AEROSPACE STANDARD

AS6332™	REV. A
Issued 2017-08 Revised 2021-07 Effective 2021-08 Superseding AS6332	

Aircraft Ground Deicing/Anti-Icing Quality Management

RATIONALE

The purpose of this document is to provide industry standards for the management of quality systems and processes for the proper deicing and anti-icing of aircraft on the ground using AMS1424 and AMS1428 qualified fluids (Types I, II, III, and IV) and non-fluid methods. AS6332 forms one part of three related SAE Aerospace Standards (AS) and should be read in conjunction with AS6285 and AS6286. Collectively, AS6285, AS6286, and AS6332 are known to the international community as the “global aircraft deicing standards.”

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, and 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.

Regulations governing aircraft operations in icing conditions shall be followed. Specific rules for aircraft are set forth in the United States Code of Federal Regulations (14 CFR), EASA Operation Regulations (EU-OPS), Canadian Aviation Regulations (CAR), and others. Paraphrased, these rules specify that no one may dispatch or take off an aircraft with frozen deposits on components of the aircraft that are critical to safe flight. A critical surface or component is one which could adversely affect the mechanical or aerodynamic function of an aircraft. In the event of differences or discrepancies in the requirements set out in this standard and any requirements set out in the domestic regulations applicable to the end user, the domestic regulation requirements shall supersede those set out in this standard.

Quality management concerns the establishment, documentation, implementation and maintenance of a system in order to deliver the required process outcome and to continually improve effectiveness. Quality management is therefore a system that allows the effective delivery of the clean aircraft concept. Although no system is perfect, it is necessary to ensure the operation and processes evolve and learn from both non-conforming practice and opportunities for improvement in this critical area of aircraft safety. As individual icing situations or aircraft types and models may require special procedures, this document can never replace the aircraft operator’s judgement. However, it does give guidance on the principles of systematic operation of deicing and the improvements that allow valuable learning from operations to be captured for even greater assurance of safe operations.

Changes in this Revision A include:

- Updated descriptive figure for a general quality management system.
- Updated Appendix A to clearly show the split between quality assurance (documented elements) and quality control (implemented elements) of the system.
- Minor editorial updates to further align AS6332 with AS6285 and AS6286.

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1. SCOPE

This document establishes the general requirements for the quality management of aircraft ground deicing/anti-icing systems and processes. It covers the areas of:

- Quality system, documentation, and control of records;
- Management responsibility;
- Resource management;
- Product realization; and
- Measurement, analysis, and improvement.

This document defines these areas and their key aspects so they can be practically managed, and that deicing operations can become safer with time. In alignment with AS6285 and AS6286, the primary focus of this standard is on the deicing/anti-icing of aircraft using deicing and anti-icing fluids.

2. REFERENCES

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 Applicable Documents

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.

AMS1424	Fluid, Aircraft Deicing/Anti-Icing, SAE Type 1
AMS1424/1	Deicing/Anti-Icing Fluid, Aircraft SAE Type I Glycol (Conventional and Non-Conventional) Based
AMS1424/2	Deicing/Anti-Icing Fluid, Aircraft SAE Type I Non-Glycol Based
AMS1428	Fluid, Aircraft Deicing/Anti-Icing, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV
AMS1428/1	Fluid, Aircraft Deicing/Anti-Icing, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV Glycol (Conventional and Non-Conventional) Based
AMS1428/2	Fluid, Aircraft Deicing/Anti-Icing, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV Non-Glycol Based
ARP6257	Aircraft Ground De/Anti-Icing Communication Phraseology for Flight and Ground Crews
AS6285	Aircraft Ground Deicing/Anti-Icing Processes
AS6286	Aircraft Ground Deicing/Anti-Icing Training and Qualification Program
AS9100	Quality Management Systems - Requirements for Aviation, Space, and Defense Organizations

2.1.2 ISO Publications

Available from International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, Tel: +41 22 749 01 11, www.iso.org.

ISO 9000 Quality Management Systems - Fundamentals and Vocabulary

ISO 9001 Quality Management Systems - Requirements

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, Part I — International Commercial Air Transport — Aeroplanes

Annex 14 Aerodromes, Volume I — Aerodrome Design and Operations

Doc 4444 ATM/501 Procedures for Air Navigation Services – Air Traffic Management

Doc 9157 Aerodrome Design Manual, Part 2 — Taxiways, Aprons and Holding Bays

Doc 9376 Preparation of an Operations Manual

Doc 9640-AN/940 Manual of Aircraft Ground Deicing/Anti-icing Operations

3. ABBREVIATIONS AND DEFINITIONS

NOTE: For the purposes of this document, the abbreviations, terms, and definitions given in AS6285 apply.

3.1 Abbreviations and Acronyms

AS Aerospace Standard

OEM Original Equipment Manufacturer

QA Quality Assurance

QC Quality Control

QMS Quality Management System

RI Refractive Index

SMS Safety Management System

3.2 Definitions

NOTE: Throughout the text of this AS, wherever the term “product” occurs, it can also mean “service,” and vice versa.

For the purposes of this document, the following definitions apply:

a. Advisory Word Definitions:

The following advisory words are to be used as defined:

MAY: This is used to describe that the practice is encouraged and/or optional.

SHALL: This will mean that the practice is mandatory.

SHOULD: This means that the practice is recommended or strongly encouraged.

b. Words and Phrase Definitions: The following words and phrases are to be used as defined:

AUDIT EVIDENCE: Records, statements of fact or other information, which are relevant to the audit criteria and verifiable.

CLEAN AIRCRAFT CONCEPT: During conditions conducive to airplane icing during ground operations, take-off shall not be attempted when ice, snow, slush, or frost is adhering to the wings, propellers, control surfaces, engine inlets, or other critical surfaces. This is known as the “clean aircraft concept.”

Critical surface or component is one which could adversely affect the mechanical or aerodynamic function of an aircraft.

CONFORMITY: The fulfillment of a requirement.

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

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

CORRECTIVE ACTION: Corrective action is a reactive process to address concerns or issues after they have occurred. It assumes that a non-conformance or problem has been identified and has been reported by employees of the organization or by customers or other interested parties/stakeholders.

DEICING SERVICE PROVIDER: The company responsible for aircraft deicing/anti-icing operations. This may include contracted service providers, or where the air carrier/operator or airport authority performs these services internally.

FINDING: The results of an evaluation of the collected audit evidence against audit criteria. A finding can indicate conformity or nonconformity with audit criteria, or opportunities for improvement.

GROUND ICING CONDITIONS: With due regard to aircraft skin temperature and weather conditions, ground icing conditions exist when frost, ice, or snow is adhering or may adhere to the critical surfaces of an aircraft.

Ground icing conditions also exist when active frost, frozen or freezing precipitation is reported or observed.

GROUND ICING PROGRAM: A ground icing program consists of a set of procedures, guidelines, and processes, documented in manuals, which ensure that aircraft do not depart with frost, ice, snow, or slush adhering to critical surfaces.

HEAD OF DEICING TRAINING: The person responsible for ensuring that their own understanding and competence is sufficient for them to hold this position, and for ensuring the effective delivery of the deicing/anti-icing training of personnel for the whole organization. By agreement of the senior management team, this may also be the program manager/responsible person/accountable executive.

NONCONFORMITY: The non-fulfilment of a requirement.

OBSERVATION/OPPORTUNITY FOR IMPROVEMENT: A statement of fact made during an audit and substantiated by objective evidence.

PREVENTIVE ACTION: Preventive action is a proactive process and is initiated to stop a potential problem from occurring or from becoming too severe. Preventive action focuses on identifying negative trends and addressing them before they become significant.

PROGRAM MANAGER/RESPONSIBLE PERSON/ACCOUNTABLE EXECUTIVE/ACCOUNTABLE PERSON: The person responsible for ensuring that the process needed to maintain the quality of systems to deliver the clean aircraft concept during winter operations is established and maintained.

QUALITY ASSURANCE: Quality assurance is a way of preventing mistakes or defects in products and avoiding problems when delivering services to customers; which ISO 9000 defines as "part of quality management focused on providing confidence that quality requirements will be fulfilled." This defect prevention in quality assurance differs subtly from defect detection and rejection in quality control as it focuses on quality earlier in the process. Quality assurance is a proactive process (process driven).

QUALITY CONTROL: Quality control is a process by which entities review the quality of all factors involved in production or in the provision of services. ISO 9000 defines quality control as "A part of quality management focused on fulfilling quality requirements." Quality control is a reactive process (identify and correct).

QUALITY IMPROVEMENT: The actions taken throughout an organization to increase the effectiveness of activities and processes to provide added benefits to both the organization and its customers.

QUALITY MANAGEMENT: Quality management ensures that an organization, product, or service is consistent. It has four main components: quality planning, quality assurance, quality control and quality improvement. Quality management is focused not only on product and service quality, but also on the means to achieve it. Quality management, therefore, uses quality assurance and control of processes as well as products to achieve more consistent quality.

QUALITY MANAGEMENT SYSTEM: The ability to demonstrate both management commitment to and the organizational ability to deliver the required level of product or service.

QUALITY MANUAL: The central document that brings together all the aspects necessary to demonstrate control, conformance and continual improvement over aircraft deicing and anti-icing.

NOTE: The contents of a quality manual may be included as part of a ground icing program.

QUALIFIED PERSONNEL: Trained personnel that have successfully completed theoretical and/or practical training requirements and certification (including examinations, evaluations, etc.). Refer to AS6286 for further requirements as applicable to the specific occupational requirements.

ROOT CAUSE: A root cause is an initiating cause of either a condition or a causal chain that leads to an outcome or effect of interest. Commonly, root cause is used to describe the depth in the causal chain where an intervention could reasonably be implemented to improve performance or prevent an undesirable outcome.

SAFETY MANAGEMENT SYSTEM: A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies, and procedures.

SENIOR MANAGEMENT: A team of individuals at the highest level of management of an organization who are responsible for ensuring the proper delegation and delivery of performance for the day-to-day tasks of managing the winter operation.

WINTER OPERATIONS: An operational period where ground icing conditions are present or could occur, and aircraft deicing/anti-icing services may be required.

4. QUALITY MANAGEMENT

The basic concepts of quality management are set out in ISO 9001 and AS9100, summarized in two main points:

- The need to demonstrate and consistently provide a product or service that meets customer and applicable regulatory requirements; plus
- Aims to enhance the product or service through effective systems and processes for continual improvement.

For aircraft deicing and anti-icing, the safety critical nature of this work requires complete conformance to the principle of the clean aircraft concept. It involves both conformance to standards of operation, and continual improvement in line with the principles of quality management plus the updating of the relevant SAE standards.

ISO 9001 and AS9100 further defines the general areas that should be covered to ensure conformance to the principles of quality and these will be used to define the sections in this document with respect to deicing/anti-icing. These include:

- Quality system, documentation, and control of records;
- Management responsibility;
- Resource management;
- Product realization; and
- Measurement, analysis, and improvement.

While the individual areas of a process based quality management system (QMS) overlap and interact, a diagram of how these fit together is shown in Figure 1.

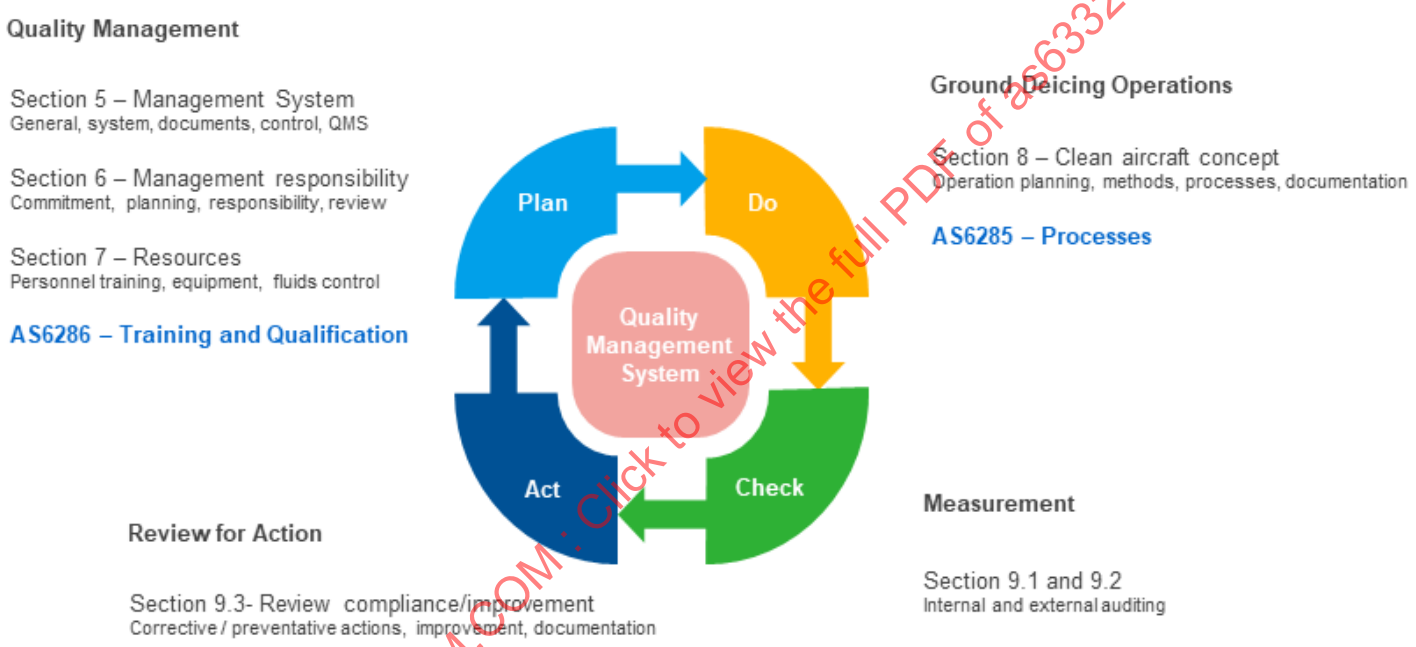

Figure 1 - Elements of QMS for aircraft ground deicing and anti-icing

NOTE: Although the above description of a QMS outlines the terms and definitions of a quality system, each individual deicing service provider will need to find the right level of accountability, documentation, and systems review for the effectiveness of their operations.

NOTE: ISO 9001 principles are used here in preference to AS9100. The latter document is based on the former and incorporates many detailed engineering aspects. The concepts of ISO 9001 are sufficient to support the delivery of the clean aircraft concept.

NOTE: Formal certification of a deicing service provider to the ISO 9001 or AS9100 standard is recommended, however is not mandatory at this time, unless required otherwise by a customer or regulatory authority.

5. QUALITY MANAGEMENT SYSTEM (APPENDIX REFERENCE: A.1 PROCEDURES AND DOCUMENTATION)

5.1 General Requirements

The deicing service provider shall establish, document, implement, and maintain a QMS and continually improve its effectiveness. The deicing service provider shall:

- Determine the processes needed to manage effective aircraft deicing/anti-icing;
- Determine the criteria and methods needed to ensure the operation and control of these processes are effective;
- Ensure the availability of resources necessary to support the operation and monitoring of these processes;
- Monitor, measure where applicable, and analyze these processes; and
- Implement actions necessary to achieve the planned results and to continually improve these processes.

NOTE: The extent of the QMS documentation can differ from one organization to another due to:

- The size of the organization and types of activities;
- The complexity of their processes and interactions; and
- The competence of the personnel.

5.2 System Requirements

The QMS shall include:

- Documented statements of the quality policy and objectives;
- A quality manual (may be included as part of a ground icing program);
- Documented procedures and records for effective aircraft deicing/anti-icing; and
- Documents necessary to ensure effective winter planning, operation, and control of these processes.

5.3 Document Control

Documents required by the quality management system shall be controlled. A documented procedure shall be established to define the control needed. Documents shall:

- Be approved for use;
- Be reviewed and updated as necessary;
- Be written to ensure that changes in these documents are shown;
- Refer to the relevant versions of applicable documents;
- Ensure that any external reference documents are identified and controlled; and
- Effectively managed to prevent the use of obsolete documents.

5.4 Control of Records

Records established to provide evidence of conformity to requirements and of the effective operation of the quality of the management system shall be controlled.

5.5 Documentation Requirements for a Deicing/Anti-Icing QMS

For deicing/anti-icing operations, documentation shall include:

- Ground icing program (may require regulatory approval of such program, where applicable);
- Quality manual (may be included as part of a ground icing program);
- SMS (safety management system);
- Documented deicing/anti-icing procedures in conformance to the latest editions of AS6285, AS6286, other applicable SAE documentation (as required), and local state regulatory requirements;
- Conformance with latest revisions of local state regulatory authority procedures and requirements; and
- Deicing location procedures as applicable (gate, remote apron, central/designated deicing facility, etc.)
- Aircraft size limits, safe zones, communications, emergency procedures, etc.; and
- Procedures for the performance of engines running deicing, where applicable.

6. MANAGEMENT RESPONSIBILITY (APPENDIX REFERENCE: A.2 MANAGEMENT RESPONSIBILITY)

6.1 Management Commitment

Senior management shall provide evidence of its commitment to the development and implementation of a suitable management system for the effective deicing/anti-icing of aircraft. This shall include:

- Communicating the need to demonstrate complete conformance to the clean aircraft concept during winter operations through a clear policy statement;
- Establishing the systems and procedures for carrying this out effectively;
- Ensuring the availability of resources;
- Conducting management reviews and documenting recommended actions; and
- Following up actions to ensure completion of these.

NOTE: The formal extent of the detail of this management commitment can differ from one organization to another due to:

- The size of the organization and types of activities;
- The complexity of their processes and interactions; and
- The competence of the personnel.

6.2 Planning Objectives

Senior management shall ensure that conformance to the clean aircraft concept is carried out, and that the requirements to meet this objective are established for all relevant functions and levels of the organization.

6.3 Responsibility, Authority, and Communication

6.3.1 Responsibility and Authority

Senior management shall ensure that responsibilities and authorities are defined and communicated within the organization.

6.3.2 Management Representative

Senior management shall appoint a manager on an annual basis who, irrespective of other responsibilities, shall have the responsibility that includes:

- Ensuring that the process needed to maintain the quality of systems to deliver the clean aircraft concept during winter operations are established and maintained;
- Report to senior management on the performance and effectiveness of these systems and any need for improvement; and
- Ensuring the need to conform to the clean aircraft concept is communicated throughout the organization.

This person may be known by the title program manager/responsible person/accountable executive/accountable person or some other title that identifies them as responsible and accountable to senior management for the effective delivery of this service.

6.3.3 Head of Deicing Training

As required by AS6286, senior management shall appoint a manager on an annual basis who, irrespective of other responsibilities, shall have the responsibility that includes:

- Ensuring that their own understanding and competence is sufficient for them to hold this position; and
- Ensuring the effective delivery of the deicing/anti-icing training of personnel for the whole organization.

If agreed by senior management, the program manager/responsible person/accountable executive/accountable person and head of deicing training may be the same person.

6.4 Management Review

6.4.1 General

Senior management shall review the organizations QMS at planned intervals to ensure their continuing suitability, adequacy, and effectiveness.

6.4.2 Review Input

The input to management review shall include information on:

- The results of audits, both internal and external;
- Customer feedback as appropriate;
- Process and product conformity;
- Status of corrective and preventative actions;
- Accident/incident/irregularity, in terms of investigation, corrective action, and continuous improvement
- Follow up of previous management reviews; and
- Recommendations for improvement.

6.4.3 Review Output

The output of management review shall include any decisions and actions related to:

- Improvement of the effectiveness of the systems and processes;
- Improvement in the delivery of the effectiveness of these processes;
- Any recommendations to the impact of these on resource needs; and
- An updated ground icing program, policies, and procedures.

6.5 Documentation Requirements for Management Responsibility

- Clear communication of the policy to deliver the clean aircraft concept.
- Communication of the responsibilities and authorities of those involved in delivering the clean aircraft concept.
- Letter of appointment of the program manager/responsible person/accountable executive/accountable person and head of deicing training as appropriate.
- Minutes of meetings of the senior managers to discuss and agree actions to update winter operations.
- Updated ground icing program, policies, and procedures.

7. RESOURCE MANAGEMENT (APPENDIX REFERENCE: A.3, A.4, A.5, AND A.6)

The deicing service provider shall determine and provide the resources needed to implement and maintain the safety of these services, and to continually improve their effectiveness.

7.1 Personnel Competence, Training, and Qualification (Appendix reference: A.3 Training and Qualification)

7.1.1 Requirements

The deicing service provider shall:

- Ensure that its personnel are aware of the relevance and importance of the clean aircraft concept;
- Determine the necessary competence for personnel performing services or manufacturing products;
- Provide initial and annual recurrent training (as appropriate) to ensure the necessary competence of such personnel;
- Evaluate the effectiveness of the training given; and
- Maintain appropriate records of education, training, skills, and experience.

The standard of training and competency is given in AS6286. The areas covered by this AS include:

- Levels of qualification for the various roles carried out by personnel (e.g., deicing instructor, deicing operator, etc.);
- The content of the training sessions and their relevance to the appropriate roles as standard teaching plans;

- The running and delivery of training sessions;
- The examination/evaluation process for theoretical and practical components; and
- How such training and qualification is carried out by deicing service providers.

7.1.2 Documentation Requirements for Competence, Training, and Qualification

Personnel involved in carrying out the functions necessary to obtain the clean aircraft concept shall be able to provide documentation that confirms:

- Documented deicing/anti-icing training programs in conformance to the latest editions of AS6285, AS6286, other applicable SAE documentation (as required), and local state regulatory requirements;
- Documented passing rates, in accordance with AS6286 or local state regulatory requirements;
- Training and qualification requirements applicable to each role;
- Initial and annual recurrent training records, including theoretical examinations, practical evaluations (where required), and certificates (where require) as applicable to the role's qualification requirements;
- Trainer certification;
- Confirmation training and evaluation has been performed by qualified personnel; and
- Training and qualification for the performance of engines running deicing, where applicable.

7.2 Facilities Infrastructure and Deicing/Anti-Icing Equipment (Appendix reference: A.4 Deicing Facilities and A.5 Deicing/Anti-icing Equipment)

7.2.1 General

The deicing service provider shall ensure and maintain the infrastructure needed to achieve the required performance of deicing/anti-icing, including:

- Deicing/anti-icing fluid storage, handling, transfer lines, and dilution, as appropriate;
- Preventative maintenance and calibration/accuracy testing of equipment, as required;
- Fluid spraying equipment such as equipment, hoses, and spray nozzles; and
- Supporting equipment, such as transport, communication, and information systems.

The appropriate guidance for the effective use of equipment is normally described in the OEM *User's Manual*s. The contents may include the following and some guidance checks are shown in Appendix 1:

- Technical requirements;
- Acceptance inspection;
- Maintenance manuals; and
- Product support.

7.2.2 Documentation for Facilities

- Approved locations where de/anti-icing operations are performed.
- Storage vessels, filling ports and connecting hoses are marked with the appropriate fluid manufacturer and brand name, type of fluid (SAE Type I, II, III, or IV) and concentration as appropriate.
- Hazard identification labelling on storage vessels (as required per local state regulations).
- Inspection and maintenance records are available and up to date. Inspection and maintenance frequency is per those as prescribed by applicable SAE, local state regulatory authority, or manufacturers requirements/recommendations.
- Checks have been carried out on fluids and analysis (appearance, RI, pH, and viscosity as appropriate) shows these fluids are within the specifications required.

7.2.3 Documentation for Deicing/Anti-Icing Equipment

- Equipment is marked with the appropriate fluid manufacturer and brand name, type of fluid (SAE Type I, II, III, or IV) and concentration as appropriate. Tanks, tank lids, and/or fill ports are identified. Spray nozzles are identified.
- Hazard identification labelling on equipment (as required per local state regulations).
- Inspection and maintenance records of equipment are available and up to date. Inspection and maintenance frequency is per those as prescribed by applicable SAE, local state regulatory authority, or manufacturers requirements/recommendations.
- Equipment walk around checks are performed and documented prior to operation.
- Equipment has the capability to heat deicing fluids within the prescribed temperature ranges.
- Equipment is free from discrepancies, both those that could negatively affect its safety, and those that could affect the operation (not necessarily safety related).
- Aerial device inspection and maintenance is performed, up-to-date and records available.
- Fire extinguisher/suppression system inspection and maintenance is performed, up-to-date and records available.
- Fall protection equipment is available (as required), inspected frequently (as required), and records available.
- Personal protective equipment (as required) is available and used by personnel during operation.
- Checks have been carried out on fluids and analysis (appearance, RI, pH, viscosity as appropriate) shows these fluids are within the specifications required.
- Equipment that has an onboard blending system and/or onboard manufacturing system, records to demonstrate the accuracy of the mixing and/or production.
- Equipment maintenance issue reporting process and “out of service” (lockout/tag-out) process is documented and in place.
- Calibration and/or accuracy testing of flow meters, temperature sensors, and pressure gauges (where required).

7.3 Deicing/Anti-Icing Fluids Quality Control (Appendix reference: A.6 Deicing/Anti-Icing Fluids)

7.3.1 Requirements

Deicing/anti-icing fluids are designed to deliver the clean aircraft concept during times of freezing precipitation with three characteristics:

- Use of heated deicing fluid to remove frozen contamination from the aircraft;
- Use of unthickened or thickened deicing/anti-icing fluids to maintain the aircraft free of frozen precipitation for a limited time (holdover time) to allow the aircraft to taxi to its takeoff position; and
- The shedding of remaining fluid from the aircraft during takeoff.

The correct storage and handling of these fluids in line with the manufacturer's recommendations are essential to preserve the performance characteristics of these fluids. Quality control checks (refer to AS6285) shall be carried out to ensure the suitability of the fluid for use.

7.3.2 Documentation Requirements for Deicing/Anti-Icing Fluids

- Authorizations of specific fluids used by the deicing service provider;
- Certificates of conformance/analysis (or equivalent documentation) with each fluid delivery;
- Acceptance checks carried out on the fluid as appropriate;
- Refractive index checks are carried out and records maintained for when equipment is in use, and at other times as required;
- Procedure for fluid sampling;
- Laboratory testing results for SAE Type I, II, III, and IV fluids within the specifications set by the appropriate fluid manufacturer, as applicable;
- Field testing results for sprayed thickened SAE Type II, III, and IV fluids within the specifications set by the appropriate fluid manufacturer, as applicable; and
- Calibration and accuracy testing (as applicable) records for refractometers, pH meters, and viscometers.

8. AIRCRAFT GROUND DEICING/ANTI-ICING OPERATIONS/METHODS/PROCESSES (APPENDIX REFERENCE: A.7 AIRCRAFT GROUND DEICING/ANTI-ICING OPERATIONS)

8.1 Planning of Aircraft Ground Deicing/Anti-Icing Operations

The aircraft deicing service provider shall plan and develop the processes needed to deliver the clean aircraft concept. This shall include:

- The need to establish or check current processes and documents;
- The verification and validation of the specific test activities used; and
- The records needed to provide evidence that the service is effective and safe.

8.2 Aircraft Deicing/Anti-Icing Methods and Processes

The deicing service provider shall plan and carry out the deicing/anti-icing of aircraft under controlled conditions, to include:

- The availability of work instructions as necessary;
- The availability of suitably qualified personnel;

- The use of suitable deicing/anti-icing application equipment;
- The use of suitable deicing/anti-icing fluids; and
- The availability and use of suitable fluid testing equipment (for field and laboratory testing).

8.3 Aircraft Deicing/Anti-Icing Processes

Best practice guidance for aircraft deicing/anti-icing is given in AS6285. This document describes the following process areas:

- Roles and responsibilities;
- Quality (including quality control of fluids);
- Communications (ground crew to flight crew), delays, accident notification;
- Aircraft requirements after deicing/anti-icing;
- Checks (the need for deicing and associated contamination check/inspection after deicing/anti-icing);
- Methods of aircraft deicing/anti-icing;
- Ground equipment; and
- Fluids.

8.4 Documentation Requirements for Aircraft Ground Deicing/Anti-Icing Operations

- Clear definition of roles and their responsibilities shall be included in the quality manual and/or ground icing program described in 7.1.2;
- Quality systems shall be defined in the quality manual and/or ground icing program. Quality control of fluids shall be as described in 7.3;
- Communications procedure shall conform to the requirements in AS6285, ARP6257, or Doc 4444 ATM/501;
- Random and periodic QC checks and audits during live deicing operations;
- Procedures for the tasks and responsibilities for the post deicing inspection;
- Procedures for the communications between flight crew and the deicing service provider groundcrew; and
- Record of required deicing/anti-icing data elements (either on a paper log and/or by an equivalent electronic method).

9. MEASUREMENT, ANALYSIS, AND IMPROVEMENT (APPENDIX REFERENCE: A.8 DOCUMENTATION FOR MEASUREMENT, ANALYSIS, AND IMPROVEMENT)

Due to the safety critical nature of the deicing/anti-icing processes delivering the clean aircraft concept on every occasion, there is a need to demonstrate the correct effectiveness of the service provided, and for the continuous improvement of its effectiveness.

9.1 Internal Auditing

The deicing service provider shall conduct internal audits at planned and random intervals to determine whether the QMS:

- Conforms to the planned arrangements of this international standard and of those of AS6285 and AS6286; and
- Is effectively implemented and maintained.

9.1.1 The auditing arrangements shall take into account the following requirements:

- A documented procedure shall be established to define the responsibilities and requirements for planning and conducting audits, establishing records, and for reporting results;
- The audit criteria, scope frequency, and methods shall be defined, and shall take into account the results of previous audits;
- Auditors shall be selected to ensure objectivity and impartiality of the audit process, and auditors shall not audit their own work;
- Management responsible for the deicing/anti-icing area being audited shall ensure that any necessary corrective actions are taken without undue delay to eliminate non-conformances and their causes; and
- Follow up activities shall include the verification of the actions taken and the reporting of the verification results.

The information arising from the last two points shall be discussed in the management review (6.4).

9.2 External Auditing by Air Carriers/Air Operators/Customers and Third-Party Organizations/Groups

External auditing shall follow the general requirements of internal auditing (9.1). Once again, the output of the external audit shall be discussed and actioned by senior management in the management review (6.4).

9.3 Review for Compliance and Improvement

The deicing service provider shall continually improve the effectiveness of aircraft ground deicing/anti-icing through the use of its quality policy, quality objectives, audit results, analysis of data corrective and preventative actions and management review.

9.3.1 Corrective Actions

The organization shall take action to eliminate the cause of non-conformances in order to prevent reoccurrence. A documented procedure shall be established to define the requirements for:

- Reviewing and determining the cause of non-conformances;
- Determining the need for and implementing actions to ensure that non-conformances do not reoccur;
- Record the results of the action taken; and
- Reviewing the effectiveness of the actions taken.

9.3.2 Preventative Action/Opportunities for Improvement

The deicing service provider shall take action in order to prevent non-conformances or to improve the operations as appropriate. A documented procedure shall be established to define the requirements for:

- Determining potential non-conformances and their effects;
- Determining potential improvements in the methods and control of aircraft deicing/anti-icing;

- Evaluating the need to take action, and implementing these as appropriate; and
- Reviewing the effectiveness of the actions taken.

9.4 Documentation Requirements for Measurement, Analysis, and Improvement

- The schedule for internal audits as appropriate.
- The documented result of each audit, including any findings/observations/opportunities for improvement, root causes, corrective actions, and preventive actions.
- Accident/incident/irregularity, in terms of investigation, corrective action, and continuous improvement.
- Minutes of meetings of the senior managers to discuss and agree actions to update winter operations (6.4).
- Updated ground icing program, policies, and procedures (5.5 and 6.4) and reviewing the effectiveness of actions taken (9.3.2).

See Appendix A for the direction and guidelines to build a check list for auditable areas and documentation requirements.

10. NOTES

10.1 Revision Indicator

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

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