NFD - (DIM) - Deicing Manual

0.1 Purpose of Nordic Flight Deicing Manual (DIM)

In accordance with EASA recommendations (EASA SIB 2017 11 and EASA SIB 2018 12), The Nordic Flight de-/anti-icing manual (DIM) defines rules, standards and specifications for the execution and quality management of Deicing and Anti-icing operations performed by Nordic Flight.

These procedures are maintained in alignment with the following documentation known to the international community as the “global aircraft deicing standards.”.

- ICAO document 9640 ‘Manual of Aircraft Ground Deicing/Anti icing Operations
- SAE AS6285 Aircraft Ground Deicing/Anti Icing Processes
- SAE ARP6257 Aircraft Ground De/Anti Icing Communication Phraseology for Flight and Ground Crews
- SAE AS6286 Training and Qualification Program for Deicing/Anti icing of Aircraft on the Ground
- SAE AS6332A Aircraft Ground Deicing/Anti icing Quality Management

Nordic Flight utilized the latest FAA published “FAA Holdover time Guidelines in accordance with the recommendations issued by EASA in SIB 2017-11.

Exposure to weather conditions on the ground conducive to ice formation can cause the accumulation of frost, snow, slush, or ice on aircraft surfaces and components. These contaminants can adversely affect aircraft performance, stability, control, and operation of mechanical devices such as control surfaces, sensors, flaps, and landing gear. If frozen deposits are present, other than those considered in the aircraft certification process, the performance of the aircraft may be compromised.

As individual icing situations or aircraft types and models may require special procedures, this document can never replace the aircraft operator’s judgement. The responsibility for the correct deicing and anti-icing procedures for aircraft always rests with the operator of the aircraft.

The ultimate responsibility for the determination that the aircraft is clean and meets airworthiness requirements rests with the pilot-in-command of the aircraft.

0.2 Rotary Wing Operations

This manual and its content are not applicable to Nordic Flight Rotary Wing Operations.

0.3 Ownership

The Nominated Person Ground Operations is responsible for DIM being updated to current standards. Changes to the DIM should be discussed and approved by the de-icing board.

Changes to the DIM shall be approved by the de-icing board. (**0.4 - De-Icing / Anti-icing Board**)

CERTIFICATE OF ANALYSIS: A document, issued by a manufacturer, attesting that a lot or batch of a product fulfills the manufacturer's sales specification requirements, listing the tests, the test requirements, the test results on that lot or batch, the lot or batch number and a date.

CERTIFICATE OF CONFORMANCE: A document declaring that a product fulfills the requirements of a standard. Also known as certificate of conformity.

CHECK: Examination against a relevant standard by a trained and qualified person to ascertain satisfactory condition.

CHEMICAL CONTAMINATION: Condition when substances (chemicals) are present where they should not be or are at concentrations higher than they should be.

CLEAR ICE: Ice difficult to detect visually. It is normally formed in the area of the wing fuel tanks, caused by cold-soaking. Clear ice may break loose during or after takeoff, and poses a hazard particularly to aircraft with rear mounted engines.

COLD-SOAKING: Ice can form on aircraft surfaces even when the outside air temperature (OAT) is well above 0 °C (32 °F). An aircraft equipped with wing fuel tanks may have fuel that is at a sufficiently low temperature such that it lowers the wing skin temperature to below the freezing point of water. The low temperature of the fuel may come from flying at a high altitude, where cold temperature prevails, for a period of time, or from fueling with cold fuel. This phenomenon is known as cold soaking. While on the ground, the cold-soaked aircraft will cause ice to form when water as rain or as vapor (humidity), comes in contact with cold-soaked surfaces.

CONTAMINATION: All forms of frozen or semi-frozen deposits on an aircraft, such as frost, snow, slush, or ice (also known as frozen contamination).

CONTAMINATION CHECK: A check of aircraft surfaces and components for contamination to establish the need for deicing.

DEICING: Procedure by which frost, snow, slush, or ice are removed from an aircraft in order to provide clean surfaces and components.

DEICING/ANTI-ICING: Combination of or referring to both of the procedures for "deicing" and "anti-icing." It may be performed in one or two steps.

DEICING FLUID:

1. Heated water.
2. Heated mixture of water and Type I fluid.
3. Heated premix Type I fluid.
4. Heated Type II, III, or IV fluids.
5. Heated mixture of water and Type II, III, or IV fluids.

NOTE: Unheated fluids are ineffective to deice.

Operational Standard

NOTE: For clarification; Type I, II, III and IV refer to de-icing fluids manufactured according to SAE standards, other fluids are NOT acceptable for Nordic Flight operations.

DEICING SERVICE PROVIDER: The company responsible for the aircraft deicing/anti-icing operations on an airfield.

DEICING PERSONNEL: Ground crew personnel with roles and responsibilities associated with aircraft ground icing operations.

DEW POINT: temperature at which unsaturated air must be cooled to cause saturation with respect to liquid water. The moisture condenses to liquid water either on surfaces as dew or as tiny liquid droplets suspended in air.

3.4 Deicing Service Provider

Shall have responsibility for:

- The safety and operability of the designated deicing facilities.
- Aircraft ground deicing/anti-icing procedures.

A deicing service provider shall have aircraft deicing/anti-icing procedures, including a quality control (QC) program. These procedures, which ensure compliance with the relevant regulations and global aircraft deicing standards such as AS6285, AS6286, and AS6332, shall cover all aspects of the aircraft ground deicing/anti-icing process, including (but not limited to) instructions, tasks, responsibilities, authorizations, and infra-structure for the deicing/anti-icing process as follows:

- Use of suitable deicing/anti-icing treatment method according to this standard.
- Remote deicing/anti-icing instructions (when applicable).
- Sufficient number of trained and qualified deicing/anti-icing personnel.
- Qualified staff to coordinate and supervise the deicing/anti-icing treatments.
- Use of suitable deicing/anti-icing equipment meeting specification ARP1971.
- Special handling procedures for Type II, III, and IV deicing/anti-icing fluids to maintain quality.
- Post-deicing/anti-icing check (when applicable).
- Protocol for communications with flight crew for both gate and remote locations (when applicable).
- Communicating the post-deicing/anti-icing report to the flight crew.
- Documentation of all deicing/anti-icing treatments.
- Personnel safety arrangements.
- Provisions for tools and clothing for deicing/anti-icing personnel.
- Environmental arrangements.
- A QC program.

3.4.1 Deicing Service Providers

IATA	Name:	Provider:	Types of fluid Available
THU	Thule Air Base	USAF: United States Air Force	
EVE	Harstad	Avinor	
KEF	Keflavik	Airport Associates	
RVN	Rovaniemi	Finavia	

4.3 Fluid Quality Control

To ensure the necessary safety margins are maintained in the deicing/anti-icing operation, the fluid used to both deice and anti-ice aircraft surfaces must meet specification and be at the correct concentration. Factors like pumping, storing, heating, and spraying may cause degradation/contamination of deicing/anti-icing fluids. To assure the correct quality of these fluids, follow fluid manufacturer's recommendations and perform the following checks and tests. Results of all testing shall be recorded.

Operational Standard

NOTE: If any of the following checks are not within limits set by the applicable fluid manufacturer, the respective storage tank or vehicle shall immediately be taken out of service. The storage tank or vehicle shall only commence service after making sure discrepancies have been cleared and checks have been confirmed to be within limits.

4.3.1 Fluid Delivery and Acceptance

4.3.1.1 Fluid Delivery Methods

Some of the most common delivery methods and their precautions are the following:

- Bulk Shipments (e.g., Tank Trucks and Rail Cars)
- Packaged Goods (i.e., Totes, Pails, or Drums)

4.3.1.1.1 Bulk Shipments (e.g., Tank Trucks and Rail Cars)

This delivery method consists of the usage of reusable vessels which can hold a larger fluid quantity. After performing the proper fluid quality controls, it is then transferred into the receiver's storage.

The fluid supplier shall provide an assurance that one of the following has been met prior to loading the bulk shipping container for delivery to the customer:

a. The shipping container and included delivery hoses were cleaned.
b. The previous load consisted of fluid identical to the delivered fluid.

4.3.1.1.2 Packaged Goods (i.e., Totes, Pails, or Drums)

When de/anti-icing fluid are delivered in a single or multiple containers (i.e., totes, pails, or drums) all sealed and shipped by the fluid manufacturer (or authorized company), fluid supplier shall provide all pertinent documentation as required in 4.3.1.3.

5.5 Deicing by Fluids

Frost, snow, slush, or ice may be removed from aircraft surfaces by the use of deicing fluids. It is the responsibility of the deicing service provider to ensure that all frozen deposits (with the possible exception of frost, which may be allowed as described in **Section 7**) are removed from the specified surfaces during the deicing procedure.

Caution: Consult aircraft maintenance manuals for limitations for the maximum application pressure, temperature, and the use of glycol (AMS1424/1 and AMS1428/1) versus non-glycol (AMS1424/2 and AMS 1428/2) fluids.

Operational Standard

Refer to relevant Aircraft Maintenance Manual.

Aircraft type	Low temperature	High temperature	Nozzle pressure
L1011	60°C	82°C	100 PSI
B720	62°C	80°C	100 PSI
B727-100	60°C	82¨C	100 PSI

5.5.1 Removal of Contaminants

For maximum effect, fluids shall be applied close to the surface to minimize heat loss. Fluid temperature and pressure should not exceed aircraft maintenance manual requirements. The heat in the fluid effectively melts any frost, as well as light deposits of snow, slush, and ice. Heavier accumulations require the heat to break the bond between the frozen deposits and the structure; the hydraulic force of the fluid spray is then used to flush off the contamination. The deicing fluid will prevent refreezing for a period of time, depending on aircraft skin and OAT, the fluid used, the mixture strength, and the weather.

5.5.1.1 Removal of Frost and Light Ice

A general procedure consisting of a nozzle setting that gives a solid cone (fan) spray should be used. This ensures the largest droplet pattern available, thus retaining the maximum heat in the fluid. Providing the hot fluid is applied close to the aircraft skin, a minimal amount of fluid will be required to melt the deposit.

5.5.1.2 Removal of Snow

A nozzle setting sufficient to flush off deposits and minimize foam production is recommended. Foam could be confused as snow. The method adopted will depend on the equipment available and the depth and type of snow; i.e., light and dry or wet and heavy. In general, the heavier the deposits of snow or ice, the heavier the fluid flow that will be required to remove it effectively and efficiently from the aircraft surfaces. For light deposits of both wet and dry snow, similar procedures as for frost removal may be adopted.

Wet snow is more difficult to remove than dry snow, and unless deposits are relatively light, the selection of a high fluid flow will be found to be more effective. Under certain conditions, it will be possible to use the heat, combined with the hydraulic force of the fluid spray, to melt and subsequently flush off frozen deposits. However, where snow has bonded to the aircraft skin, the procedures detailed in **5.4.1.3** should be utilized. Heavy accumulation of snow will always be difficult to remove from aircraft surfaces and vast quantities of fluid will invariably be consumed in the attempt. Under these conditions, serious consideration should be given to removing the majority of the snow using a pre-deicing procedure before attempting a normal deicing procedure.

5.8.6 Air Conditioning and Bleed Air

Engines shall remain running at idle or can be shut down during deicing/anti-icing operations. Air conditioning and/or auxiliary power unit (APU) bleed air shall be selected OFF, or as recommended by the airframe and engine manufacturer. Avoid spraying deicing/anti-icing fluid directly into the engine inlet core.

Operational Standard

B727-100:

Danger: Be careful if you operate the engines during the deicing/anti−icing procedure. Engine operation can cause the aircraft to move. The rotating propellers and engine exhaust are dangerous. Also, deicing/anti−icing fluids can go into the engine intakes, nacelle and fuselage inlets/outlets, and the pitot/static probes.

Caution: do not let the deicing/anti−icing fluids collect near the engine inlet and the exhaust gas areas. If you do this, ingestion or ignition of the deicing/anti−icing fluid can occur during the start.

It is recommended that you do not operate the engines or APU (if installed) during the deicing/anti−icing procedure. If you operate the engines during the deicing/anti−icing procedure, make sure that the BLEED air is OFF.

NOTE: Observe the rotating propeller danger areas and hot engine exhaust gases vented areas.

See relevant Aircraft Maintenance Manual for additional information.

5.8.7 Spray Precautions and Sensitive Areas

Do not spray deicing/anti-icing fluids directly onto wiring harnesses and electrical components (receptacles, junction boxes, etc.), brakes, wheels, exhausts, thrust reversers, cavities, or other sensitive devices.

5.8.7.1 Sensors

Deicing/anti-icing fluid spray shall not be directed into the orifices of pitot tubes (heads), static ports/vents, or directly onto air stream direction detectors probes/angle of attack airflow sensors. This includes all openings.

5.8.7.2 Engines

All reasonable precautions shall be taken to minimize fluid entry into engines, APU, other intakes/outlets, and control surface cavities. Refer to manufacturer documentation. Deicing/anti-icing fluid spray shall not be directed into engine core or directly onto engine probes/sensors.

5.9.8 Table 7 – Generic Holdover Times for Type II Fluids as a Function of Weather Conditions

TYPE II HOLDOVER TIMES FOR KILFROST ABC-K PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow, Snow Grains or Snow Pellets[4,5,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above	100/0	2:15 - 3:45	1:00 - 1:40	1:50 - 2:00	1:00 - 1:25	0:20 - 2:00	
	75/25	1:40 - 2:30	0:35 - 1:10	1:25 - 2:00	0:50 - 1:10	0:15 - 2:00	
	50/50	0:35 - 1:05	0:07 - 0:15	0:20 - 0:30	0:10 - 0:15	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C	100/0	0:30 - 1:05	0:55 - 1:30	0:25 - 1:00	0:15 - 0:35		
	75/25	0:25 - 1:25	0:35 - 1:05	0:20 - 0:55	0:09 - 0:30		
below -8 to -14 °C	100/0	0:30 - 1:05	0:50 - 1:25	0:25 - 1:00[10]	0:15 - 0:35[10]		
	75/25	0:25 - 1:25	0:35 - 1:05	0:20 - 0:55[10]	0:09 - 0:30[10]		
below -14 to -18 °C	100/0	0:30 - 0:55	0:02 - 0:07				
below -18 to -25 °C	100/0	0:30 - 0:55	0:01 - 0:03				
below -25 °C to -29 °C	100/0	0:30 - 0:55	0:00 - 0:01				

(Ref FAA HOT guidelines Table 11 Winter 2023-2024)

NOTES

1. Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2. Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C and below.
3. Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4. To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table **(ANX1)** is required.
5. Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table **(ANX1)** is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a“moderate” or “heavy” precipitation intensity.
6. Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.

Continued next page

8.4.1 Post-Deicing/Anti-Icing Check and Transmission of the Post-Deicing/Anti-icing Report to the Flight crew

It shall be clearly defined by the aircraft operator which company is responsible for conducting the post-deicing/anti-icing check and providing the flight crew with the post-deicing/anti-icing report including the anti-icing code, when applicable. If two different companies are involved in the deicing/anti-icing treatment and post-deicing/anti-icing check, it must be ensured that the post-deicing/anti-icing communication is not given before the post-deicing/anti-icing check has been completed.

The company conducting the deicing/anti-icing treatment shall be responsible for the treatment and transmit all information about the treatment to the company conducting the post-deicing/anti-icing check. The company conducting the post-deicing/anti-icing check shall have overall responsibility for the performance of the company conducting the deicing/anti-icing treatment.

8.4.1.1 The Anti-Icing Code

The following elements comprising the anti-icing code shall be recorded and be communicated to the flight crew by referring to the anti-icing treatment. The elements below shall be provided:

NOTE: This information shall not be communicated in circumstances where anti-icing holdover times do not apply, e.g., local frost prevention in cold-soaked wing areas, symmetrical local area deicing, or deicing of specific surfaces only (such as leading edges for removal of impact ice), etc. See **8.4.1.2 - Post-Deicing Report (Deicing Treatments Only; Anti-Icing Holdover Times Do Not Apply)** and **8.6.1.1 - Normal Operations** for more information.

a. The fluid type (i.e., Types I, II, III, or IV).
b. The fluid name (manufacturer and brand/trade name) of the Types II, III, or IV anti-icing fluid. (***Not Applicable for Type I Fluid***)
c. The concentration of fluid (dilution) within the undiluted fluid/water mixture, expressed as a percentage by volume for Types II, III, or IV (i.e., 100% (“undiluted”) = 100% fluid, 75% = 75% fluid and 25% water, 50% = 50% fluid and 50% water). (***Not Applicable for Type I Fluid***).
d. The local time (hours and minutes - hh:mm), either: For a one-step deicing/anti-icing operation: at the start of the final treatment, or For a two-step deicing/anti-icing operation: at the start of the second step (anti-icing)
e. The date in the following format: day, month, year (DDMMMYY format) (e.g., 28JAN15 = January 28, 2015))
NOTE: This element is required for record keeping and is optional for flight crew notification.
f. The statement “post-deicing/anti-icing check completed.”

NOTE 1: For specific aircraft types, additional requirements exist, e.g., tactile checks for clear ice on wing surfaces. Additional confirmation for these checks may be required.

NOTE 2: An alternative means of visual communication of the anti-icing code to the flight crew can be used (e.g., written on paper, MBs, ACARS, EFBs, etc.).

NOTE 3: Aircraft onboard systems, available to assist flight crew to determine holdover time, require a good coordination between service providers and aircraft operators to provide fluid information in advance or to inform the customers of any change of fluids prior the de/anti-icing operation.

Follow the suggested phraseology in **Table 2**.

10.2 Fluid Transfer Systems

The performance characteristics of Type II, III, and IV deicing/anti-icing fluids may be degraded by excessive mechanical shearing or chemical contamination. Therefore, only compatible pumps, control valves, piping, hoses, and application devices (nozzles) shall be used. The design of fluid transfer systems shall be in accordance with the fluid manufacturer's recommendations. Fluid transfer systems shall be dedicated to the specific fluid being handled to prevent inadvertently mixing fluids of different Types or manufacturers. All fill ports and discharge points shall be clearly labeled to prevent inadvertent product mixing. All fill ports must be protected to prevent foreign contamination.

10.3 Heating

Deicing/anti-icing fluids shall be heated according to the fluid manufacturer's guidelines, and the heated fluids shall be checked periodically.

For Type I fluids, water loss may cause undesirable aerodynamic effects.

For Type II, III, and IV fluids, thermal exposure and/or water loss may cause degradation making them not usable.

Caution: Avoid unnecessary heating of fluid in vehicle tanks. Prolonged or repeated heating of fluids (directly or indirectly) may result in loss of water or oxidation, which can lead to the performance degradation of the fluid, and may cause viscosity degradation in Type II, III, and IV fluids leading to shorter holdover times. Any of the following situations or a combination of them can accelerate the fluid performance degradation:

- Low fluid usage (turnover).
- Trucks being in standby mode with heating system on for extended periods of time.
- High temperatures in the fluid tanks.
- High temperatures in water tanks which are in direct contact with the fluid tanks (no insulation between tanks).

The integrity of the fluid following heating shall be checked periodically. Factors like heating rate, time, and temperature cycling should be considered in determining the frequency of fluid inspections. Refer to the fluid manufacturer's recommendations.

10.4 Application Equipment

Check with the fluid manufacturer's recommendations for filling and fluid transitions in order to prevent fluid contamination and degradation. Requirements for suitable equipment are described in ARP1971. Application equipment shall be clean before being initially filled with deicing/anti-icing fluid in order to prevent fluid contamination.

Deicing/anti-icing procedures must be carried out exclusively by personnel trained and qualified on this subject. Companies providing deicing/anti-icing services shall have both a qualification program and a QC program to monitor and maintain an acceptable level of competence.

Training programs shall follow the guidelines and recommendations published in AS6286.