configuration of a deicing facility, as well as support equipment and facilities. It may be necessary to reconfigure or reduce the size of a proposed facility in order to be accommodated in an operationally desirable area of the airfield.

##### 3.2.2.1 Determination of Throughput Capacity Requirements

The facility's throughput capacity can have a bearing on siting a facility since the facility's configuration can limit the processing capacity. Throughput capacity requirements should include consideration of the following:

##### 3.2.2.1.1 Aircraft Types and Associated Levels of Demand

Aircraft Types and Associated Levels of Demand provide information on the existing aircraft fleet mix at an airport. Future fleet mix information can be derived from airport planning documents and/or airlines. Also refer to AS6286/6.

### 3.2.2.1.2 Procedures and Methods

The extent (processing time) of the deicing/anti-icing treatment can influence the facility's location. Users may have varying ground deicing/anti-icing programs in which some require extra treatment time, fewer deicing vehicles, or post-treatment checks.

### 3.2.2.2 Bypass Capability

A deicing facility's processing capacity can be enhanced if bypass taxiing capability can be provided to mitigate congestion/conflict with inbound and outbound taxiing aircraft and with aircraft entering or departing the facility. This capability, which may require additional physical space, can also facilitate the removal of a disabled aircraft at or near the deicing facility, or aircraft requiring bypass capability for other reasons. It may be possible to configure bypass capability to offer a return/recirculation route for aircraft that have exceeded the holdover time of the fluid applied and require a reapplication of fluid (deicing and anti-icing) or a physical check.

Additionally, new bypass taxiing routes should have a minimum of turns, taxiway intersections, and runway crossings, and should avoid areas that require repeated air traffic control clearances. The bypass taxi routes should not create potential bottlenecks or operational problems for landing aircraft.

### 3.2.2.3 Future Growth and Ultimate Demand

Growth in aircraft activity and future changes to both the airport's physical configuration and aircraft dimensions should be reviewed for pertinent information to the siting process. Trends in aircraft deicing practices and procedures to the extent that these can be identified or defined, can also be relevant to the siting process.

## 3.2.3 Completion of the Inventory Phase

At the conclusion of the inventory phase, a planner/designer should have a thorough understanding of the overall layout and ultimate development plan of the airport, as well as the airfield operational characteristics. The process of identifying potential sites begins at this point since primary physical and dimensional constraints are highlighted as the inventory of defining criteria progresses.

## 3.3 Additional Siting Considerations

Additional siting considerations should focus on minimizing resultant increases in ATC workload and ground movement complexities, impacts of additional taxi distances, delays, inefficiencies in supporting the operation of deicing/anti-icing operations, and environmental runoff impacts. The following items address these areas with respect to new or existing paved areas, and mobile deicing vehicles or fixed deicing equipment operations.

### 3.3.1 Siting Based on Runway and Taxiway Utilization

Runway and taxiway utilization can have a significant impact on the siting of a deicing facility. At airports with an ATC TWR, there is an established preferential runway and taxi routes for both arriving and departing aircraft to and from the gate area for particular operating configurations. The planner/designer should become thoroughly familiar with the established winter runway operating configurations and taxi routes through consultation with the local ATC representatives to develop an understanding of the level of operations on relevant taxiway segments and common or potential points of congestion in the taxiway system. Consideration should also be given to expected taxi speeds and reduced visibility under adverse weather conditions. Information can be obtained through consultation with the local ATC representatives.

3.3.1.1 Deicing facilities near winter departure runway end(s) tend to minimize the time between fluid application and aircraft takeoff and better accommodates the deicing facility's departure demand for the runway end(s) that it serves if it has adequate throughput capacity.

### 3.3.2 Aircraft Ground Movement Complexity

A potentially significant consideration in siting deicing facilities is the introduction of increased ground movement complexity that can cause substantial added ATC workload and the potential for runway/taxiway incursions. Aspects to avoid to the extent possible in siting a deicing facility include circuitous taxi routes, significant cross-field taxiing, introduction of inbound/outbound aircraft conflict points and congestion.