ALLCLEAR SYSTEMS

# Product Guide

# Lift-Off P-88

## SAE AMS 1424/1 Type I
## Aircraft De/Anti-Icing Fluid

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# 1. About AllClear Systems LLC

AllClear Systems LLC (hereinafter AllClear) is a dynamic, customer-focused company providing aviation de/anti-icing products to the commercial and military sectors of the aviation industry, with a service-delivery ethos that is second to none.

Headquartered near Philadelphia, Pennsylvania, AllClear has extensive regional product manufacturing and logistics capability across North America.

# 2. The Product

Lift-Off P-88 is a Propylene Glycol-based deicing fluid containing water, corrosion inhibitors, wetting agents and an orange dye. The fluid has been tested in accordance with SAE International (SAE) Aerospace Material Specification (AMS) 1424/1 and has been fully qualified.

Lift-Off P-88 is available in either concentrated or diluted product form.

**WARNING**: Lift-Off P-88 Concentrate nominally contains approximately 88% by weight Propylene Glycol. It **MUST BE** mixed with the appropriate amount of water **BEFORE USE** to make an aqueous deicing solution with the desired freezing point; the user should refer to Section 10.2 of this Product Guide for the Product Dilution and Lowest Operational Use Temperature (LOUT) Table.

The details contained within this Product Guide were based on information believed to be reliable at the time of publication and are intended to provide general guidance on this product and its usage. All references within this document to third-party information were correct at the time of this document's publication.

AllClear does not guarantee, expressly or implied, any specific properties of the product or the suitability of the product for a particular application. The user of the product must determine the product's suitability for the intended application and purpose. The user assumes all risk and liability in connection with the use of the product.

This Product Guide provides details and guidance information for the handling and use of Lift-Off P-88. The user of Lift-Off P-88 shall ensure that the fluid is

always employed in conjunction with the procedures and processes included in the latest version of SAE Aerospace Standard (AS) 6285 and all applicable service provider and/or air carrier de/anti-icing programs. The user of Lift-Off P-88 shall also ensure that only properly trained personnel are employed to receive, handle and apply Lift-Off P-88 to aircraft.

The user of Lift-Off P-88 shall include applicable information from this Product Guide within employee training programs, to ensure company personnel are knowledgeable of product properties, handling considerations, limitations and performance characteristics, at a minimum.

This Product Guide (Version 8.0) is dated September 2023 and will remain in effect until a subsequent revision of the Product Guide is developed and made available on the www.allclearsys.com website. The user of the Lift-Off P-88 shall always ensure that the most recent version of the Product Guide is employed and that all previously issued Product Guides are destroyed.

The user of Lift-Off P-88 shall read this entire document and the associated Safety Data Sheet (SDS) before receiving, handling or using Lift-Off P-88.

## 3. Delivery Options

AllClear Lift-Off P-88 fluid can be obtained from AllClear in the following delivery formats:

- Bulk (typical volume, but can vary by region):
  - Tanker truckload ~32,000 litres (~8,450 US gallons)
  - ISO tank ~22,700 litres (~6,000 US gallons)
  - Railcar ~70,000 litres (~18,500 US gallons)
- IBC/Totes ~1,000 litres (~265 US gallons)
- Drums ~208 litres (~55 US gallons)

## 4. Product Development Testing and Qualification

SAE AMS 1424/1 establishes the testing and performance requirements for all Type I de/anti-icing fluids used in aircraft ground de/anti-icing operations. AMS 1424/1 requires the conduct of extensive product testing, which measures the compatibility of materials used in aircraft construction with the fluid and establishes the compliance requirements for the physical properties of the fluid. In addition, AMS 1424/1 requires that anti-icing and aerodynamic performance tests are performed and that minimum performance results are achieved.

Lift-Off P-88 fluid has been fully tested by accredited independent laboratories and has been found to meet or exceed the requirements of SAE AMS 1424/1. A copy of the full Fluid Qualification Report for Lift-Off P-88 can be obtained directly from AllClear upon request.

Lift-Off P-88 is included on the Qualified Fluids List published by the Anti-Icing Materials International Laboratory (AMIL). The list can be found at the following location:

https://amillaboratory.ca/aircraft-deanti-icing-fluids/qualified-fluids-lists/

## 5. Regulatory Approval

AllClear Lift-Off P-88 has been included on the Transport Canada (TC) and Federal Aviation Administration (FAA) lists of Approved Fluids, which are contained within the Annual Holdover time Updates issued by each regulator. The TC and FAA Guidance Material can be found at the following locations:

**Transport Canada**

www.tc.gc.ca/eng/civilaviation/standards/commerce-holdovertime-menu-1877.htm

**Federal Aviation Administration**

www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing

## 6. Operational Data Summary

<table>
<tr><th colspan="4">Lift-Off P-88 Concentrate</th></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Composition</td><td colspan="3">Approximately 88% Propylene Glycol</td></tr>
<tr><td>Appearance</td><td colspan="3">Clear or slightly turbid orange/red colored liquid, free from any visible impurities.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Dilution</td><td colspan="3"><u>WARNING: Must Be Diluted before Use</u><br>See product dilution information in Section 10.2</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Refractive Index at 20ºC</td><td colspan="3">1.4235 - 1.4265</td></tr>
<tr><td>Brix at 20ºC</td><td colspan="3">52.1 – 52.7</td></tr>
<tr><td>pH at 20ºC</td><td colspan="3">7.5 – 8.5</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="3">Lowest Operational Use Temperature (LOUT)</td><td colspan="3"><u>Aircraft Take-off Rotation Speed Certification</u></td></tr>
<tr><td>Dilution</td><td><u>High Speed</u></td><td><u>Low Speed</u></td></tr>
<tr><td>70/30:</td><td>-29.5°C</td><td>-24.5°C</td></tr>
<tr><td></td><td>50/50:</td><td>-18°C</td><td>-18°C</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Product Freezing Point</td><td colspan="3">Lift-Off P-88 Concentrate does not freeze. Refer to section 10.2 for freezing points of diluted product.</td></tr>
</table>

# 7. Lowest Operational Use Temperature

The Lowest Operational Use Temperature (LOUT) for a Type I fluid is defined as the higher (warmer) temperature of:

- The freezing point of the fluid plus the required freezing point buffer of 10ºC (18ºF); and

- The lowest temperature at which the fluid meets the aerodynamic acceptance test (determined in accordance to SAE AS 5900) for a given type of aircraft rotation speed (high-speed or low-speed).

Based on the results of testing conducted with Lift-Off P-88, the LOUT of Lift-Off P-88 fluid for high-speed aircraft has been determined to be -29.5ºC (-21.1ºF). The LOUT of Lift-Off P-88 for low-speed aircraft is -24.5ºC (-12.1ºF).

The user of Lift-Off P-88 shall ensure that the LOUT is always respected, and that Lift-Off P-88 is never applied to aircraft surfaces below this temperature.

# 8. Storage and Handling

The user should ensure that this product is stored and handled correctly to prevent degradation and the potential for performance reduction.

## 8.1 Product Safety

The user should consult the latest SDS before handling this product, and all necessary steps to ensure that this product is used safely and in an environmentally responsible manner consistent with all applicable regulations at your location should be made.

Because regulations and use conditions are subject to change by government, state, provincial and local authorities, it is the user's responsibility to determine that available information is appropriate and suitable under current, applicable laws and regulations.

The user should provide all applicable information to its employees, contractors, and customers, or any other users of the product(s), and request that they do the same.

Areas sprayed with glycol-based products may become slippery. The user should employ caution while operating equipment or walking on areas exposed to these products. Even areas only affected by overspray or dripping should be treated with the same caution. Before the user enters vehicles, aircraft or buildings, feet should be wiped and the user should be aware that vehicles and even foot traffic can cause other areas to become slippery. If vacuum trucks are available, they can remove excess accumulations on the ground. If further ground cleanup is required using solid or absorbent materials, the user should ensure that it is quickly removed and disposed of in accordance with the regulations in force at your location.

## 8.2 Storage Vessels

Bulk deliveries of Lift-Off P-88 should only be stored in well-maintained tanks. These can be made from carbon steel, coated carbon steel, aluminum, stainless steel or light colored opaque high-density polyethylene (dark colors can generate higher internal tank temperatures due to sunlight exposure). Other materials may be considered subject to AllClear approval on a case-by-case basis.

When supplied in totes and drums, it is preferable for the totes and drums to be stored inside a dry building with all fill and drain ports protected against damage. The totes and drums should be kept away from direct heat sources and shielded from fluorescent lights. If this is not possible, the totes and drums should be fully covered over to prevent exposure to ultraviolet light (UV). Common UV sources are sunlight and fluorescent lights.

Lift-Off P-88 is not corrosive and will not damage materials commonly used for storage tanks, pumps, fittings and transfer lines, as well as many gasket, seal and hose elastomers. The user should avoid using dissimilar metals in contact with each other as galvanic action can occur, which may degrade the fluid. Some, but not all, symptoms of galvanic action occurring may be the presence of gels or light residues.

## 8.3 Piping and Hoses

All piping and hoses should be dedicated solely for use with this product, clearly labelled and well maintained. A minimum pipe or hose diameter of 8 centimeters (3 inches) is recommended.

Fixed piping can be made from the metals listed in Section 8.2, with care being taken again regarding the use of dissimilar metals and the potential for galvanic action to degrade the fluid. Piping should be well maintained, and the surfaces should be smooth with sharp bends being avoided.

Flexible hoses approved for use with either petroleum-based products or chemical solvents should be used. Hose fittings should be capped when not in use and stored off the ground to keep them free from contaminants.

## 8.4 Pumping and Handling

Lift-Off P-88 can be transferred with various commercially available pump types, such as gear, centrifugal, diaphragm and progressive cavity without affecting its performance. At colder temperatures more powerful pumps may be needed due to the associated increase in product viscosity.

## 8.5 Maintaining Product Integrity

The user should ensure that storage or deicing unit tanks are clean, dry and stain free prior to initially filling with Lift-Off P-88. The user should **NOT** mix Lift-Off P-88 with any other product. All tank access hatches and fill/dispense ports should be properly closed and sealed to prevent ingress of foreign matter.

Once Lift-Off P-88 has been loaded into the deicing equipment, it must not be transferred back into a storage vessel that contains fresh Lift-Off P-88. This will prevent the possibility of contamination in the deicing application equipment from degrading the fresh product in the storage vessel.

Lift-Off P-88 Concentrate must be stored **unheated**.

Lift-Off P-88 Type I dilutions are stored unheated, however, to reduce heating time when preparing for a deicing event, it is permissible to pre-heat it to a maximum of 60°C (140°F), either in a storage facility or in the deicing truck. The user should avoid unnecessary standby heating as water evaporation may cause an increase in glycol concentration or a change in pH. Evaporation can be reduced by keeping tank access hatches closed, although you must ensure

that tank vents are open to prevent a pressure buildup. The user should verify the refraction regularly to make sure that the deicing fluid strength and freezing point are within the acceptable range for the conditions under which it will be used. Water loss due to evaporation can normally be corrected by thoroughly mixing clean water directly into the tank. The user should test again to ensure that the required fluid strength, freezing point and pH (if necessary) are achieved.

Excessive heating can also induce thermal degradation of the product. Thermal degradation. A lowering of pH or an increase in glycol concentration (increase in refraction) or discoloration are indicative of thermal degradation.

The dye in Lift-Off P-88 is designed to degrade upon exposure to UV light, causing the product color to gradually fade. While the deicing properties of the product will be maintained, the lack of color will make it more difficult to determine where the fluid has been sprayed. If the integrity of the product is in doubt, the user should contact AllClear.

### 8.6 Storage Stability

Provided that storage requirements are adhered to, under normal ambient conditions the shelf life of Lift-Off P-88 will exceed one year.

It is recommended that, at a minimum, product samples are quality tested against AllClear specifications prior to use at the start of each deicing season. The user or customer may specify that a more frequent schedule is adopted, and therefore the user should refer to its own approved Ground Icing Operations Program or similar customer programs for testing requirements.

## 9. Product Delivery Acceptance

Prior to accepting product delivery, the user should confirm that:

- All delivery vessel port caps are secured and locked with individually identifiable tamper proof seals that match the delivery documentation.
- All delivery documentation/labelling refers to Lift-Off P-88 Concentrate.
- The product complies with the test parameters described on the delivery Certificate of Analysis, in accordance with the scope of the user's product

acceptance requirements. The following table summarizes the acceptance criteria on the Certificate of Analysis.

| Lift-Off P-88 Concentrate | |
|---|---|
| | |
| Base Composition | Propylene Glycol |
| | |
| Appearance | Clear or slightly turbid orange/red colored liquid, free from any visible impurities. |
| Refractive Index at 20°C | 1.4235 - 1.4265 |
| Brix at °C | 52.1 – 52.7 |
| The user should refer to section 10.3 for refractometer guidance. | |
| pH at 20°C | 7.5 – 8.5 |
| | |
| **If any test results are out of range, <u>do not use</u>; contact AllClear immediately.** | |

# 10. Product Usage

## 10.1 Introduction

Aircraft manufacturers provide recommendations for the de/anti-icing their aircraft models in maintenance and operating manuals. Additionally, aviation regulators, such as TC and the FAA, require air operators to have a regulator approved Ground Icing Operations Program. Industry standards, material specifications and recommended practices published by SAE are employed generally as the basis for these programs and should be adhered by the user of Lift-Off P-88.

Environmental considerations may need to be adopted depending on federal, state, provincial and local agency requirements at the airport location.

Consideration should be given to the suitability of the de/anti-icing location with respect to all applicable airport operational and environmental factors.

**CAUTION**: As with any aircraft deicing or anti-icing process, only personnel who have been properly trained in the use of Lift-Off P-88 fluid in accordance with the requirements of applicable approved Ground Icing Operations Program should be employed. Personnel should also be kept up to date on revised Lift-Off P-88 technical material as provided from time to time by AllClear.

## 10.2 Product Dilutions

Lift-Off P-88 Concentrate must **NEVER** be applied to an aircraft until it has been diluted with the correct volume of water to make an aqueous deicing fluid solution with the required freezing point and Lowest Operational Use Temperature (LOUT) in accordance with the following table. Dilution is normally confirmed using a correctly calibrated refractometer.

## AllClear Lift-Off P-88 Dilution Table

| Dilution (v/v) Lift-Off P-88 / Water | *Refractive Index @ 20°C (± 0.002) | *BRIX @ 20°C (±0.25) | **LOUT by Aircraft Rotate Speed (°C) | | Product Freezing Point (°C)[°F] |
|---|---|---|---|---|---|
| By Volume | | | <100 kts | >100 kts | |
| 100/0 | 1.425 | 52.40 | Do Not Use | | N/A |
| **70/30** | **1.401** | **40.70** | **-24.5** | **-29.5** | **-50 [-58]** |
| **65/35** | **1.397** | **38.60** | **-24.5** | **-29.5** | **-49 [-56.2]** |
| 64/36 | 1.396 | 38.16 | -24.5 | -29.5 | -47.8 [-54] |
| 63/37 | 1.395 | 37.69 | -24.5 | -29.5 | -46.5 [-51.7] |
| 62/38 | 1.394 | 37.21 | -24.5 | -29.5 | -45.3 [-49.5] |
| 61/39 | 1.393 | 36.73 | -24.5 | -29.5 | -44 [-47.2] |
| **60/40** | **1.393** | **36.40** | **-24.5** | **-29.5** | **-41 [-41.8]** |
| 59/41 | 1.392 | 35.77 | -29.5 | | -39.5 [-39.1] |
| 58/42 | 1.391 | 35.28 | -28.2 | | -38.2 [-36.8] |
| 57/43 | 1.390 | 34.78 | -27.0 | | -37 [-34.6] |
| 56/44 | 1.389 | 34.28 | -25.7 | | -35.7 [-32.3] |
| **55/45** | **1.388** | **34.00** | **-24.0** | | **-34 [-29.2]** |
| 54/46 | 1.387 | 33.27 | -23.2 | | -33.2 [-27.8] |
| 53/47 | 1.386 | 32.76 | -22.0 | | -32 [-25.6] |
| 52/48 | 1.385 | 32.25 | -20.8 | | -30.8 [-23.4] |
| 51/49 | 1.384 | 31.73 | -19.6 | | -29.6 [-21.3] |
| **50/50** | **1.383** | **31.10** | **-18.0** | | **-28 [-18.4]** |
| 49/51 | 1.382 | 30.68 | -18.3 | | -27.5 [-17.5] |
| 48/52 | 1.381 | 30.15 | -17.1 | | -27.1 [-16.8] |
| 47/53 | 1.380 | 29.62 | -16.0 | | -26 [-14.8] |
| 46/54 | 1.379 | 29.08 | -14.9 | | -24.9 [-12.8] |
| **45/55** | **1.378** | **28.40** | **-13.0** | | **-23 [-9.4]** |

| Dilution (v/v) Lift-Off P-88 / Water | *Refractive Index @ 20°C (± 0.002) | *BRIX @ 20°C (±0.25) | **LOUT by Aircraft Rotate Speed (°C) | | Product Freezing Point (°C) [°F] |
|---|---|---|---|---|---|
| By Volume | | | <100 kts | >100 kts | |
| 44/56 | 1.377 | 27.99 | -12.7 | | -22.7 [-8.9] |
| 43/57 | 1.376 | 27.44 | -11.7 | | -21.7 [-7.1] |
| 42/58 | 1.375 | 26.89 | -10.6 | | -20.6 [-5.1] |
| 41/59 | 1.374 | 26.33 | -9.6 | | -19.6 [-3.3] |
| **40/60** | **1.374** | **26.2** | **-9.0** | | **-19 [-2.2]** |
| 39/61 | 1.373 | 25.20 | -8.7 | | -18.7 [-1.7] |
| 38/62 | 1.372 | 24.63 | -7.8 | | -17.8 [0] |
| 37/63 | 1.371 | 24.06 | -6.9 | | -16.9 [1.5] |
| 36/64 | 1.370 | 23.48 | -6 | | -16 [3.2] |
| **35/65** | **1.369** | **23.1** | **-5.0** | | **-15 [5]** |
| 34/66 | 1.369 | 22.31 | -4.4 | | -14.4 [6] |
| 33/67 | 1.368 | 21.72 | -3.6 | | -14 [6.8] |
| 32/68 | 1.367 | 21.13 | -2.9 | | -13.8 [7.2] |
| 31/69 | 1.366 | 20.53 | -2.2 | | -13.4 [7.9] |
| **30/70** | **1.366** | **21.3** | **-3.0** | | **-13 [8.6]** |
| 29/71 | 1.363 | 19.32 | -0.9 | | -10.9 [12.4] |
| 28/72 | 1.362 | 18.71 | -0.4 | | -10.4 [13.3] |
| 27/73 | 1.361 | 18.10 | +0.2 | | -9.8 [14.4] |
| 26/74 | 1.360 | 17.48 | +0.6 | | -9.0 [15.8] |
| **25/75** | **1.357** | **15.9** | **+2.0** | | **-8 [17.6]** |
| 24/76 | 1.357 | 16.23 | +1.5 | | -7.8 [18] |
| 23/77 | 1.356 | 15.60 | +1.8 | | -7.6 [18.3] |
| 22/78 | 1.356 | 14.96 | +2.2 | | -7.4 [18.7] |
| 21/79 | 1.355 | 14.33 | +2.4 | | -7.2 [19] |
| **20/80** | **1.354** | **13.9** | **+3.0** | | **-7 [19.4]** |

***** All values are typical and may vary depending on production results. Values in **bold** are directly measured whereas unbolded values are calculated.
****** Lowest Operational Use Temperature (LOUT): The dilution ratio must have a LOUT lower than the expected ambient temperature

**Note:** The FAA and TC Holdover Time Guidance, as well as the SAE AS 6285 document, describe the use of a 10°C (18°F) Freezing Point Buffer below the Outside Air Temperature (OAT) when using SAE Type I deicing fluid in a single step process.

## 10.3 Refractometers

While laboratories use specialized equipment and procedures to determine fluid refractive index, or degrees Brix, this is not necessarily practical for testing during winter operations on the airport. In the field, temperature-compensated, correctly calibrated, portable refractometers are more convenient for operational usage. Do not use hydrometers on AllClear products.

The user should contact AllClear for guidance on obtaining a suitable refractometer model for use with AllClear products.

The user should always comply with the refractometer manufacturer's requirements for the maintenance and calibration schedule of the selected refractometer, as well as its proper care and use.

## 10.4 Precautions

a) Undiluted Lift-Off P-88 Concentrate should not be applied to an aircraft. The user should refer to Section 10.2 for dilution information to make an aqueous deicing fluid.

b) Lift-Off P-88 aqueous deicing fluid solution is only to be applied **heated** and is recommended for application on aircraft exterior surfaces only.

c) Lift-Off P-88 should not be applied on:

- Helicopters (unless approved by the helicopter manufacturer);
- Areas designated by the aircraft manufacturer as no spray zones. Common examples have historically been, but are not limited to, cockpit windows, aircraft brakes, engine/auxiliary power unit inlets and exhausts, passenger or cargo door gaps, systems inlets or vents, instrument sensors etc.;
- Runways;
- Pavement;

- Roadways;
- Sidewalks;
- Vehicles; and
- Ground Support Equipment.

d) Lift-Off P-88 should not be employed as antifreeze for:

- Vehicles;
- Ground Support Equipment;
- Sanitary Water Facilities; or
- Aircraft or Portable Lavatories.

e) In recent years deicing truck manufacturers have offered forced air application systems as options on their equipment. These trucks may either inject deicing fluid into the airstream, or on top of it. Consideration should be given to the effect that this type of application has on the integrity of SAE Type I fluids under active weather precipitation conditions. Industry guidance on the safe and efficient use of this equipment is available in SAE documentation.

## 10.5 Application Guidance

The following guidance is provided for general informational purposes only. The user is responsible for correct application in accordance with the approved Ground Icing Operations Program in effect.

The user should always follow the application, usage and inspection procedures of the specific aircraft operator, while ensuring compliance with the minimum acceptable requirements specified by the applicable government regulator.

General Lift-Off P-88 Application Tips:

Application temperature and velocity is critical in ensuring an efficient deicing process. Lift-Off P-88 should be heated to a temperature between 60°C (140°F) to 82°C (180°F) when measured at the dispensing nozzle. The heat energy in the fluid will melt/break the bond of frozen accumulations adhering to the aircraft surface. The pressure energy used to spray the fluid will then dislodge and flush away those frozen accumulations.

**CAUTION**: Fluid temperature and pressure shall not exceed aircraft maintenance manual requirements to avoid causing damage to the aircraft.

The user should ensure that the fluid remaining on the surface has a freezing point at least 10°C (18ºF) below outside ambient temperature (OAT); however, if the aircraft surfaces have been cold soaked then they may be colder than OAT requiring additional consideration in determining the freezing point buffer temperatures.

Before starting, the user should be aware of the no-spray zones for the aircraft type you will be working on. These should be described in the user or customer Ground Icing Operations Program.

The user should apply heated Lift-Off P-88 deicing fluid in sufficient quantity to completely remove all frozen deposits from all the areas required by your Ground Icing Operations program. The user should allow time for fluid to work its way into gaps in the wing and stabilizer control surfaces. Sometimes it is necessary to coat an area with the heated fluid, then just let the heat energy soak into the packed snow or ice, while another area is sprayed. Upon return, the user should remove any dislodged contamination and repeat as necessary.

**CAUTION**: During the deicing process, all SAE Type I fluids become further diluted due to contact with snow and ice meltwater as well as continuing precipitation. This additional dilution may raise the fluid freezing point to a point where freezing can occur on the aircraft surface.

The user should inspect the aircraft to ensure that it is in compliance with the requirements of the user or customer Ground Icing Operations Program before announcing that the deicing is complete.

Depending on the ambient conditions present, different processes can be employed for safe and efficient aircraft deicing.

<u>One-Step Deicing</u>

When a one-step process is considered suitable for the prevailing or expected ambient and operational conditions, it is accomplished using only heated SAE Type I fluid.

This process is typically used to remove frozen deposits from the aircraft after the active precipitation has ceased.

The user should clean the aircraft surfaces in accordance with the procedural and inspection requirements of the approved Ground Icing Operations Program in effect for the aircraft.

SAE Type I fluids have a very limited capability of preventing refreezing and snow or ice build-up. If any doubt exists then protection time can be increased by using the "two-step" process described below.

Two-Step Deicing/Anti-icing

A two-step process is necessary when the prevailing or expected ambient and operational conditions are beyond the safe holdover time performance capabilities of just a Type I fluid. In this case, deicing is accomplished using heated SAE AMS 1424/1 Type I fluid, but it is immediately followed by an application of a qualified SAE AMS 1428/1 Type II, III or IV anti-icing fluid (as appropriate) to provide the necessary holdover time protection.

The two-step process is generally used when frozen deposits are required to be removed from the aircraft and active freezing precipitation is either occurring or expected before take-off.

- First step. The user should apply heated Lift-Off P-88 Type I deicing fluid, at the concentration strength appropriate for the worst weather conditions expected before take-off. The aircraft surfaces should be cleaned in accordance with the procedural and inspection requirements of the approved Ground Icing Operations Program in effect for the aircraft.
- Second step. After the heated Type I application has been satisfactorily completed and the required aircraft surfaces are clean, the user should apply a fully qualified, unheated SAE AMS 1428/1 Type II, III or IV anti-icing fluid (as appropriate) to the required aircraft surfaces before any refreezing occurs, typically within 3 minutes. The user should ensure that enough fluid is sprayed to adequately displace any Type I used in the first step and also to form a layer of suitable thickness to provide adequate protection. The user should refer to the approved Ground Icing Operations Program in effect for details.

Monitoring Fluid Effectiveness

As with any SAE deicing or anti-icing fluid, continued exposure to precipitation after application will eventually cause the fluid to lose its effectiveness in preventing frozen contamination from reforming.

It is important that both flight and ground personnel are trained to recognize when this might be about to happen or has happened. A fluid will typically start to lose its glossy look or fluid dye when it is losing its effectiveness. At this point it may be close to providing inadequate protection, so it is important to also look for signs of snow or ice accumulation, surface freezing, build-up of ice crystals in or on the fluid, or the presence of slush. A pre-takeoff check, or if necessary, a pre-takeoff contamination check is the only way to determine if an aircraft is free of contamination prior to takeoff.