RDT Standards Transmittal

Hanford Engineering Development Laboratory

Operated by
Westinghouse
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for the USAEC
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FANS, BLOWERS, AND
COMPRESSORS FOR DRY
GAS CIRCULATION

APRIL 1973

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Division of Reactor Development and Technology
United States Atomic Energy Commission
# FANS, BLOWERS, AND COMPRESSORS FOR DRY GAS CIRCULATION

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1. SCOPE

This standard covers the requirements for construction and delivery of gas movers for the circulation of air or inert, potentially radioactive process gases. Equipment covered by the standard includes axial and centrifugal fans, blowers and compressors having pressure-retaining boundaries (i.e., casings) designed to meet the requirements of Section III of the ASME Boiler and Pressure Vessel Code, hereinafter referred to as the "Code."

1.1 Classification. The gas movers shall be one of the following types, open or hermetic as specified in the Ordering Data, and shall be considered as dry compression machines:

a. Axial flow fan, blower, or compressor.

b. Centrifugal fan, blower or compressor.

Sub-classification shall be specified in the Ordering Data.

Code classification shall be as specified in the Ordering Data and references to the Code in this standard apply to the code class selected.

1.2 Components and Services. All components and services to be provided by the supplier shall be as specified in the Ordering Data.

1.3 Definitions.

1.3.1 Aerosol. A suspension of insoluble particles in the gas stream.

1.3.2 Hermetic. Not requiring shaft seals. Motor is in or out of the gas stream.

1.3.3 Open. Requiring shaft seal(s). Motor is out of the gas stream.

1.3.4 Service Life. The operating time until wearout of an item.
2. APPLICABLE DOCUMENTS

The following documents are a part of this standard to the extent specified herein. The issue of a document in effect on the date of the invitation to bid, including any amendments also in effect on that date, shall apply unless otherwise specified in the Ordering Data. Where this standard appears to conflict with the requirements of a reference document, such conflict shall be brought to the attention of the purchaser for resolution.

2.1 Exceptions. Where the materials or specifications to be employed in the manufacture of any part are not identified in this standard, the documents referenced herein, or the Ordering Data, the supplier shall submit for purchaser approval the materials or standards he proposes to use prior to their use.

2.2 Reactor Development and Technology (RDT) Standards.

RDT F 2-2T Quality Assurance Program Requirements
RDT F 2-4T Quality Verification Program Requirements
RDT F 3-6T Nondestructive Examination
RDT F 4-20T Operation and Maintenance Manuals
RDT F 5-1T Cleaning and Cleanliness Requirements for Nuclear Components
RDT F 7-2T Preparation for Sealing, Packaging, Packing and Marking of Components for Shipment and Storage
RDT F 7-3T Requirements for Identification Marking of Reactor Plant Components and Piping
RDT F 8-6T Hoisting and Rigging of Critical Components and Related Equipment
RDT M 6-2T Mechanical Locking Devices

2.3 American National Standards Institute (ANSI) Standards.

ANSI B1.1 Unified Screw Threads
2.4 **American Society of Mechanical Engineers (ASME) Codes.**

**Section III** ASME Boiler and Pressure Vessel Code, Nuclear Power Plant Components

**PTC 9** Displacement Compressors, Vacuum Pumps and Blowers

**PTC 10** Compressors and Exhausters

2.5 **Other Codes and Standards.**

**AMCA 210** Test Code for Air Moving Devices

**AMCA 300** Test Code for Sound Rating

**AFBMA** Standards of the Antifriction Bearing Manufacturers Association

**NEMA MG-1** Motors and Generators

2.6 **Other Documents.** Other documents shall apply as specified in the Ordering Data.

3. **TECHNICAL REQUIREMENTS**

3.1 **General.** The gas mover is part of a closed circuit cooling system that will cool potentially contaminated cell atmosphere, certain reactor components, and pipeways within the facility. Cooling is accomplished by recirculating warm or hot gas from the cells, through the gas mover, a heat exchanger and piping and returning the cooled gas to the cells.

3.1.1 **Design Codes for Pressure-Retaining Boundary Parts.** The pressure-retaining boundary parts of the gas mover described by this standard shall be designed and constructed in accordance with the rules of Section III of the Code. The class designation and Code stamp requirements shall be as specified in the Ordering Data.
3.2 Design or Performance Requirements.

3.2.1 General. The gas mover shall be an integrated unit consisting of an impeller, motor, casing and all other components, equipment, supports, and appurtenances as are necessary for the safe, reliable, and continuous movement of inert gas or air through a closed system. Reliability in service and accessibility of all parts (where practicable or specified) for inspection, maintenance or repair shall be a design objective.

3.2.2 Gas Mover Performance. The gas mover shall be capable of producing the required gas flow and pressure in accordance with the performance requirements provided in the Ordering Data. The Ordering Data will specify whether the gas movers are to operate singly or whether parallel or series operation is required. The gas mover shall operate out of the surge region in all cases. Data not furnished by the purchaser shall be submitted by the supplier for approval.

3.2.3 Operating Conditions. The gas mover shall be capable of continuous operation under normal conditions as well as under abnormal conditions (i.e., seismic acceleration, externally induced vibrations, specified maximum ambient temperatures and pressures, gas containing sodium particles in the form of an aerosol, radiation dose exposure, etc.) as specified in the Ordering Data.

3.2.4 Service Life. The service life of the gas mover and all of its parts including bearings and gasketed closures shall be as specified in the Ordering Data. Pressure-retaining boundary parts and gasketed closures shall be designed to be leak free during the design life under all service conditions specified in the Ordering Data.

3.2.5 Size and Weight. Size and weight of the gas mover shall be kept to the minimum necessary to fulfill the requirements of this standard, and shall not exceed the values specified in the Ordering Data.

3.2.6 Mechanical Design and Operational Loadings.

3.2.6.1 Vibration. The gas mover and all its parts shall be designed to withstand mechanical vibrations transmitted from components to which it is connected, fluid flow induced vibrations, shaft whirl induced vibrations, and shock of vibration encountered during shipping without damage or impairment of operation. External excitation shall be as specified...
in the Ordering Data. Vibration test results may be substituted for analytical verification of structural-dynamic integrity when approved by the purchaser. The supplier shall provide pads, suitably located, for mounting a vibration pickup device as specified in the Ordering Data.

3.2.6.2 Seismic. The gas mover shall be designed to withstand the effects of earthquake ground motion at the plant site without breaching of the fluid containment. Displacements at the support structure as a function of time, established design basis earthquake, and the maximum piping reactions induced by those displacements, including design rules, shall be as specified in the Ordering Data.

3.2.6.3 Foundation, Shipping and Erection Loads. Support lugs, brackets, and other attachments which will be subjected to forces and moments resulting from dead load, nozzle loads, seismic forces, and other external forces shall be designed to withstand such forces without damage or impairment. The purchaser will supply structural support and foundation drawings after receipt of drawings from the supplier showing the support loadings transmitted to the foundations.

The gas mover and its internals shall be designed to withstand loads imposed on it during shipping and erection, including loads that may be imposed when it is oriented in attitudes other than its normal operating attitude.

3.2.6.4 Nozzle Loads. The casing and nozzles shall be designed to withstand the piping loads applied to the nozzles as specified in the Ordering Data.

3.2.7 Corrosion Allowance. Corrosion allowances shall be as specified in the Ordering Data.

3.2.8 Design for Maintainability. As part of the design, a maintenance plan shall be developed by the supplier. This plan shall define the maintenance activities that have been established as a basis for design and the methods to be used in accomplishing those maintenance activities. Recommended procedures for performing each separate activity shall be prepared and furnished in the Maintenance Manual. The design of the gas mover shall include provisions for performing the identified maintenance activities using the procedures submitted to the purchaser in the Maintenance Manual (See 3.5.3).

3.2.8.1 Access Openings and Closures. Handholes shall be provided as specified by the Ordering Data.
3.2.8.2 Work Space. The supplier shall determine the minimum work space required around the gas mover for performing the expected maintenance activities. In determining the space requirements, consideration shall be given to human factors and the use of special tools.

3.2.9 Design for Inspectability. Pressure-retaining boundary details shall be designed such that seams, joints, and surfaces are capable of being inspected or examined with interpretable results. Special tools such as boroscopes, long-handled mirrors, radiographic or ultrasonic equipment required to perform inspections and examinations shall be identified and described in the Maintenance Manual.

3.2.10 Spare Parts and Special Tool List. The supplier shall recommend a list of spare parts to be stocked at the plant site. This list is to contain those parts and tools likely to be damaged or expended during delivery, plant operations, or both. When approved, the supplier shall process and deliver these spare parts in accordance with the requirements for deliverable items.

3.2.11 Nonfunctional Performance. Restrictions for nonfunctional performance outputs such as noise and vibration will be specified in the Ordering Data.

3.2.12 Interface Requirements. The Ordering Data will include requirements for the physical, mechanical, electrical and structural interfaces as applicable.

3.3 Materials. All materials specified in the Ordering Data shall conform to the requirements of applicable RDT standards and the class of components of the Code specified in the Ordering Data.

3.3.1 Bolting and Fasteners. Pressure-retaining boundary threaded fasteners shall conform to the requirements of Section NB-3230 of the Code.

3.3.1.1 Screw Threads. Threaded connections shall have unified thread form in accordance with ANSI B1.1. Special threads shall meet the requirements of ANSI B1.1. Designation of threads on drawings, fabrication requirements, and gaging of threads shall be in accordance with ANSI B1.1.

3.3.1.2 Limitations on Bolting. Capscrews or studs, threaded into tapped holes shall not be used for pressure-retaining boundary closures without purchaser approval. The minimum
bolt or stud size for specially designed pressure-retaining boundary closures or flanged joints in the pressure boundary shall be as specified in the Ordering Data.

3.3.1.3 Locking Devices. Locking devices meeting the requirements of RDT M 6-2 shall be provided on all threaded fasteners used internally in the gas mover.

3.3.1.4 Lubricants. Only lubricants approved by the purchaser shall be used on parts, including fasteners, that will be exposed to the process gas in service.

3.3.2 Carbon Steel. Impact testing of carbon steel shall be as specified in the Ordering Data.

3.3.3 Gaskets. Gasket style shall be submitted for purchaser approval prior to manufacture.

3.4 Design and Construction.

3.4.1 Crevices and Dead Spaces. Crevices, dead spaces, and other unflushable or undrainable spaces shall be minimized in the design of the gas mover and shall be acceptable only where they are unavoidable for its correct functioning.

3.4.2 Casing. Gas mover casing penetrations for electric wiring and grease leads shall be a bulkhead type of fitting. The casing thickness shall be such that a broken rotating part will not cause a breaching of the gas containment.

3.4.3 Rotor Assembly. The rotor assembly may be attached to the motor shaft by the following methods:

1. Key and secure by means of a ball bearing lock nut and washer.
2. Couplings.
3. Other purchaser approved attachment method.

3.4.4 Vibration Isolators. Vibration isolators shall be provided by the supplier as required. The selection of the isolator shall reflect the values developed by the seismic calculations and inherent vibration characteristics of the gas mover.
3.4.5 Electric Motor. The electric motor shall be totally enclosed, fan cooled (TEFC) with antifriction bearings designed specifically for the gas mover type in accordance with AFBMA Standards and in accordance with NEMA standard MG-1. Ambient temperatures, nuclear radiation, aerosol atmosphere, pressure differentials and other conditions for design purposes, shall be as specified in the Ordering Data. The data will be specified as a function of time where applicable. The motor shall be rated for continuous duty with insulation capable of operating at the maximum gas temperature as specified in the Ordering Data. Electrical insulating materials are subject to purchaser approval. Two-speed motors, when specified in the Ordering Data, shall have separate windings.

Thermal (embedded in the windings) overload protection shall be provided. The maximum torque shall be as specified in the Ordering Data. Magnetic starters, safety disconnect switches and other motor accessories will be provided at the installation site under a separate contract unless otherwise specified in the Ordering Data.

The motor shall be rated for a service factor of 1.0 or as specified in the Ordering Data. The motor shall be designed for normal starting torque and low starting current for "across the line" full voltage starting as listed in NEMA Standard MG-1 and as specified in the Ordering Data.

3.4.6 Motor Drives. The type of motor drive shall be as specified in the Ordering Data.

3.4.7 Bearings. All shaft bearings shall be antifriction type. AFBMA type and life shall be as specified in the Ordering Data. A relief grease lead shall provide protection against bearing seal rupture.

3.4.8 Seals. Seals shall be constructed using materials compatible with the process fluids and environmental conditions specified in the Ordering Data.

3.4.9 Bearing Lubrication. Where a circulating lubricating system is required the supplier shall furnish all components including piping, valves, sight flow indicators at each drain where possible, pressure gauges, thermometers, temperature and pressure switches, oil pump, driver, oil reservoir, filters, and coil coolers. The supplier shall submit detailed requirements for purchaser approval.

A brass tag firmly affixed to the lubrication leads shall bear the legend "Lube with_____ only". The relief lead
shall be positively identified as such.

The supplier shall recommend lubricants of adequate properties for serving the antifriction function and also suitable for service without breakdown under environmental conditions of temperature coincident with the nuclear radiation exposure as specified in the Ordering Data.

3.4.10 Bolted Connections. Split casings or flanged connections shall be provided with jacking bolts to permit easier dismantling. Dowel pins shall be provided where a specific orientation is required between the bolted connections.

3.4.11 Gas Mover Supports. The Ordering Data will specify whether the equipment will be mounted vertically, horizontally or included, on the floor, ceiling, wall suspended, or supported by the end flanges.

3.4.12 Insulation Supports. Unless otherwise specified, supports for installation of insulation shall be provided. The type and thickness of insulation shall be as specified in the Ordering Data. Insulation supports shall be attached in a manner that will not affect the structural integrity of pressure-retaining parts.

3.5 Design Analysis, Drawings and Manuals.

3.5.1 Design Report. The supplier shall submit a design report showing that the requirements of this standard and the attached Ordering Data have been satisfied. Submittal requirements shall be as specified in the Ordering Data. The design report shall include the following as a minimum:

1. A design description of the unit, including operating characteristics, operational limitations, and safety considerations.

2. A strength calculation report for the pressure-retaining boundary satisfying the requirements of the Code, this standard and the Ordering Data. Special configurations that affect the gas containment structure which are not covered by this standard or the Ordering Data require a nonstandardized stress analysis. Nonstandardized stress analysis procedures require purchaser approval.

3. Vibration analyses or test results which consider the amplitudes and effects of vibrational motion.

4. Weight and center-of-gravity analyses.
5. Materials of construction.

6. Surge analysis as specified in the Ordering Data.

Information furnished in the design report shall be of sufficient detail to permit independent audit. The references from which data or formulas are taken shall be identified. The validity of the data and conclusions supporting the design shall be discussed. All computer codes used in design shall be identified by name and source and described in sufficient detail to permit independent audit and verification.

The supplier shall make additions and corrections to the report as necessary to keep the information current. Such additions and corrections shall be numbered and dated, and shall be submitted to the purchaser for approval.

3.5.2 Drawings. The supplier shall prepare the following drawings. All drawings shall be arranged and prepared in accordance with the conventions and recommendations of ANSI Y14. The times and approval requirements of submittals of drawings, and the number of copies required for each submittal, shall be as specified in the Ordering Data. Reproducibles shall not be folded.

3.5.2.1 Outline Drawings. Outline drawings shall include the following information, as applicable: Design and salient features, including principle and critical dimensions; information required for the preparation of supports and foundations; size and location of all connections and fittings; the clear space for access; thermal and pressure movement of all connections with respect to equipment supports; special instructions necessary for hoisting, alignment, installation, and storage; removal of motor and impeller and repair operations; identification of reference drawings; as-built changes.

Outline drawings submitted with the assembly drawings shall show the following:

1. Outline dimensions.

2. Wiring and electrical connections.

3. Weight and center of gravity of the assembled gas mover.
4. Weights of all items removable for maintenance.

5. Weights and centers of gravity of subassemblies into which the gas mover is divided for shipping.

3.5.2.2 Detail Drawings. Detail drawings shall include the following, as applicable: Detailed dimensions, tolerances, surface-roughness requirements for critical surfaces; tolerance block including geometric tolerances; material specifications and special requirements concerning nondestructive testing, heat treatment, hardness, etc.

Fabrication instructions including welding, hard surfacing, cleaning, and inspection symbols and reference to assembly procedure requirements; all as-built changes and modifications.

The supplier shall furnish weld details of all pressure part welded joints.

3.5.2.3 Assembly Drawings (Design Layout Drawings). Assembly drawings shall include the following, as applicable:

1. Dimensions establishing size, shape, fit and clearances of each major part and subassembly.

2. Identification of interfaces with adjacent components and environment, including weight, center of gravity, personnel access, maintenance services, etc.

3. A bill of materials showing location, identity (drawing and part numbers) and material types including the specification to which the material is to be procured.

4. The position and type of all welds, classification of welds by common groupings to cover specified general weld and identification of the type of examination to be performed.

5. Identification of all component parts, if any, which will not be manufactured to RDT standards.

6. Identification of all component parts, if any, which will not be subjected to RDT cleanliness requirements.

7. Lubricants to be used during assembly, and where permitted.
8. Pressure and temperature data, including design pressure and temperature and test pressure.

9. Pertinent references to cleaning, marking, torque, locking, handling and packaging instructions.

10. All as-built changes.

3.5.2.4 Drawing List. A drawing list shall be furnished showing, by drawing number and title, all specified drawings for the gas mover. The drawing list shall be kept up to date throughout the period of the contract to show the latest revisions of drawings and additions to the list at all times.

3.5.3 Manuals. Information concerning the operation and maintenance of the gas mover, including instructions, procedures, recommended practices, etc., shall be furnished for inclusion in the plant operations manual. Maintenance Manuals shall be in accordance with RDT F 4-20 as specified in the Ordering Data. Such information shall reflect the as-built configuration of the gas mover and shall include, but is not limited to, the following:

1. A detailed description of the gas mover and associated items.

2. Instructions for operation, installation, preventative maintenance, and repair; procedures shall include a description of any special tools required to make repairs after installation.

3. Procedures for replacing seals, gaskets, and other replaceable parts.

4. Reduced size drawings for operation, maintenance, and instructional purposes, including drawings of special tools, jigs, fixtures, and equipment required.

5. Instructions for the use of any lifting and handling fixtures, special tools, and equipment.

6. Instructions for disassembly, cleaning, preparation of items for shipment, and crating.

7. List of recommended spare parts including an essential spare part inventory and a distributor directory.
8. In-service inspection requirements, recommendations, and procedures.

9. Procedures for making and removing seal welds, where applicable.

The information shall be organized and submitted in the form of a loose-leaf manual. The number of copies to be submitted shall be as specified in the Ordering Data.

3.6 Fabrication. The supplier shall maintain and conform to written procedures for welding, heat treating, bending and forming, assembly, preparation of surfaces for an application of protective coatings, cleaning and cleanliness control, materials and parts handling, and other critical operations. Copies of such procedures shall be furnished to and approved by the purchaser before they are placed in use; copies shall also be made available to representatives of the purchaser at the manufacturing site upon request.

3.6.1 Welding. Weld design, procedure and performance qualifications and examination of welds shall conform to the requirements of the Code. Any supplementary welding requirements will be as specified in the Ordering Data. All welds shall be full penetration and continuous.

3.6.1.1 Seal Welds. Seal welds may be used if required to meet the leakage requirements specified in the Ordering Data. Seal welds shall be designed to permit cutting and rewelding without damaging the basic parts beyond the point that they can be rewelded. Seal welds shall be made only between similar materials, and shall not require preheat or post-weld heat treatment. Seal welded joints shall be designed or located so that welding causes no distortion of threaded areas or of adjacent mating parts.

3.6.1.2 Repair of Materials by Welding. Where the applicable material standard and procurement specification allow the use of welded processes for repair of defects in the materials, repair welding shall be performed in accordance with the requirements of the Code. No repair welding of bolting material shall be permitted.

3.6.2 Heat Treatment. Heat treatment and stress relieving shall be in accordance with the requirements of the applicable materials standards and as specified in the Ordering Data.
3.6.3 Bending and Forming. Thickness of materials after bending and forming shall be not less than the minimum design thickness. The supplier shall evaluate the need for heat treatment of the material following bending and forming operations for stress relief or material structure improvement.

3.6.4 Assembly. Assembly procedures shall include, but are not limited to the following:

1. Assembly sequence.
2. Cleaning procedures to be used and sequence of cleaning operations.
3. Cleanliness control and housekeeping requirements to be employed at each step of assembly.
4. Special machining and fit-up-assembly instructions.
5. Handling and storage methods and procedures.
6. Tightening torque requirements for threaded parts.
7. Procedures for installing tacking devices.
9. Drawings, photographs, or both to illustrate problem areas and assembly techniques which may present problems.

3.6.5 Cleaning and Painting.

3.6.5.1 Cleaning and Cleanliness Control. The fabrication, storage and preparation for shipment of all parts, subassemblies, and final assemblies shall be conducted to facilitate cleaning and inspection for cleanliness, and to prevent rust and contamination by extraneous material.

The supplier shall submit his cleaning procedures and acceptance criteria for cleanliness for purchaser approval. The cleaning procedures shall be based upon the requirements for cleaning procedures given in RDT F 5-1. The acceptance criteria as a minimum, shall include the acceptance criteria for pitted corrosion defined in RDT F 5-1.
3.6.5.2 Painting and Protective Coatings. External carbon and low-alloy steel surfaces (except machined or threaded surfaces) shall be painted with heat and radiation-resistant paint. Preparation for painting shall be in strict accordance with instructions of the paint manufacturer. Unpainted carbon and low-alloy steel external surfaces shall be coated with grease or oil, unless otherwise specified in the Ordering Data; internal surfaces shall not be coated or painted. Unless specified in the Ordering Data, the type of paint or corrosion-resistant treatment shall be recommended by the supplier and must be approved by the purchaser before use.

3.6.6 Surface Finish. The finish of machined surfaces and surfaces which will be in contact with the process fluid shall be specified on the drawings in accordance with ANSI B46.1. Surfaces which will be examined by nondestructive methods shall have a finish of 250 microinches AA or better to permit satisfactory liquid penetrant, magnetic particle, or ultrasonic inspection.

3.6.7 Manufacturing Release. The supplier shall not release materials, parts, or supplies for use until the purchaser has approved the applicable outline, detail, or assembly drawings, bills of materials, specifications, and other documentation related to the item, including any engineering analysis or section of the design report relating to the item. The design report section may be in preliminary form, but shall be complete with respect to design adequacy verification.

3.6.8 Handling and Storage. Handling and storage procedures shall be developed in accordance with RDT E 9-7T to ensure that all items are furnished in an undamaged condition. The procedures shall ensure that lifting and handling devices are not overstressed and that adequate precautions, such as buffers, covering, etc., are employed to prevent damage to or contamination of items being lifted or transported during manufacture, assembly, temporary storage, or preparation for shipment, or while awaiting shipment.

Each part of subassembly weighing more than 50 lbs. and which must be handled individually shall be designed for or provided with means for lifting and handling using standard cranes and hoisting equipment.

3.6.9 Identification.

3.6.9.1 Identification of Materials and Parts During Manufacture. Methods and procedures for identifying and
maintaining the identity and source of all materials and purchased items that will become a part of the pressure-retaining boundary of the gas mover shall be established and followed at all times during the course of manufacture. Identification shall permit accurate tracing of the item to original certification data. Methods and materials for both temporary and permanent marking shall meet the requirements of RDT F 7-3. When materials are cut or sectioned, the identification of the original piece shall be transferred to the cut or sectioned piece.

3.6.9.2 Identification Marking of Components.
Permanent identification marking of the gas mover shall be as specified in the Ordering Data and shall conform to the requirements of RDT F 7-3. The identification or nameplate shall include the following information:

1. Name of component.
2. Type designation (if applicable).
3. Manufacturer's name and model number.
4. Contract or purchase order number.
5. ASME Boiler and Pressure Vessel Code symbol (if applicable).
6. Month and year of manufacture.
7. Number of applicable technical manual.
8. Design pressure and temperature.
9. Rated flow and pressure rise.
10. Motor horsepower and frame size.
11. Voltage, phase and hertz.
12. Bearing type and lubricant.
13. Space for system identification number.
14. Other information as specified in the Ordering Data.

Identification marking and nameplates shall be located where they will not be painted or covered by insulation, attachments, etc.
4. QUALITY ASSURANCE REQUIREMENTS

4.1 Quality Assurance Program. The supplier shall establish and conform to a written program of plans and actions for assuring the quality and functional reliability of items furnished in accordance with this standard. The quality assurance program shall meet the requirements of RDT F 2-2, Sections 1 through 5 and Section 8, and the additional requirements for inspection and testing of this standard. The supplier shall insure that all requirements of the QA program are transmitted to subsuppliers. Certain subcomponents may only require quality verification in accordance with RDT F 2-4 which will be as specified in the Ordering Data.

4.2 Access to Supplier's Plant. The purchaser and his designated representative shall be permitted to visit those areas of the supplier's plant and the plants of his subcontractors necessary to witness work being done under this standard, to inspect materials, parts, and the completed component, to witness or conduct tests specified in this standard, and to examine applicable documentation, drawings, records, and certifications.

4.3 Purchaser Witness. The purchaser may witness examinations, inspections, and tests. Such examinations, inspections and tests will be designated as witness points in the Ordering Data or in the plans to be submitted by the supplier (see 4.6.1). The purchaser may expand the list of witness points or may waive any witness point. The supplier shall notify the purchaser at least five days in advance of each designated witness point, and shall confirm the schedule within 24 hours of the specified examination, inspection, or test.

4.4 Inspection and Test.

4.4.1 Inspection. In addition to the inspections and tests specified in the Code and other applicable documents, the following inspections and tests shall be made:

1. Visual Inspection. The gas mover and its parts shall be inspected during manufacture and after completion to ensure conformance with the requirements of this standard with respect to material, workmanship, finish, cleanliness, identification of materials and parts, marking, and other characteristics that might affect its serviceability.
2. **Dimensional Inspection.** All items shall be subjected to dimensional examination to verify conformance with drawing requirements.

4.4.2 Testing. Mercury or mercury containing instruments shall not be used during the manufacture or testing of the gas mover or any of its parts.

4.4.2.1 Performance Test. Dynamic testing of the gas movers shall be performed and witnessed in accordance with AMCA 210 standard or ASME Performance Test Codes PTC-9 and PTC-10. Data generated from the tests shall be plotted showing fan total pressure, efficiency, brake horsepower, speed, and purchaser supplied system curve as functions of volumetric flow. Data shall be generated at each of the motor speeds specified in the Ordering Data.

An impeller overspeed test shall be performed when specified in the Ordering Data.

Sound data shall be obtained from actual measurements taken on a gas mover identical to that being furnished, in accordance with AMCA 300 standard and at the specified operating point. The maximum sound level shall be as specified in the Ordering Data.

After installation in the facility, the gas mover will be subjected to tests proposed by the supplier and approved by the purchaser, to determine whether the equipment performs in accordance with the requirements of this standard and the Ordering Data.

4.4.2.2 Pneumatic Test. The gas mover shall be pneumatic tested as specified in the Ordering Data upon completion of the assembly.

4.4.2.3 Helium Leak Test. After completion of pneumatic testing a helium leak test shall be performed on the gas mover in accordance with the requirements of RDT F 3-6 and the acceptance standards specified in the Ordering Data. Unless otherwise specified in the Ordering Data, the sniffer method shall be used.

4.4.2.4 Load Tests. Load tests shall be performed when specified in the Ordering Data. All handling attachments on the gas mover shall be tested statically to 150 percent of the gas mover weight. A dynamic test shall be performed at 125 percent of dead load by lifting the gas mover at the speeds and motions which would be expected during actual handling operations. Following satisfactory completion of the load tests, the attachment welds shall be examined by the magnetic particle or the liquid penetrant method.
4.4.2.5 Motor Tests. Motor test shall be as specified in the Ordering Data.

4.4.3 Nondestructive Examination. In addition to examinations made during fabrication, all welds on the pressure-retaining boundary shall be nondestructively examined in accordance with the Code following final assembly and stress relief (if applicable) of the gas mover.

4.5 Verification of Procedures. Cleaning, inspection, maintenance procedures and special processing procedures developed by the supplier for purchaser approval shall be demonstrated to verify their adequacy and the adequacy of related drawings and specifications relative to correctness, clarity, and access requirements.

4.5.1 Special Process Control. The supplier shall provide written procedures to control each special quality assurance or production process. Controls shall be established for welding, heat treating, nondestructive examination, cleaning, protective coating preparation and application, and assembly.

4.6 Documentation and Records. The supplier shall furnish copies of all test reports, certifications, work plans, drawings, procedures, technical manuals, and other documentation specified in this standard and other applicable documents in the quantities specified in the Ordering Data. Unless otherwise specified, purchaser approval shall be obtained before using materials or operations affected by the documents. Document submittals shall be as listed in Table 1 (see next page) and as specified in the Ordering Data.

4.6.1 Plans. The supplier shall prepare plans that describe all work operations and quality assurance activities. Each plan shall be submitted for approval as specified in the Ordering Data. Each plan shall include, but not be limited to, the following:

4.6.1.1 Manufacturing Plan. The supplier shall prepare a production plan that identifies each manufacturing, assembly, and cleaning operation, the methods that will be employed for cleanliness control during each stage of manufacture, and the sequence, methods, and procedures that will be employed. Purchaser approval shall be obtained before manufacturing release. The manufacturing plan shall be keyed to the quality assurance program plan.
### TABLE 1 - DOCUMENT SUBMITTAL

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* The number of copies and document submittal requirements shall be as specified in the Ordering Data.
4.6.1.2 Quality Assurance Program Plan. The supplier shall prepare a work plan that identifies each quality assurance provision, describes planned activities at each stage of manufacture, and the sequence, methods, and procedures that will be employed. Purchaser approval shall be obtained before manufacturing release. The quality assurance program plan shall comply with the applicable requirements of RDT F 2-2 and shall be keyed to the manufacturing plan.

4.6.2 Progress Reports. Reports of progress in design, fabrication, inspection, testing, and shipment shall be made at times specified by the purchaser. The reports shall show the progress made since the previous report, with only enough repetition to place the present report in its proper context. Progress reports shall show difficulties experienced and the efforts taken or planned to overcome them. Problems foreseen as possible disruptions of the schedule shall be brought to the attention of the purchaser as early as possible. Breakthroughs of significance shall be discussed fully. Records of all nonconformances shall be maintained including corrective action and proposed rework/repair/retest procedures. Nonconformance reports shall also be prepared and submitted separately when specified in the Ordering Data.

4.6.3 Final Report. The supplier shall submit a final report which summarizes the complete history of the design, development, fabrication, testing, and shipping of the gas mover and its auxiliary equipment. The report should not contain proprietary information except as necessary to support the history, but should include:

1. Analyses specified by this standard and the Ordering Data.

2. Copies of final as-built drawings reduced to convenient size for binding with the report.

3. Illustrations, sketches, schematic diagrams, and photographs of major stages of fabrication, assembly, cleaning, testing, repair, packing, and shipping.

4.6.4 Procedures. The supplier shall prepare a manual of policies, procedures, and work instruction that includes engineering and manufacturing activities specified in Section 3, quality assurance requirements specified in Section 4, and methods of packing and preparation for shipment specified in Section 5. Each procedure shall be written in a systematic
standard format under the controls of the quality assurance program. Purchaser approval of the procedures shall be obtained before they are put into use.

5. PREPARATION FOR DELIVERY

5.1 Preparation for Shipment. Upon completion of all shop testing and inspection the supplier shall prepare the gas mover for delivery to the designated site. Preparation shall include, but is not limited to, any disassembly, recleaning, if required, surface preparation, and other steps necessary to prepare the item for packaging. When specified in the Ordering Data the gas mover shall be purged, pressurized, and sealed in accordance with RDT F 7-2.

When specified in the Ordering Data the interior surfaces of the gas mover shall be protected with a desiccant in accordance with RDT F 7-2.

Wrappings, blocking, and bracing shall be provided as necessary to ensure safe delivery to the designated site. The supplier shall submit packaging plans to the purchaser for approval in accordance with RDT F 7-2.

5.2 Repair Parts and Tools. Repair parts and special tools shall be individually wrapped in moisture and vapor-proof envelopes in accordance with RDT F 7-2 and then boxed or crated for shipment with the gas mover.

5.3 Routing. The supplier shall establish the routing of the gas mover and shall make all arrangements necessary to ship it to the designated site. When specified, routing shall be subject to approval by the purchaser.

5.4 Shipping and Storage Instructions. The supplier shall prepare instructions to the shipper for handling, in-transit storage, and unloading of the gas mover.

5.5 Loading. The supplier shall establish the required shipping orientation and necessary supports, bracing, and crating and shall supervise loading of the gas mover on a suitable vehicle. Handling equipment, bracing, crates, and other items required for loading and shipment shall meet the requirements of Section 3.
5.6 Handling and Shipping Facilities. Special shipping and handling devices shall be designed for a static load of 5x normal anticipated static loads, based on ultimate material strength. Lifting, handling, and shipping fixtures temporarily attached or connected to the gas mover made from ferritic materials shall be sufficiently ductile to permit safe handling and shipment at ambient temperature of 10°F and higher. If shipment is scheduled for the winter months (October through March) and the anticipated temperature may be less than 10°F, the supplier shall take any necessary precautions to prevent brittle fracture of such fixtures and attachments.

Shipping container skids, fixtures, and other shipping devices shall be adequate to prevent damage to the component from shock and vibration. Dynamic loadings for use as a reference basis shall be recommended by the supplier. Proof tests, when specified in the Ordering Data, shall be made and documented for all critical lifting, handling, supporting, and shipping fixtures prior to use.

5.7 Marking for Shipment. The outer wrappings of the gas mover shall be marked in accordance with RDT F 7-2. A bill of lading, giving the same information and also stating whether the shipment is complete or partial shall accompany each shipment.

When specified in the Ordering Data, the gas mover shall be clearly and legibly marked in as many locations as necessary with a heat-resistant paint of contrasting color in letters at least 1-1/2 inches high with the following instructions:

WARNING - DO NOT BURN, WELD, CHIP, GRIND, OR ALLOW ARC STRIKES ON THIS UNIT

CAUTION - UNIT UNDER PRESSURE -- VENT BEFORE OPENING ANY CLOSURE

6. NOTES AND ORDERING DATA CHECKLIST

6.1 Compliance. The standard and the Ordering Data for the gas mover shall be certified by a registered Professional Engineer representing the purchaser to be correct and complete with respect to the specified functions and operating conditions, and in compliance with the applicable section(s), of the ASME Boiler and Pressure Vessel Code.
6.2 Ordering Data Checklist. The detailed requirements and conditions necessary to design, fabricate, examine, test, and deliver a gas mover in accordance with this standard are to be included in the Ordering Data. These requirements are also indicated in the following Order Data checklist. The list includes topics to which the standard makes specific reference, as well as other supplemental information needing definition by the purchaser.

The applicable paragraph number of the standard is used herein to identify information and its location. Any omission of a paragraph number indicates that the particular paragraph of the standard is believed to adequately specify the requirement.

1. Scope. This section should include a statement indicating the document is the Ordering Data which supplements this standard. In addition, include a brief presentation of basic information which will aid the supplier in performing his work. Coverage should also include:

   a. Location of installation site.
   b. Additional definitions.
   c. Owner and purchaser names and addresses (1.3).
   d. Definition of process fluid.
   e. Classification of gas mover (1.1).
   f. Components and services to be furnished (1.2).
   g. Name and address of Code enforcement authority having jurisdiction at the site.

2. Applicable Documents. List all documents and drawings which are specifically called out in Sections 3, 4, or 5 of the Ordering Data. All documents should be referenced as to issue, revision, amendment, etc. in order to preclude confusion.

3. Technical Requirements.

   3.1 General operation conditions.
   3.1.1 Code class designation.
   3.1.1 Code Stamp requirement.
3.2.2 Performance requirements.
3.2.2 Parallel, series or single operation.
3.2.3 Operating conditions.
3.2.4 Service life.
3.2.5 Size and weight.
3.2.6.1 Vibration requirements (externally produced excitation frequency, vibration switches).
3.2.6.2 Seismic requirements.
3.2.6.4 Nozzle loads.
3.2.7 Corrosion allowance.
3.2.8.1 Access openings and closures.
3.2.11 Nonfunctional performances.
3.2.12 Interface requirements.
3.3 Materials.
3.3.1.2 Limitations on bolting.
3.3.1.3 Locking device classification.
3.4.5 Electric motor requirements (maximum torque, service factor, speed, accessories).
3.4.6 Type of motor drives.
3.4.7 Bearing requirements (AFBMA type and life).
3.4.8 Shaft seal requirements.
3.4.11 Horizontal, vertical or inclined mounting.
3.4.12 Insulation supports.
3.5.1 Design report.
3.5.2 Drawings.
3.5.3 Manuals.
3.6.1 Welding requirements.
3.6.5.2 Painting and protective coating requirements.
3.6.8 Equipment class for loading requirements.
3.6.9.2 Identification marking requirements.

4.1 Subcomponents that require quality verification only.

4.3 Purchaser witness points.

4.4.2.1 Performance test requirements.

4.4.2.1 Sound level requirements.

4.4.2.3 Helium leak test requirements.

4.4.2.4 Handling attachment load test.

4.4.2.5 Motor tests.

4.6 Document submittal requirements.

4.6.2 Nonconformance reports.

5. Preparation for Delivery.

5.1 Preparations for shipment.

5.3 Routing approval.

5.6 Lifting device proof test.

5.7 Marking for shipment.