

Examination Standard for Air Drying Units

Class Number 1034

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Foreword

This standard is intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of this standard is to present the criteria for examination of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistent and reliable product.

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1 INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states testing and certification requirements for air drying units for use in dry pipe and refrigerated area sprinkler system piping. They provide compressed air, with reduced humidity, to the sprinkler piping to reduce the possibility of ice formation.
- 1.1.2 Testing and certification criteria may include performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 Scope

1.2.1 This standard encompasses the design and performance requirements for air drying units. In cases where metric sized products are to be examined for certification, test criteria comparable to the equivalent or nearest nominal inch size shall be used.

1.3 Basis for Requirements

- 1.3.1 The requirements of this standard are based on experience, research and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, jurisdictions and/or loss control specialists was also considered.
- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of air drying units for the purpose of obtaining certification.

1.4 Basis for Certification

Certification is based upon satisfactory evaluation of the product and the manufacturer in the following major areas:

- 1.4.1 Examination and tests on production samples shall be performed to evaluate:
 - the suitability of the product;
 - the performance of the product as specified by the manufacturer and required for certification,
 - the durability and reliability of the product.
- 1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be conducted to evaluate the manufacturer's ability to consistently produce the product which is examined and tested, and the marking procedures used to identify the product. Subsequent surveillance may be required by the certification agency in accordance with the certification scheme to ensure ongoing compliance.

1.5 Basis for Continued Certification

The basis for continual certification may include the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;
- the continued use of acceptable quality assurance procedures;
- compliance with the terms stipulated by the certification;

- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agency's product surveillance program.

1.6 Effective Date

The effective date of this examination standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this standard is eighteen (18) months after the publication date of the standard for compliance with all requirements.

1.7 System of Units

Units of measurement used in this Standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Conversion of U.S. customary units is in accordance with ANSI/IEEE/ASTM SI 10.

Two units (liter and bar), outside of but recognized by SI, are commonly used in international fire protection and are used in this Standard.

1.8 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the cited edition applies:

American National Standards Institute (ANSI) B16.5, Pipe Flanges & Flanged Fittings

ANSI/American Water Works Association (AWWA) C-606, Grooved and Shouldered Joints

American Society of Mechanical Engineers (ASME) B1.20.1, Pipe Threads, General Purpose, (Inch)

ANSI/ASME Boiler & Pressure Vessel Code, Section VIII Division 1 – Rules for Construction of Pressure Vessels

ANSI/IEEE/ASTM SI 10, American National Standard for Metric Practice

1.9 Terms and Definitions

Accepted

This term refers to installations acceptable to the authority enforcing the applicable installation rules. Acceptance is based upon an overall evaluation of the installation. Acceptance is not a characteristic of a product. It is installation specific. A product accepted for one installation may not be acceptable elsewhere.

Adsorption

Physical process by which gas or vapor is attracted to and captured on a solid surface.

Air Pressure Maintenance Device

A device that automatically maintains, within pre-set limits, the air pressure for a dry pipe sprinkler system.

A dessicant is a hygroscopic substance that induces or sustains a state of dryness. This term is used to describe the chemical(s) (typically activated alumina) that are used to attract water vapor and capture it in the dryer tower.

Dew Point

This term refers to the temperature at which water vapor in the air will start to condense.

End Connections

The term "End Connections" refers to the method of connecting components of a fire protection system. Typical end connections in fire protection service are flanged, grooved, threaded and welded end.

Pressure Dew Point

Dew point measured at the actual pressure.

Rated Working Pressure

This is the maximum sustained pressure at or below which the device shall operate trouble free for its entire design life. This value sets the basis for the testing described in Section 4.

Relative humidity

Ratio of the partial pressure of water vapor in an air-water mixture to the saturated vapor pressure of water at that temperature.

Regeneration

The process where a portion of the dried air is used to remove water from one dryer tower, preparing it to enter a new period of operation.

System Pressure

The maximum output pressure the system is rated for. This pressure is chosen by the manufacturer .

2. GENERAL INFORMATION

2.1 **Product Information**

- 2.1.1 Air drying units provide compressed air with a reduced humidity level to a dry pipe or refrigerated area sprinkler system. This minimizes the possibility of ice formation.
- 2.1.2 In order to meet the intent of this standard, air drying units must be examined on a model-by-model, type-by-type, manufacturer-by-manufacturer, and plant-by-plant basis. This is predicated on the basis that identical designs, fabricated in identical materials by different manufacturers or, even by different plants of the same manufacturer, have been seen to perform differently in testing. Sample assemblies, selected in conformance to this criterion, shall satisfy all of the requirements of this standard.

2.2 Certification Application Requirements

The manufacturer shall provide the following preliminary information with any request for certification consideration:

- a complete list of all models, types, sizes, and options for the products or services being submitted for certification consideration;
- general assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, piping and electrical schematics, nameplate format, brochures, sales literature, spec. sheets, installation, operation and maintenance procedures, and
- the number and location of manufacturing facilities.

All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All foreign language documents shall be provided with English translation.

2.3 Requirements for Samples for Examination

- 2.3.1 Following authorization of certification examination, the manufacturer shall submit samples for examination and testing based on the following:
 - Sample requirements to be determined by the certification agency.
- 2.3.2 Requirements for samples may vary depending on design features, results of prior or similar testing, and results of any foregoing tests.
- 2.3.3 The manufacturer shall submit samples representative of production.
- 2.3.4 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to evaluate the air dryers.

3. GENERAL REQUIREMENTS

3.1 Review of Documentation

- 3.1.1 During the initial investigation and prior to physical testing, the manufacturer's specifications, technical data sheets, and design details shall be reviewed to assess the ease and practicality of installation and use. The product shall be capable of being used within the limits of the certification investigation.
- 3.1.2 The manufacturer's dimensional specifications and/or dimensional drawings shall fully describe the product. All critical dimensions shall be indicated with the allowed upper and lower tolerance limits clearly shown.

3.2 Physical or Structural Features

- 3.2.1 Air drying units supply dry compressed air to an air maintenance device. They shall be compatible with the piping and threads of the country of installation.
- 3.2.2 Air drying units submitted for testing shall be true production samples and shall be free of sharp edges, burrs, or other imperfections which might injure the installer or interfere with proper assembly of the unit.
- 3.2.3 An assembly shall be considered to contain four main parts: a control panel, an electric motor, air compressor with capacity tank, and a dessicator, typically regenerating twin dryer towers.
- 3.2.4 The control panel shall be a metal enclosure containing timers, displays and control circuitry. The panel shall include an hour meter, capacity tank pressure, tower pressure and outlet pressure meters.
- 3.2.5 The drying section shall have easily changed desiccant. Other components needing regular service shall be readily accessible.
- 3.2.6 Typical end connections are cut grooved per ANSI/AWWA C-606, threaded per ANSI/ASME B1.20.1, or flanged per ANSI B16.5, or other national or international recognized Standard. Other types of end connection will be evaluated on a case by case basis.
- 3.2.7 Pressure Vessels
 - 3.2.7.1 Pressure vessels utilized in air dryers shall conform to the appropriate regulations and design standards for the installation location. In the U.S.A., pressure vessels must conform to the following regulations:
 - ASME Boiler & Pressure Vessel Code, Section VIII, Division 1 "Rules for Construction of Pressure Vessels".
 - Vessels that are shipped pressurized within the U.S.A. must also conform to DOT Title 49, CFR, Parts 171 through 180.
 - 3.2.7.2 The following documents shall be submitted for each size pressure vessel design, to demonstrate compliance with the relevant design standard:
 - calculation of wall thicknesses per the method specified in the design standard, with appropriate supporting references, as necessary;
 - certificate of chemical analysis of materials;
 - certificate of physical properties of materials

- 3.2.8 The assembly shall include a coalescing oil filter between the compressor and the drying towers to remove entrained oil from the air stream. This is necessary to prevent oil from fouling the dessicant.
- 3.2.9 The assembly shall include an air cooler designed to lower the temperature of air entering the dessicant chamber to below 100°F (37.8°C) if required for proper functioning of the dessicant used.

3.3 Materials

All materials used in these air drying units shall be suitable for the intended application. Parts exposed to moist compressed air shall be constructed of corrosion resistant materials. Materials shall be compatible with other sprinkler system components. When unusual materials are used, special tests may be necessary to verify their suitability. All components shall withstand the normal abuse of shipping, handling, and installation.

3.4 Markings

- 3.4.1 Marking on the product or, if not possible due to size, on its packaging or label accompanying the product, shall include the following information.
 - name and address of the manufacturer or marking traceable to the manufacturer;
 - date of manufacture or code traceable to date of manufacture or lot identification;
 - model designation; system capacity; electrical input voltage/phase/Hz etc., as appropriate.

When hazard warnings are needed, the markings should be universally recognizable

- 3.4.2 Any additional pertinent marking information required by a national or international standard to which the product is manufactured shall be permanently marked on the outside surface of each assembly.
- 3.4.3 Each required marking listed in Section 3.4.1 shall be legible and durable and applied in any of, or any combination of casting, die stamping, forging, roller embossing or electro-etching. As an alternate method, the markings may be printed on a paper label that has been shown to be durable and non-fading.
- 3.4.4 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.
- 3.4.5 The certification agency's mark of conformity shall be displayed visibly and permanently on the product and/or packaging as appropriate and in accordance with the requirements of the certification agency. The manufacturer shall exercise control of this mark as specified by the certification agency and the certification scheme.

3.5 Manufacturer's Installation and Operation Instructions

- 3.5.1 The manufacturer shall:
 - prepare instructions for the installation, maintenance, and operation of the product;
 - provide facilities for repair of the product and supply replacement parts; and
 - provide services to ensure proper installation, inspection, or maintenance for products where it is not reasonable to expect the average user to be able to provide the installation, inspection, or maintenance.

3.6 Calibration

- 3.6.1 Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment is required. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified and traceable to an acceptable reference standard and certified by an ISO/IEC 17025 accredited calibration laboratory. The test equipment shall be clearly identified by label or sticker showing the last date of the calibration and the next due date. A copy of the service provider's accreditation certificate as an ISO/IEC 17025 accredited calibration laboratory should be available.
- 3.6.2 When the inspection equipment and/or environment is not suitable for labels or stickers, other methods such as etching of control numbers on the measuring device are allowed, provided documentation is maintained on the calibration status of the equipment.

3.7 Tolerances

Tolerances on units of measure shall be as described in Appendix A, unless otherwise specified.

4. PERFORMANCE REQUIREMENTS

4.1 Examination

4.1.1 Requirement

The air drying units shall conform to the manufacturer's drawings and specifications and to certification requirements.

4.1.2 Test/Verification

Sample air drying units shall be examined and compared to drawings and specifications. It shall be verified that the samples conform to the physical and structural requirements described in Section 3, General Requirements.

4.2 **Operational Test**

4.2.1 Requirement

The air drying unit shall produce dry air that shall have a pressure dew point of -40° F (-40° C). System capacity, as stated by the manufacturer, shall be the amount of dry air that can be produced in 30 minutes. This capacity shall be listed as an equivalent volume of the sprinkler system (in gallons/liters). System pressure shall be stated by the manufacturer to the pressure of the air produced during this test.

4.2.2 Test/Verification

The system may be set up and run for as long as necessary to dry the desiccant in the towers prior to this test.

The air drying unit shall be placed in an environmental chamber at 100°F (37.8°C) and 90% relative humidity. The unit shall draw supply air from this chamber. The output of the air drying unit shall be independently vented to outside the chamber.

Start and run the air drying unit and set the output pressure to the maximum pressure allowed by the manufacturer's literature. Measure the output flow, pressure and pressure dew point. Record the flow for 30 minutes. The pressure dew point must be below -40° F (-40° C) for the entire 30 minutes of the test. The output pressure must be above the maximum system pressure for the entire 30 minutes of the test.

4.3 Maintenance Assessment

4.3.1 Requirement

Using the manufacturer's instructions, perform standard maintenance procedures on typical portions of the device, using spare parts supplied by the manufacturer. Maintenance shall be possible without training and using only commercially available tools or tools supplied with the unit.

4.3.2 Test/ Verification

Check safety valves, replace desiccant, replace filters, and other typical parts of the air drying unit, using the manufacturer's supplied instructions. Oil changes are not deemed to be a necessary portion of this program. Everything will be changed or installed satisfactorily, in accordance with the supplied instructions.

4.4 Pressure Capacity

4.4.1 Requirement

The components of the air drying unit shall withstand hydrostatic pressure equal to or greater than four times the rated working pressure for a period of 5 minutes without rupture. Test shall be conducted with water, not air, for safety reasons. Components may be tested individually or in subassemblies of like pressure rating.

4.4.2 Test/Verification

One sample of each type of air drying unit shall be subjected to a hydrostatic pressure test. Test pressure shall be four times the rated working pressure. Gaskets and seals may be reinforced if necessary during this test. Pressure shall be maintained for 5 minutes without rupture.

4.5 System Durability

4.5.1 Requirement

The entire air drying unit shall be designed to operate reliably 10,000 cycles.

4.5.2 Test/Verification

A sample device will be subjected to 10,000 cycles of operation. Outlet pressure piping shall be vented to atmosphere through a solenoid. Outlet pressure shall be set to the system pressure and controlled with a regulator. Air shall be discharged through the solenoid valve until the electric motor starts and then the solenoid shall be shut. The system shall run until the control panel shuts off the electric motor. This shall be considered one cycle. The system shall remain at rest for 15 minutes and then the next cycle initiated. At the conclusion of this test, there shall be no mechanical failure, or any appreciable change in operating characteristics of the air compressor section or the desiccating section.

4.6 Control Panel Cycling

4.6.1 Requirement

The control panel shall be designed to operate reliably for 25,000 cycles.

4.6.2 Test/Verification

A sample device will be subjected to 25,000 cycles of operation, not including the compressor and electric motor. Inlet pressure to the coalescing oil filter shall be supplied by the laboratory air supply. The control panel shall be supplied with 120V AC power to the control circuitry to simulate a continuously running motor. Outlet pressure piping shall be vented through a solenoid. Outlet pressure shall be set to the system pressure and controlled with a regulator. Air shall be discharged through the solenoid valve for 30 seconds, then held for 30 seconds. This shall be considered one cycle. At the conclusion of this test, there shall be no mechanical failure, or any appreciable change in operating characteristics of the air compressor section or the desiccating section.

4.7 Dielectric Strength

4.7.1 Requirement

Electrical Components shall withstand application of twice their rated voltage plus 1000 volts between all terminals provided for external connections and ground.

4.7.2 Test/Verification

Voltage shall be applied between each terminal and ground. For devices rated at 60 V, or less, the test voltage shall be 500 V. Components subjected to the Dielectric Strength test shall continue to function normally after the test.

5. MANUFACTURER'S REQUIREMENTS

5.1 Demonstrated Quality Control Program

- 5.1.1 A quality assurance program is required to assure that subsequent products produced by the manufacturer shall present the same quality and reliability as the specific products examined. Design quality, conformance to design, and performance are the areas of primary concern.
 - Design quality is determined during the examination and tests and may be documented in the certification report.
 - Continued conformance to this standard is verified by the certifier's surveillance program.
 - Quality of performance is determined by field performance and by periodic re-examination and testing.
- 5.1.2 The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:
 - existence of corporate quality assurance guidelines;
 - incoming quality assurance, including testing;
 - in-process quality assurance, including testing;
 - final inspection and tests;
 - equipment calibration;
 - drawing and change control;
 - packaging and shipping; and
 - handling and disposition of non-conforming materials.
 - 5.1.3 Documentation/Manual

There should be an authoritative collection of procedures/policies. It should provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system should require that sufficient records are maintained to demonstrate achievement of the required quality and verify operation of the quality system.

5.1.4 Records

To assure adequate traceability of materials and products, the manufacturer shall maintain a record of all quality assurance tests performed, for a minimum period of two years from the date of manufacture.

5.1.5 Drawing and Change Control

The manufacturer shall establish a system of product configuration control that shall allow no unauthorized changes to the product. Changes to critical documents, identified in the certification report, may be required to be reported to, and authorized by the certification agency prior to implementation for production.

Records of all revisions to all certified products shall be maintained.

5.2 Surveillance Audit

- 5.2.1 An audit of the manufacturing facility may be part of the certification agencies surveillance requirements to verify implementation of the quality assurance program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to ensure a uniform product consistent with that which was tested and certified.
- 5.2.2 Certified products or services shall be produced or provided at, or provided from, location(s) disclosed as part of the certification examination. Manufacture of products bearing a certification mark is not permitted at any other location prior to disclosure to the certification agency.

5.3 Product Modification

5.3.1 The manufacturer shall notify the certification agency of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

5.4 Manufacturing and Production Tests

- 5.4.1 The manufacturer shall test 100 percent of production air drying units by operating the assembly and verifying that it is capable of producing air at -20°F (-29°C) pressure dewpoint.
- 5.4.2 The panel functions shall be verified and all lights and alarms checked.
- 5.4.3 All connections shall be tested under working pressure with soap solution to check for leaks.

6. **BIBLIOGRAPHY**

ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories.

FM Global Property Loss Prevention Data Sheet 2-0, Installation Guidelines for Automatic Sprinklers

FM Global Property Loss Prevention Data Sheet 8-29, Refrigerated Storage

NFPA 13, Standard for the Installation of Sprinkler Systems

APPENDIX A: Tolerances

Unless otherwise stated, the following tolerances shall apply:

Angle	$\pm 2^{\circ}$
Frequency (Hz)	\pm 5 percent of value
Length	± 2 percent of value
Volume	\pm 5 percent of value
Pressure	± 5 psi (35 kPa)
Air Flow	± 2 percent of value
Dew Point	± 2 percent of value
Humidity	± 2 percent of value
Temperature	$\pm 4^{\circ}F(2^{\circ}C)$
Time	+ 5/-0 seconds
	+0.1/-0 minutes

Unless stated otherwise, all tests shall be carried out at a room (ambient) temperature of $68 \pm 9^{\circ}$ F ($20 \pm 5^{\circ}$ C).

APPENDIX B: Sample Listings

Air Drying Units

Fire Protection / Automatic Sprinkler Systems / Air Drying Units

These devices are intended for use in a dry pipe or a refrigerated area sprinkler system application. Each unit, in conjunction with a certified air maintenance device, provides air with reduced humidity to lower the possibility of ice formation in a single dry pipe system.

System capacity listed below is the amount of dry compressed air the system is capable of supplying at the system pressure in 30 minutes. This volume has been converted to gallons to allow it to be compared to the sprinkler system volume.

Company Name, Address

Product Designation	Outlet Pipe Connection Size, NPT inches	System Capacity, gallon (liter)	System Pressure, psi (Kpa)
Figure 101	3/4	250 gal	175 psi
		(950 L)	(1205 kPa)
Figure 102	1	500 gal	175 psi
-		(1890 L)	(1205 kPa)
Figure 102	1	800 gal	50 psi
-		(3030 L)	(345 kPa)