

AMERICAN NATIONAL STANDARD
REACTOR PLANTS AND THEIR MAINTENANCE

Packaging, Shipping, Receiving,
Storage and Handling of Items
for Nuclear Power Plants
(During the Construction Phase)

ANSI N45.2.2 - 1972

SECRETARIAT

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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FOREWORD

This standard deals with the care and inspection of material, equipment and components, hereafter referred to as items, from the time they have been released for packaging at the end of manufacturing until they have been placed in their final designated location in the generating station. The standard was developed under sponsorship of The American Society of Mechanical Engineers (ASME) as an effort by the American National Standards Committee N45 on Reactor Plants and Their Maintenance. This committee has been chartered to promote the development of standards for the location, design, construction, and maintenance of nuclear reactors and plants embodying nuclear reactors, including equipment, methods, and components specifically for this purpose.

In May of 1969 the N45 Committee established an ad hoc Committee (N45-3.2) on Packaging, Shipping, Receiving, Storage and Handling of Equipment. The purpose of this committee was to prepare a standard for general industry use that would define the requirements for these activities so as to assure attainment of quality construction. The ad hoc committee was composed of representatives of key segments of the nuclear industry, including utilities, reactor suppliers, construction contractors, component manufacturers, and consultants.

The preparation of material for this standard was initiated with the intent that appropriate requirements would be included in the ASME Boiler and Pressure Vessel Code. Subsequent to these efforts, it was decided that the requirements would be prepared as a separate American National standard. The initial draft of this standard was prepared in February 1970. Since then revisions have been made to reflect comments received from committee members, other ad hoc committees of N45, and selected individuals from the nuclear industry and the United States Atomic Energy Commission. The standard contained herein was developed from this activity.

In April of 1970 the N45 Committee established a subcommittee N45-3.0 to guide the preparation of nuclear quality assurance standards. This subcommittee is responsible for establishing guidelines and policy to govern the scope and content of various standards, monitoring the status of standards in process, recommending preparation of additional standards, and final approval of standards prior to their submittal to the N45 Committee for balloting. Working with the N45-3.0 Subcommittee and concurrently with the development of this standard by the N45-3.2 ad hoc committee, other ad hoc committees of N45 developed a series of standards that set forth both general and detailed technical provisions for certain activities to assure quality during the construction phase of nuclear power plants. These standards include the general quality assurance program requirements and provisions for cleaning, instrumentation and electrical work, housekeeping, civil, structural, and mechanical work; qualifications of quality assurance personnel; and other quality assurance practices.

In October 1972 the N45-3 Subcommittee was renamed N45-2, and Work Group N45-3.2 was renamed N45-2.2.

At the time of issue of this standard the following other N45 quality assurance standards were in preparation or issued:

1. N45.2, Quality Assurance Requirements for Nuclear Power Plants.
2. N45.2.1, Cleaning of Fluid Systems and Associated Components During the Construction Phase of Nuclear Power Plants.
3. N45.2.3, Housekeeping During the Construction Phase of Nuclear Power Plants.
4. N45.2.4, Installation, Inspection, and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Station.
5. N45.2.5, Construction Phase Quality Assurance Requirements for Installation, Inspection and Testing of Structural Concrete and Structural Steel for Nuclear Power Plants.
6. N45.2.6, Qualification of Inspection, Examination, and Testing Personnel for the Construction Phase of Nuclear Power Plants.

7. N45.2.8, Installation, Inspection, and Testing Requirements for Mechanical Equipment During Construction of Nuclear Power Plants.
8. N45.2.9, Requirements for Quality Assurance Records for Nuclear Power Plants.
9. N45.2.10, Definition of Terms.
10. N45.2.11, Quality Assurance Requirements for the Design of Nuclear Power Plants.
11. N45.2.12, Quality Assurance Program Auditing Requirements for Nuclear Power Plants.
12. N45.2.13, Supplementary Quality Assurance Requirements for Preparation of Procurement Documents for Nuclear Power Plants.
13. N45.2.14, Supplementary Quality Assurance Requirements During the Manufacture of Class IE Instrumentation and Electric Equipment for Nuclear Power Generating Stations.

Suggestions for improvement gained in the use of this standard will be welcome. They should be sent to the Secretary, American National Standards Committee N45, The American Society of Mechanical Engineers, United Engineering Center, 345 East 47 Street, New York, New York 10017.

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A3.9 Marking

Items shall be marked to preserve identity in accordance with the following criteria:

- (1) The specified identification shall be stamped, etched, stenciled or otherwise marked on the item or on tags to be affixed securely to the item in plain, unobstructed view. When metal stamps are employed, low stress rounded bottom type stamps shall be used when the item proper is marked. When vibrating marking tools are used they shall be fitted with a carbide marking tip or equivalent and shall be designed to provide a rounded impression not to exceed 0.010 inches in depth. Etching shall not be used on nickel alloys or on weld areas or sensitized areas of stainless steel. Electric arc marking pencils shall not be used.
- (2) The marking shall not be deleterious to the material nor violate any other section of this standard.
- (3) When tags are employed, they shall be of a material which will retain the marking, withstand weathering deterioration, and other normal shipping and handling effects and shall not be detrimental to the item.
- (4) The English language shall be used. Duplicate marking may be made in other languages.
- (5) References to weights shall be in avoirdupois units. Duplicate markings in other systems may also be indicated.

Markings on the outside container shall be in accordance with the following criteria

- (1) Container markings shall appear on a minimum of two sides of the container, preferably on one side and one end.
- (2) The English language shall be used. Duplicate marking may be made in other lan-

guages or in pictorial markings according to ISO Recommendation R780 Pictorial Markings For Handling of Goods (general symbols) or ANSI MH6.1.

- (3) References to weights shall be in avoirdupois units. Duplicate marking in other systems may also be indicated.
- (4) Container markings shall be applied with waterproof ink or paint in characters no less than 3/4 inch high, container size permitting.
- (5) Where tags or labels are used, they shall be affixed to the container using a waterproof adhesive, tacks where practical, or a corrosion resistant wire.
- (6) Container marking shall include the following information:
 - (a) Destination
 - (b) Return address
 - (c) Package numbers showing the purchase order number, followed by the package number and the total number of packages.
 - (d) Material identification number
 - (e) Handling instructions - Fragile, Center of Gravity, Keep Dry, This Side Up, Sling Here, Do Not Freeze, stacking limitations as appropriate.
 - (f) Weight of package (in excess of 100 pounds).
 - (g) Special Instructions. Desiccant Inside, Special Inspection, Storage, Unpacking Restrictions, etc. as appropriate.

Marking of items not within a container, such as pipe, tanks and heat exchangers, shall exhibit specified information in a location which is in plain unobstructed view, but not directly applied to bare austenitic stainless steel and nickel alloy metal surfaces of the item.

(7) Packages and items containing desiccant shall be marked. The total number of separate bags and/or containers in the package shall be indicated.

(8) The minimum quantity of desiccant for use in each package shall be determined in accordance with Formula I or Formula II, as applicable.

Formula I: To determine minimum of desiccant for use with other than sealed rigid metal barrier:

$U = 1.6A \text{ plus } XD.$

Formula II: To determine minimum units of desiccant for use within sealed rigid metal barrier:

$U = KV \text{ plus } XD.$

In the above formulas:

A= Areas of barrier in square feet

U= Number of units* of desiccant to be used

*A desiccant unit is that quantity of desiccant, as received, which will absorb at equilibrium with air at 25 C at least the following quantities of water vapor: 3.00 grams at 20% relative humidity and 6.00 grams at 40% relative humidity.

D= Pounds of dunnage (other than metal) within barrier

K= 0.0007 when volume is given in cubic inches

K= 1.2 when volume is given in cubic feet

V= Volume within barrier in cubic inches or cubic feet

X= 8 for hair felt, cellulosic material (including wood) and other material not categorized below

X= 6 for bound fibers (animal hair, synthetic fiber or vegetable fiber bound with rubber)

X= 2 for glass fiber

X= 0.5 for synthetic foams and rubber

(9) A humidity indicator shall be included in every water-vaporproof envelope containing desiccant. As applicable, the indicator shall be located behind inspection windows or immediately within the closing edge, face, or cover of the barrier, and as far as practical from the nearest unit of desiccant.

A3.7.1 Fiberboard Boxes. The following criteria apply for fiberboard boxes used as exterior containers:

- (1) Boxes shall be weather-resistant fiberboard preferably from the following grade types (or compliance symbol): V2 s, V3 s, or V3 c. (Federal Specification PPP-B-636.)
- (2) Box style shall be RSC Regular slotted

box, (Outer flaps meet, inner flaps and outer flaps are of equal length).

(3) Fiberboard boxes shall be securely closed with a water resistant adhesive applied to the entire area of contact between the flaps. All seams, and joints shall be further sealed with not less than two inch wide, water resistant tape.

(4) Boxes shall be strapped with pressure-sensitive reinforced tape, length-wise (top, bottom and ends), girthwise (top, bottom and sides) and horizontal sides and ends.

(5) Wood cleating on fiberboard boxes shall be fabricated from sound, well-seasoned lumber.

A3.8.1 Cushioning. Selection of cushioning materials shall be based on the following:

- (1) It shall exhibit no corrosive effect when in contact with the item being cushioned.
- (2) It shall have low moisture content and exhibit low moisture absorption properties; or if the cushioning material has some moisture absorbing capacity, the item shall be protected with a watervapor-proof barrier.
- (3) It shall have negligible dusting characteristics.
- (4) It shall not readily support combustion.

A3.8.3 Anchoring. When bolts are used for anchoring the following criteria shall apply.

- (1) If precision bolt holes in the item are used for anchoring, precaution shall be taken to insure that properly fitting bolts of the correct dimension and characteristics are used to prevent marring or elongation of the holes.
- (2) Holes bored through containers or mounting bases shall provide a snug fit.
- (3) When mounting items to container bases equipped with skids, bolts shall be extended through the skids whenever practical. In such instances counter-sinking of the bolt in the sliding surface of the skid is necessary.
- (4) Washers shall be used under the nuts to decrease the possibility of the bolt pulling through the wood.
- (5) Nuts shall be properly torqued. To prevent their loosening during shipment, lock nuts, lock washers, cotter pins, or staking shall be employed.

tained for 24 hours without adding gas, prior to shipping the item from the manufacturer's plant.

- (4) The item or container shall be marked in bold letters cautioning that an inert gas blanket has been used. The required pressure range also shall be marked on the item or container.

A3.5.1 Caps and Plugs. Caps and plugs shall conform to the following criteria:

- (1) Nonmetallic plugs and caps shall be brightly colored. Clear plastic closures are not to be used except when specified for a special purpose; for example, as a window for humidity indicator cards. Special attention shall be given in the control of these closures.
- (2) Metallic plugs and caps contacting metal surfaces shall not cause galvanic corrosion at the contact areas. Gasketing or other nonmetallic materials used in conjunction with metallic caps or plugs shall exhibit no corrosive effect on the material.
- (3) Simplicity of installation, inspection, and removal without damage to the item shall be considered.
- (4) Provisions shall be made to preclude the plug or cap from falling into or being pushed into the opening after its installation.
- (5) Plugs or caps shall be secured with tape (see paragraph A3.5.2 of this Appendix) or other means as necessary to prevent accidental removal.
- (6) All plugs and caps shall be clean and free of visible contamination such as, but not limited to dust, dirt, stains, rust, discoloration or scale.
- (7) Plugs and caps used in contact with austenitic stainless steel shall be made from non-halogenated materials or stainless steel.

A3.5.2 Tapes and Adhesives. Tapes and adhesives shall conform to the following criteria:

- (1) When contacting austenitic stainless steel and nickel alloy surfaces:
 - (a) The halogen and sulfur contents of tapes should not be in excess of 0.10% by weight each. Paperbacked (masking) tape shall not be used.
 - (b) Upon removal of tape, all residual adhesive shall be removed by a non-halogenated solvent (acetone, alcohol or equal) wiping.

- (c) Starch, silicone and epoxy type material may be used for tape adhesives.

- (2) When contacting other surfaces and containers:

- (a) Tapes and adhesives used to seal non-austenitic materials or containers are not subject to the above restrictions.

- (b) Tape shall be impervious to water and not subject to cracking or drying out if exposed to sunlight, heat or cold.

- (3) Tapes should be brightly colored to preclude their loss into a system.

A3.6.2 Vapor Barrier Material. When maximum vapor protection is required, barrier material shall meet the maximum water vapor transmission rate of 0.05 grams per 100 square inches per 24 hours per ASTM E96 Tests for Water Vapor Transmission Of Materials In Sheet Form, Procedure E and shall be packaged with an approved desiccant. The barrier material should be brightly colored to preclude loss within a system.

A3.6.3 Desiccants. Desiccants shall consist of nondeliquescent, nondusting, chemically inert, dehydrating agents. The following criteria apply when they are used.

- (1) When used with austenitic stainless steels, the desiccant and the bag material shall not have a halogen content over 0.25%. The desiccant bag shall be made of puncture, tear and burst resistant material.

- (2) The reactivation temperature and time shall be marked on the desiccant container.

- (3) Canisters used to contain desiccants shall be placed so as to cause no deleterious effects such as galvanic corrosion, even when the desiccant has reached its absorptive capacity for water vapor.

- (4) Desiccant bags and canisters, when used, shall be secured to prevent movement, rupture of the bags, or damage to the item being protected.

- (5) Water-vaporproof flexible barriers shall be used to seal items containing desiccants. The included air volume within the flexible barrier shall be kept to a minimum.

- (6) Items which contain desiccant shall have all openings securely sealed. When flange connections are a part of the barriers, O-rings or gaskets shall be used with all bolts in place and tightened sufficiently to insure a water-vaporproof seal. Weld end preparations, after capping, shall be covered with a water-vapor proof seal.

APPENDIX

A3 *PACKAGING

The following are additional minimum requirements to be used with the rules of Section 3. of N45.2.2: "Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants".

A3.3 Cleaning

Specific cleaning procedures are considered to be part of the manufacturing specifications. The following general criteria shall apply:

- (1) The cleaning process including cleaning compounds chosen shall in no way damage the item during cleaning or subsequent service when considering the composition, surface finish, complexity or other inherent features or other interface equipment after installation.
- (2) The cleaning process or processes chosen shall remove loose mill and heat scale, oil, rust, grease, paint, welding fluxes, chalk, abrasives, carbon deposits, coatings used for nondestructive testing processes and other contaminants which would render ineffective the method of preservation and packaging, or other specified requirements.
- (3) Item surfaces after cleaning shall be free of cleaning media, such as aluminum oxide, silica, grit, lint, chemical cleaning residue, petroleum solvent residue, etc.
- (4) After cleaning, the item shall be protected from contamination until preservation or packaging is complete.

A3.4.1 Contact Preservatives. The following criteria shall be used when considering the type of contact preservative to be used.

- (1) The contact preservative shall be compatible with the material on which it is applied.
- (2) Contact preservatives which are nondrying

NOTE: *The paragraph numbers contained herein are not sequential but correspond to the respective paragraph of Section 3 of this standard where they are referenced.

shall require a neutral-grease-proof protective wrap when packaged.

- (3) The procedure for applying contact preservatives shall not require disassembly of the item nor shall it be necessary to disassemble the item at the site for complete removal. An exception would be for long term storage protection to be agreed upon by the owner, buyer and manufacturer.
- (4) The method of contact preservative removal shall be accomplished with approved solvents and wiping cloths or by flushing internal cavities with solvents which are not deleterious to the item or other interconnecting material. However, preservatives for inaccessible inside surfaces of pumps, valves and pipe for systems containing reactor coolant water shall be indicated to facilitate touch-up.
- (5) The name of the preservative used shall be the water flushable type.
- (6) When motors, pumps, turbines, etc., are shipped with oil reservoirs and bearings cavities filled with preservative oil, the item shall be so tagged and instructions for draining, flushing, refilling and periodic rotation shall be included with the item.
- (7) When it is anticipated that the item might require an extended storage period, six (6) months or longer, a preservative needed for the long term protection of the item shall be applied or arrangements shall be made to periodically reapply the preservatives.

A3.4.2 Inert Gas Blankets. When inert gas blankets are used, the following criteria shall apply:

- (1) Inert gas blankets shall be used only when the exterior shell of the item or its container can be tightly sealed to form a leak-proof barrier.
- (2) Only a commercial grade of dry, oil-free, inert gas shall be used.
- (3) Provisions shall be made for measuring and maintaining the blanket pressure within the required range within each pressurized purged item or container. Closures and seals shall be tightly secured so that the absolute (by mass) pressure after final seal is main-

be handled and shall give weights, sling locations, balance points, methods of attachment, maximum hoist line speeds and other pertinent features to be considered as necessary for safe handling.

Items not specifically covered above shall be handled in accordance with sound material handling practices.

7.3 Hoisting Equipment

All equipment for handling items shall be used and maintained in accordance with the following:

7.3.1 Hoisting equipment used for handling shall be certified by the manufacturer. The certification shall indicate the various parameters for the maximum load to be handled.

7.3.2 Hoisting equipment shall not be loaded beyond its rated load, as certified by the manufacturer, except for test purposes.

7.3.3 The requirements of ANSI B30.2.0, Safety Standard for Overhead and Gantry Cranes, ANSI B30.5, Safety Standard for Crawler, Locomotive and Truck Cranes, ANSI B30.6, Safety Standard for Derricks, and ANSI A10.5, Safety Requirements for Material Hoists shall be followed.

7.3.4 For special lifts, hoisting equipment may be re-rated, or modified and re-rated, upon approval by the manufacturer or if the manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a qualified engineer competent in this field and such determination shall be documented and recorded appropriately. Re-rated equipment shall be given a dynamic load test over the full range of the lift using a test weight at least equal to the lift weight. A dynamic test includes raising, lowering and traversing the load in contrast to a static test where the test weight may be increased incrementally with no movement.

7.4 Inspection of Equipment and Rigging

An inspection program shall be established for equipment and rigging. A system shall be established that will indicate acceptability of all equipment and rigging after each inspection. This system shall specify control of nonconforming lifting equipment. Periodic inspections shall be supplemented with special visual and non-destructive examinations and dynamic load tests prior to handling of items described in Subsection 7.2 of this standard.

7.4.1 Rigging that is frayed, worn or otherwise deteriorated shall not be used.

7.4.2 Hoisting equipment that does not meet manufacturer's specifications shall not be used.

7.4.3 Equipment and rigging shall be kept clean and free of contaminants that are detrimental to the material being handled.

7.4.4 Rigging items such as hooks, shackles, and turnbuckles that appear to have yielded or are distorted shall not be used.

7.5 Personnel

The responsible organization shall determine that the personnel engaged in operating material handling equipment are competent and have demonstrated satisfactory ability in operating similar lifting equipment.

8. RECORDS

Record copies of completed procedures; reports; personnel qualification records; test equipment calibration records; test deviation or exception records; and inspection and examination records shall be prepared as required by this standard. These records shall be placed with other project records as required by code, standard, specification or project procedures.

9. AMERICAN NATIONAL STANDARDS REFERRED TO IN THIS DOCUMENT

When the following standards referred to in this document are superseded by a revision approved by the American National Standards Institute, the revision shall apply:

- N45.2 Quality Assurance Program Requirements for Nuclear Power Plants
- *N45.2.3 Housekeeping During the Construction Phase of Nuclear Power Plants
- *N45.2.6 Qualifications of Quality Assurance Personnel for the Construction Phase of Nuclear Power Plants
- *N45.2.10 Quality Assurance Terms and Definitions
- MH 6.1 Pictorial Markings for Handling of Goods
- B30.2.0 Safety Code for Overhead and Gantry Cranes
- B30.5 Safety Code for Crawler, Locomotive, and Truck Cranes
- B30.6 Safety Code for Derricks
- A10.5 Safety Requirements for Material Hoists

*These standards are being approved by the American National Standards Institute and they should be available early in 1973.

6.4 Control of Items in Storage

Control of items in storage is described in the following paragraphs.

6.4.1 Inspections and Examinations. Inspections and examinations shall be performed and documented on a periodic basis to assure that the integrity of the item and its container as provided for under Section 3 of this standard is being maintained. Deficiencies noted shall be corrected and documented. The characteristics verified during this inspection or examination shall include such items as:

- (1) Identification and marking (see Subsection 3.9 of this Standard).
- (2) Protective covers and seals (see Subsection 3.9 of this standard).
- (3) Coatings and preservatives (see paragraph 3.4.1).
- (4) Desiccants and inert gas blankets (see paragraph 3.6.3 and 3.4.2).
- (5) Physical damage.
- (6) Cleanness.

6.4.2 Care of Items. Care of items in storage shall be exercised in accordance with the following. Requirements for proper maintenance during storage shall be documented and written procedures or instructions shall be established.

- (1) Items in storage shall have all covers, caps, plugs or other closures intact. Methods used to seal openings shall be in accordance with Section 3 of this standard. Covers removed for internal access at any time for any reason shall be immediately replaced and resealed after completion of the purpose for removal.
- (2) Temporary preservatives shall be left intact during storage. Should reapplication of preservatives be required at the site, only those previously approved shall be used.
- (3) Items pressurized with inert gas shall be monitored at such a frequency as to insure that the gas pressure is maintained within specified limits during storage. Desiccant humidity indicators shall also be monitored and desiccants shall be changed or reprocessed when specified.
- (4) Instrumentation racks shall be energized as specified by the manufacturer.
- (5) Space heaters enclosed in electrical items shall be energized.
- (6) Rotating electrical equipment shall be given insulation resistance tests on a scheduled basis.

(7) The shafts of rotating equipment shall be rotated on a periodic basis. The degree of turn shall be established so that the parts receive a coating of lubrication where applicable, and so that the shaft does not come to rest in a previous position. (90 deg. and 450 deg. rotations are examples.)

(8) Other maintenance requirements specified by the manufacturer's instruction for the item shall be performed.

6.4.3 Post Fire Evaluation. In the event a fire should occur in the storage area or at any time, each item known to have been heated to an ambient temperature of over 150 F or subjected to smoke contamination shall be withheld from installation or use until it has been thoroughly examined and the item has been verified to be in conformance with specified requirements.

6.5 Removal of Items from Storage

Only items which have been inspected and are considered acceptable for installation or use in accordance with the receiving inspection procedure shall be removed from storage for installation or use. (See Section 5 of this standard.) Items released from storage and placed in their final locations within the power plant, shall be inspected and cared for in accordance with the requirements of Section 6 of this standard, and other applicable standards.

6.6 Storage Records

Written records shall be prepared that include such pertinent information as storage location, inspection results, protection, and personnel access.

7. HANDLING

7.1 General

This section contains requirements that are to be fulfilled by the organizations responsible for handling items. This section covers the requirements for the handling of items in Subsection 2.7 of this standard utilizing appropriate equipment in accordance with methods and procedures specified to minimize damage and preserve the quality of the item and container.

7.2 Methods and Procedures

Detailed handling instructions and procedures shall be prepared for all items that require special handling instructions because of weight, size, susceptibility to shock damage, high nil ductility transition temperatures, or any other conditions that warrant special instructions. Such instructions or procedures shall be made available prior to the time the item is to

upon receipt until the time the item is removed from storage and placed in its final location.

6.1.2 Levels of Storage. Environmental conditions for items classified as Levels A, B, C, and D described in Subsection 2.7 of this Standard shall meet requirements as described in the following paragraphs.

- (1) Level A items shall be stored under special conditions similar to those described for Level B items but with additional requirements such as temperature and humidity control within specified limits, a ventilation system with filters to provide an atmosphere free of dust and harmful vapors, and any other appropriate requirements.
- (2) Level B items shall be stored within a fire resistant, tear resistant, weathertight, and well ventilated building or equivalent enclosure. Precautions shall be taken against vandalism. This area shall be situated and constructed so that it will not be subject to flooding, the floor shall be paved or equal, and well drained. Items shall be placed on pallets or shoring to permit air circulation. The area shall be provided with uniform heating and temperature control or its equivalent to prevent condensation and corrosion. Minimum temperature shall be 40 F and maximum temperature shall be 140 F or less if so stipulated by a manufacturer.
- (3) Level C items shall be stored indoors or equivalent with all provisions and requirements as set forth in Level B items except that heat and temperature control is not required.
- (4) Level D items may be stored outdoors in an area marked and designated for storage, which is well drained, preferably gravel covered or paved and reasonably removed from the actual construction area and traffic so that possibility of damage from construction equipment is minimized. Items shall be stored on cribbing or equivalent to allow for air circulation and to avoid trapping water.

6.2 Storage Areas

Periodic inspections shall be performed to assure that storage areas are being maintained in accordance with these requirements. The housekeeping requirements shall be in accordance with N45.2.3.

6.2.1 Access to Storage Areas. Access to

storage areas shall be controlled and limited only to personnel designated by the responsible organization.

6.2.2 Cleanliness and Housekeeping Practices. Cleanliness and good housekeeping practices shall be enforced at all times in the storage areas. The storage areas shall be cleaned as required to avoid the accumulation of trash, discarded packaging materials and other detrimental soil.

6.2.3 Fire Protection. Fire protection commensurate with the type of storage area and the material involved shall be provided and maintained.

6.2.4 Storage of Food and Associated Items. The use or storage of food, drinks, and salt tablet dispensers in any storage area shall not be permitted.

6.2.5 Measures to Prevent Entrance of Animals. Measures shall be taken to prevent the entrance of rodents and other animals into indoor storage areas or equipment to minimize possible contamination and mechanical damage to stored material.

6.3 Storage Methods

Storage methods and procedures shall comply with the requirements described in the following paragraphs.

6.3.1 Ready Access to Stored Items. All items shall be stored in such a manner as to permit ready access for inspection or maintenance without excessive handling, to minimize risk of damage.

6.3.2 Arrangement of Items. Items stacked for storage shall be arranged so that racks, cribbing or crates are bearing the full weight without distortion of the item.

6.3.3 Storage of Hazardous Material. Hazardous chemicals, paints, solvents, and other materials of a like nature shall be stored in well ventilated areas which are not in close proximity to important nuclear plant items.

6.3.4 Identification. All items and their containers shall be plainly marked so that they are easily identified without excessive handling, or unnecessary opening of crates and boxes.

6.3.5 Coverings. Weatherproof covering, when used for outdoor storage, shall be flame-resistant type of sheeting or tarpaulins. They shall be placed so as to provide drainage and to insure air circulation to minimize condensation. They shall be tied down to prevent moisture from entering laps and to protect the coverings from wind damage.

quired, by either specification, purchase order, or manufacturers' instructions.

- (6) *Electrical Insulation* - Performance of insulation resistance tests for motors, generators, control and power cable, to ensure conformance with specifications.

5.2.3 *Special Inspection* - Where receiving inspection in addition to that described above is required, the "Special Inspection" procedure, complete with documentation instructions, shall be attached to the item or container (see Section 3 of this standard); this is in addition to the copy sent through normal channels. The special inspection shall be performed and the results of the inspection shall be documented.

5.3 Disposition of Received Items

5.3.1 *Acceptable* - Containers and items inspected or examined and found in conformance with specified requirements shall be identified as acceptable in accordance with the status indicating system employed (see Subsection 5.4 of this standard) and placed in a storage area for acceptable items or moved to the final location for installation or use.

5.3.2 *Nonconforming* - Items which do not conform to the specified requirements shall be identified as nonconforming in accordance with the system employed (see Subsection 5.4 of this standard) and when practical the item shall be placed in a segregated storage area or removed from the project site to prevent inadvertent installation or use.

5.3.3 *Conditional Release* - If the nonconformance which caused the item to be classified "unacceptable" can be corrected after installation, the item may be released for installation on a conditional release basis. A statement documenting the authority and technical justification for the conditional release of the item for installation shall be prepared, and made part of the documentation.

5.4 Status Indicating System

A system or method for identifying the status of items (e.g. an inventory system, tagging, labeling, color code) shall be employed that clearly indicates whether items are acceptable or unacceptable for installation. A controlled physical separation is an acceptable equivalent method. The system shall indicate the date the item was placed in the acceptable or unacceptable installation status. The use of the system shall be regulated by the Quality Control program. The system shall provide for the conditional release of items for installation pending subsequent

correction of the nonconformance. When tags are used the stock shall be made from material which will not deteriorate during storage; tags shall be securely affixed to the items and displayed in an area that is readily accessible. The stock used shall not be deleterious to the item.

5.5 Correction of Nonconformances

Items designated nonconforming or unacceptable for installation or use shall be corrected using authorized procedures, to meet specified requirements, or accepted "As is". If this is not possible, the item shall be scrapped or otherwise discarded.

5.5.1 *Reinspection* - Items that have been corrected shall be reinspected. The area of inspection may be confined to the area of the nonconformance. When it has been determined that the corrected item is satisfactory, the status of the item as denoted by the system shall be changed to acceptable. An appropriate entry shall be made in the documentation after acceptance is determined.

5.6 Marking

Required marking shall be verified to provide positive identification during receiving, storage, and installation. Items not properly identified at receiving may be marked using the method in the appendix (see Appendix A 3.9 of this standard).

Changing, correcting or any other marking on Code Stamp name plate is prohibited, unless authorized by the manufacturer whose serial number is applied.

5.7 Documentation

A written record of the receiving inspection, package identification, tagging, corrective actions, and justification for conditional acceptance shall be prepared. These records shall be made a part of the permanent records provided for in Section 8 of this standard.

6. STORAGE

6.1 General

6.1.1 *Scope*. This section contains requirements that are to be fulfilled by the organization responsible for performing the storage of items. Levels and methods of storage necessary are defined to minimize the possibility of damage or lowering of quality due to corrosion, contamination, deterioration or physical damage from the time an item is stored

5.2 Receiving Inspection Requirements

5.2.1 Shipping Damage Inspection. Preliminary visual inspection or examination shall be performed prior to unloading to determine if any damage occurred during shipping. Observations for unusual conditions shall include:

- (1) *Fire* - Charred paper, wood or paint, indicating exposure to fire or high temperature.
- (2) *Excessive Exposure* - Weather-beaten, frayed, rusted, or stained containers indicating prolonged exposure during transit.
- (3) *Environmental Damage* - Water or oil marks, damp conditions, dirty areas, or salt film (indicating exposure to sea water or winter road salt chemicals).
- (4) *Tie Down Failure* - Shifted, broken, loose or twisted shipping ties, and worn material under ties, indicating improper blocking and tie down during shipment.
- (5) *Rough Handling* - Splintered, torn, or crushed containers indicating improper handling. Review of impact recording instrument readings.

5.2.2 Item Inspection. Unless the package marking prohibits unpacking, the content of all shipments shall be visually inspected to verify that the specified packaging and shipping requirements have been maintained. When items are contained in transparent separate moisture-proof bags or envelopes, visual inspection without unpacking the contents is acceptable. Statistical sampling methods may be used for groups of similar items. Care shall be taken to avoid contamination of the items during inspection. The inspections shall be performed in an area equivalent to the level of storage requirement for the item (see Section 6 of this standard). These inspections and examinations shall include the following as appropriate:

- (1) *Identification and Marking*. Verification that identification and markings are in accordance with applicable codes, specifications, purchase orders, drawings, and this standard.
- (2) *Manufacturing Documentation* - Assurance that the item received was fabricated, tested and inspected prior to shipment in accordance with applicable code, specification, purchase order and/or drawings.
- (3) *Protection Covers and Seals* - Visual inspection to assure that covers and seals meet their intended function.
- (4) *Coatings and Preservatives* - Verification

that coatings and preservatives are applied in accordance with specifications, purchase orders or manufacturer's instructions.

- (5) *Inert Gas Blanket* - Verification that the inert gas blanket pressure is within the acceptable limits.
- (6) *Desiccant* - Verification that the desiccant is not saturated, as indicated through the use of humidity indicators. Desiccants shall be regenerated or replaced as necessary in accordance with special instructions.
- (7) *Physical Damage* - Visual inspection to assure that parts of items are not broken, cracked, missing, deformed or misaligned and rotating parts turn without binding. Accessible internal and external areas shall be free of detrimental gouges, dents, scratches and burns.
- (8) *Cleanliness* - Visual inspection to assure that accessible internal and external areas are within the specification requirements for dirt, soil, mill scale, weld splatter, oil, grease, or stains. If inspection for cleanliness was performed prior to sealing and shipping, and inspection upon receipt indicates that there has been no penetration of the sealed boundary, then inspection for internal cleanliness is optional.

Unless the completed item was inspected or examined at the source, it shall be inspected or examined at the point of receiving to verify that the following characteristics conform to the specified requirements. These inspections or examinations shall include such items as:

- (1) *Physical Properties* - Assurance that physical properties conform to the specified requirements and that chemical and physical test reports, if required, meet the requirements.
- (2) *Dimensions* - Random visual inspection to assure that important dimensions conform with drawings and specifications. Examples are: base plate mounting holes, overall external size, configuration and orientation of parts.
- (3) *Weld Preparations* - Random verification that weld preparations are in accordance with applicable drawings and specifications.
- (4) *Workmanship* - Visual inspection of accessible areas to assure that the workmanship is satisfactory to meet the intent of the requirements.
- (5) *Lubricants and Oils* - Verification of presence of proper lubricants and oils, if re-

3.8 Cushioning, Blocking, Bracing and Anchoring

3.8.1 Cushioning. Cushioning shall be used where protection from shock and vibration is required; the cushioning materials shall have sufficient strength to perform this function. (See Appendix A3.8.1 for additional requirements.)

3.8.2 Blocking and Bracing. Blocking and bracing used for protection of the load to be supported, shall be compatible with the size, shape, and strength of bearing areas of the shipment. The blocking and bracing used to prevent item movement shall withstand thrust and impact applied in any direction. Blocking and bracing used in direct contact with the item being blocked shall not have a corrosive effect on the item.

3.8.3 Anchoring. Anchoring of the item within a crate or on a skid shall adequately fasten the item during shipment and protect the item from potential damage due to rough handling. To facilitate disassembly and minimize damage when removing container contents, bolting is preferred. (See Appendix A3.8.3 for additional requirements.) Temporary cushioning, blocking, bracing or anchoring placed within an item for shipping protection that must be removed prior to operation of the item shall be identified by warnings placed in a conspicuous manner to effect proper removal of the packing material.

3.9 Marking

To maintain proper identification and instructions or both during shipping, receiving and storage, and to provide for identification after the outside of the container has been removed, the item and the outside of containers shall be marked. (See Appendix 3.9 for additional requirements.)

4. SHIPPING

4.1 General

This section covers the requirements for loading and shipment of items as defined in Subsection 2.7 of this standard. Described are environmental protection during transit, procedures to minimize damage in transit; precaution required when handling items during loading and transit, and identification and inspection on overseas shipments.

The mode of transportation used shall be consistent with the protection classification of the item (see Subsection 2.7 of this standard) and with the packaging methods employed (see Subsection 3.2 of this standard).

4.2 Transportation Requirements

4.2.1 Open Carriers. For shipment on open carriers where items may be exposed to adverse environmental conditions, the following shall apply:

- (1) Level A, B, and C items shall be covered for protection from environmental conditions. Tarpaulins, when used, shall be fire retardant; and they shall be installed in a manner to provide drainage and to insure air circulation to prevent condensation.
- (2) Barrier and wrapping materials (see Subsection 3.6 of this standard) subject to transportation damage shall be covered with waterproof shrouds such as tarpaulins, so that they are not exposed directly to the environment.

4.2.2 Closed Carriers. For shipment on closed carriers the following shall apply:

- (1) When level A, B, and C items cannot be adequately protected from weather or environment on open carriers, closed carriers shall be used.
- (2) Use of fully enclosed furniture vans is recommended when shipping large delicate items such as control panels.

4.2.3 Special Shipments. Items that exceed established weight or size limitations for railroads or highways, or require special handling should be given additional consideration in the following areas:

- (1) The type of bracing and tie down methods to be used with the mode of transportation selected for special shipments shall be specified.
- (2) "NO HUMPING" shall be specified on rail shipments of these items, and "NO HUMPING" sign shall be prominently displayed.
- (3) Use of impact recording meters should be specified on shipments of heavy or relatively large items incorporating delicate factory installed instrumentation. Meters, when specified, shall be installed prior to loading (to record any rough handling during loading). Procedures shall be established to interpret recorded data, and to thoroughly check the integrity of an item when there is evidence of rough handling. A notice that impact recording meters are being used shall be prominently displayed. Special recording meters with operating time limits greater than the expected transit time shall be specified or, if the expected transit time exceeds the operating time

3.4.1 Contact Preservatives. Contact preservatives are compounds applied to bare metal surfaces to prevent surface corrosion during shipping and storage and generally require removal prior to installation. (See Appendix section A3.4.1 for additional requirements.)

3.4.2 Inert Gas Blankets. Purging and pressurizing the interior of an item or its container or both with a dry inert gas provides a means of preventing moisture or corrosive atmospheres from acting on sensitive bare metal surfaces or other materials. The item or its container shall be either evacuated prior to filling with the inert gas or adequately purged with the same gas prior to applying the gas blanket. (See Appendix section A3.4.2 for additional requirements.)

3.5 Caps, Plugs, Tapes, and Adhesives

These items shall be of materials which enable them to perform their intended function adequately without causing deleterious effects on items or systems operation.

3.5.1 Caps and Plugs. Caps and plugs shall be used to seal openings in items having sensitive internal surfaces, and to protect threads and weld end preparations. (See Appendix section A3.5.1 for additional requirements.)

3.5.2 Tapes and Adhesives. Pressure sensitive, removable, tape should be used in lieu of adhesives in contact with bare metal surfaces. Tapes or adhesives which could have damaging effects on the item or system shall not be used. Tapes near a weld shall be removed completely immediately prior to performing a weld or closure. Tapes used for identification rather than sealing which are not near a welding operation may remain until system testing. (See Appendix section A3.5.2 for additional requirements.)

3.6 Barrier and Wrap Materials and Desiccants

A barrier generally is a flexible material designed to withstand the penetration of water, water vapor, grease, or harmful gases. A wrap is a flexible material, formed around the item or package to exclude dirt and to facilitate handling, marking or labeling. Material thickness shall be selected on the basis of type, size and weight of equipment or item to be protected, such that the barrier or wrap will not easily be damaged by puncture, abrasion, weathering, cracking, temperature extremes, wind conditions, and the like. Barrier and wrap materials shall be non-halogenated when used in direct contact with austen-

itic stainless steels, shall be noncorrosive, shall not readily support combustion and shall not be otherwise harmful to the item packaged. Vaporproof barrier materials used with desiccants constitutes another preservation system (see Subsection 3.4 of this standard); it protects against potential damage by water vapor condensate.

3.6.1 Water-proof Barrier Material. Waterproof barrier material shall be resistant to grease and water; it shall protect items from airborne and windblown soils.

3.6.2 Vapor Barrier Material. Vaporproof barrier materials shall be sealable and the edge of the barrier which normally will be opened at destination shall be of sufficient area to permit at least two subsequent sealing operations. (See Appendix A3.6.2 for additional requirements.)

3.6.3 Desiccants. Desiccants may be used within a vaporproof barrier when condensation or high humidity could damage an item by corrosion, mold, or mildew. (See Appendix A3.6.3 for additional requirements.)

3.7 Containers, Crating and Skids

3.7.1 Containers. Containers are used when maximum protection for the item or its barrier is required. Domestic types used shall be limited to:

- (1) Cleated, sheathed boxes (500 lb maximum net weight).
- (2) Nailed wood boxes.
- (3) Wood-cleated solid fiberboard boxes.
- (4) Fiberboard boxes (120 lb maximum net weight. See Appendix A3.7.1 for additional requirements).
- (5) Metal or fiber drums.
- (6) Crates (see paragraph 3.7.2).
- (7) Wire bound boxes (200 lb maximum net weight).
- (8) Other specially designed containers for special equipment.

Cleated boxes in excess of 50 lb shall be bound with steel strapping or equivalent around the container at not less than two places. (See Appendix A3.7.1 for additional requirements.)

3.7.2 Crates and Skids. Crates and skids shall be used for equipment in excess of 500 lb. Skids and runners shall be used on boxes with a gross weight of 100 lb or more, allowing a minimum floor clearance for forklift tines as provided by 4 inch lumber.

- (3) Items which are not immediately packaged shall be protected from contamination.
- (4) All Items shall be packaged with a barrier (see Subsection 3.6 of this Standard) so that water vapor, salt air, dust, dirt and other forms of contamination do not penetrate the package.
- (5) Items shall be packaged in containers or crates (see Subsection 3.7 of this standard).
- (6) Items which can be damaged by condensation trapped within the package shall be packaged with approved desiccant (see paragraph 3.6.3) inside the sealed water-vaporproof barrier or by an equivalent method (for example, see paragraph 3.6.2).
- (7) All openings into items shall be capped, plugged or sealed (see Subsection 3.5 of this standard). Weld end preparations shall be protected against corrosion and physical damage.
- (8) Items packed in containers shall be blocked, anchored, braced and/or cushioned (see Subsection 3.8 of this standard) to prevent physical damage to the item or barrier.
- (9) Items and their containers shall be identified by marking (see Subsection 3.9 of this standard).

3.2.2 Level B Items. (See paragraph 2.7.2) Level B items require a high degree of protection and the package shall be designed to avoid the deleterious effects of shock, vibration, physical damage, water vapor, salt spray, condensation and weather during shipping, handling and storage. This packaging shall be equivalent to that for Level A except that the extremes of paragraph 3.2.1 (1) need not apply. Level B items such as control panels or similar special items may be shipped with a minimum of protection when transported in a fully enclosed furniture type van with special suspension, provided the shipment goes through to destination in the original vehicle and Level B storage facilities are available at the site.

3.2.3 Level C Items. (See paragraph 2.7.3) Level C items require protection from exposure to salt spray, rain, dust, dirt, and other airborne and windblown contaminants. Protection from water vapor and condensation is less important than for Level B items. The following criteria shall apply:

- (1) Criteria (2) (3) (5) (7) (8) and (9) for Level A items (see paragraph 3.2.1) shall apply to Level C items.
- (2) Items shall be packaged with a waterproof enclosure so that water, salt spray, dust, dirt, and other forms of contamination do

not penetrate to the item.

- (3) Items subject to detrimental corrosion, either internal or external, shall be suitably protected.

3.2.4 Level D Items. (See paragraph 2.7.4) Level D items require protection from physical and mechanical damage. The following criteria shall apply:

- (1) Items, just before packaging, shall have been inspected for cleanness according to the requirements specified in the purchasing document. Dirt, oil residue, metal chips or other forms of contamination shall have been removed by approved cleaning methods. Any entrapped water shall have been removed.
- (2) All openings into items shall be capped, plugged and sealed (see Subsection 3.5 of this standard). Weld end preparations shall be protected from corrosion and physical damage.
- (3) Items subject to detrimental corrosion, either internal or external, shall be suitably protected.
- (4) Items packed in containers shall be blocked, braced and/or cushioned to prevent physical damage (see Subsection 3.8 of this Standard).
- (5) Items such as aggregate and reinforcing steel shall be suitably protected against detrimental contamination or corrosion.
- (6) The identity of the item shall be maintained by marking (see Subsection 3.9 of this standard) or other appropriate means.

3.2 Cleaning

Cleaning includes the preparation of items for preservation or packaging, or both, to minimize the requirements for site cleaning. Items shall be inspected for cleanness immediately before packaging according to the cleaning requirements specified in the purchase document. Any dirt, oil residue, metal chips or other forms of contamination shall be removed by documented cleaning methods. Any entrapped water shall be removed. Any item which is not immediately packaged shall be protected from further contamination. (See Appendix section A3.3 for additional requirements.)

3.4 Methods of Preservation

Items subject to deleterious corrosion shall be protected by using either contact preservatives, inert gas blankets, or vapor-proof barriers with desiccants. (See Subsection 3.6 of this standard for vaporproof barriers and desiccants.)

- (3) Batteries
- (4) Welding electrode and wire
- (5) Control rod drives
- (6) Motor control centers, switchgear and control panels
- (7) Motors and generators
- (8) Precision machined parts
- (9) Erection spares, such as gaskets, "O" rings
- (10) Air handling filters
- (11) Computers

2.7.3 Level C – Items classified to level C are those that require protection from exposure to the environment, airborne contaminants, g forces and physical damage. Protection from water vapor and condensation is not so important as that for Level B items.

The following shall be used as a guide for classifying items intended for this level classification.

- (1) Pumps
- (2) Valves
- (3) Fluid filters
- (4) Reactor internals
- (5) Compressors
- (6) Auxiliary Turbines
- (7) Instrument cable
- (8) Refueling equipment
- (9) Thermal insulation
- (10) Fans and blowers
- (11) Cement

2.7.4 Level D – Items classified to level D are those that are less sensitive to the environment than level C. These items require protection against the elements airborne contamination, and physical damage.

The following shall be used as a guide for classifying items intended for this level classification.

- (1) Tanks
- (2) Heat exchangers and parts
- (3) Accumulators
- (4) Demineralizers
- (5) Reactor vessel
- (6) Evaporators
- (7) Steam generators
- (8) Pressurizer
- (9) Piping
- (10) Electrical cable
- (11) Structural items
- (12) Reinforcing steel
- (13) Aggregates

3. PACKAGING

3.1 General

This section contains the requirements for packaging of items for protection against corrosion, contamination, physical damage or any effect which would lower the quality or cause the item to deteriorate during the time it is shipped, handled and stored. The degree of protection specified will vary according to storage conditions and duration, shipping environment, and handling conditions.

Implementation of this packaging section is accomplished by identifying the item and the appropriate packaging level, and then applying the appropriate criteria contained herein concerning cleaning, preservatives, desiccants, inert gas blankets, cushioning, caps and plugs, barrier and wrapping materials, tapes, blocking and bracing, containers, marking, other quality assurance provisions and documentation. Appendix A-3 contains additional requirements generally not available in other documents. These requirements are a mandatory part of this standard.

3.2 Levels of Packaging

The packaging requirements are based on the protection the items should receive during shipping, handling, and storage. The requirements of this standard are intended to be in addition to industry classifications or tariff rules for rail, truck, air and water shipments and regulatory agency rules already established in the transportation industry and in no way are they intended to reduce the minimum standards established by these regulatory agency rules.

The following packaging criteria are divided into four levels corresponding to the categories of Subsection 2.7 of this Standard.

3.2.1 Level A Items. (See paragraph 2.7.1). Level A items require the highest degree of protection and shall conform to the following criteria:

- (1) Package design requirements are for extraordinary environmental protection to avoid the deleterious effects of shock and vibration, to control temperature or humidity within specified limits, or for any other special requirements.
- (2) Items shall have been inspected for cleanliness immediately before packaging. Dirt, oil residue, metal chips or other form of contamination shall have been removed by approved cleaning methods. Any entrapped water shall have been removed.

anticipated, including nonconformance.

- (2) Identity of inspector or tester.
- (3) Completion date.

Test reports and data sheets shall include an evaluation of the acceptability of inspection and test results and provide for identifying the individual who performed the evaluation.

2.4 Personnel Qualifications

Those personnel who perform inspection, examination or testing activities at the job site shall be qualified in accordance with N45.2.6. Off-site inspection, examination or testing shall be audited and monitored by personnel who are qualified in accordance with N45.2.6.

2.5 Measuring and Test Equipment.

2.5.1 Selection. Inspection, examination, and testing equipment utilized to implement the requirements of this standard shall be selected to have accuracy and tolerance sufficient to determine conformance to specified requirements.

2.5.2 Calibration and Control. As appropriate, measuring and test equipment shall be adjusted and calibrated at prescribed intervals against certified equipment having known valid relationships to nationally recognized standards. If no national standards exists, the basis for calibration shall be documented. Records shall be maintained and equipment suitably marked to indicate calibration status.

2.6 Housekeeping

In job-site areas, facilities, and environments where packaging, shipping, receiving, storage and handling of items is performed in accordance with the requirements of this standard, the housekeeping requirements shall be in accordance with N45.2.3.

2.7 Classification of Items

The requirements for activities covered by this standard (packaging, shipping, receiving, storage and handling) are divided into four levels with respect to protective measures to prevent damage, deterioration or contamination of the items, based upon the important physical characteristics and not upon the important functional characteristic of the item with respect to safety, reliability and operation. It should be recognized, however, that within the scope of each level there may be a range of controls and that the detailed requirements for an item are dependent on the importance of the item to safety or reliability. For example, even though a reactor vessel and struc-

tural steel are classified as level D, the degree of protection and control over the reactor vessel should exceed that of the structural steel. Each of the specific items governed by this procedure (See Subsection 2.1 of this standard) shall be classified into one of these four levels by the buyer or the contractor. The manufacturer's documented standard or minimum requirements shall be considered when classifying the items. Items, once classified, shall be restricted to the level or higher for each of the packaging, shipping, receiving, storage and handling operations. Items shall not be classified according to the requirements of one level, then packaged, shipped, received, stored or handled according to a level of lower grade. Any package unit or assembly made up of items of different levels shall be classified to the highest level designated for any of the respective parts. If the unit is disassembled, a level shall be indicated for each part. When the unit cannot be physically disassembled, special rules are contained herein.

Items covered by this standard shall be categorized under the following levels:

2.7.1 Level A - Items classified to level A are those that are exceptionally sensitive to environmental conditions and require special measures for protection from one or more of the following effects: temperatures outside required limits, sudden temperature changes, humidity and vapors, gravitational (g) forces, physical damage and airborne contamination (e.g. rain, snow, dust, dirt, salt spray, fumes).

The following shall be used as a guide for classifying items intended for this level classification:

- (1) Special electronic equipment and instrumentation.
- (2) Special materials, such as chemicals that are sensitive to environment.
- (3) Special nuclear material (fuel) and sources. The requirements of the AEC fuel license and conditions and other governmental agencies shall be met.

2.7.2 Level B - Items classified to level B are those that are sensitive to environmental conditions and require measures for protection from the effects of temperature extremes, humidity and vapors, g forces, physical damage and airborne contamination and should not require special protection required for level A items.

The following shall be used as a guide for classifying items intended for this level classification:

- (1) Instrumentation
- (2) Electrical penetrations

formation describing, defining, specifying, reporting, or certifying activities, requirements, procedures or results.

Dynamic Load Test - A test to demonstrate the ability of hoisting equipment to safely handle its rated load by exercising the equipment through vertical and horizontal movement along its lines of travel, using a load of specified weight.

Handling The act of physically moving items by hand or by mechanical machinery, not including transport modes.

Item - Any level of unit assembly, including system, subsystem, subassembly, component, part, or material.

Nonconformance - A deficiency in characteristic, documentation, or procedure which renders the quality of an item unacceptable or indeterminate. Examples of nonconformance include: physical defects, test failures, incorrect or inadequate documentation, and deviation from prescribed processing, inspection or test procedures.

Package The shipping container plus the contents of the container.

Package Unit Any assembly of mechanical and/or electrical components and parts which can be disassembled without destroying the integrity of the individual parts.

Receiving To take delivery of material at the construction site or other location designated by the purchaser.

Storage The act of holding items at the construction site or in an area other than its permanent location in the plant.

Storage Facilities Warehouse or yard area designated and prepared for holding of items.

Transit Carrier (Open) Trucks, Trailers, Railroad cars, Barges, Aircraft, or Ships which *do not* provide protection of items from the environment.

Transit Carrier (Closed) - Trucks, Trailers, Railroad cars, Barges, Aircraft or Ships which *do* provide protection of items from the environment by nature of their inherent design.

Transportation Mode - A method identified by the conveyance used for transportation of items and includes any motor vehicles, ships, railroad cars, or aircraft. Each cargo-carrying body (trailer, van, box-car, etc.) is a separate vehicle.

Wrap A flexible material, formed around the item or package to exclude dirt and to facilitate handling, marking or labeling.

Other terms and their definitions are contained in ANSI N45.2.10.

1.5 Referenced Documents

Other documents that are required to be included as a part of this Standard are either identified at the point of reference or described in Section 9 of this Standard. The issue or edition of the referenced document that is required will be specified either at the point of reference or in Section 9 of this standard.

2. GENERAL REQUIREMENTS

This section contains requirements that are to be fulfilled by the organization or organizations responsible for performing any segment of work described in Sections 3 through 8 of this standard.

Measures shall be established and implemented for the packaging, shipping, receiving, storage and handling of specified items to be incorporated in the nuclear power plant, and for the inspections, examinations, testing and documentation to verify conformance to specified requirements.

2.1 Planning

The specific items to be governed by this standard shall be identified. Planning shall take into account the need for the preparation and control of procedures and work instructions as necessary to comply with specified requirements. Planning shall include a review of the design specifications and drawings for the items covered by this standard to assure that packaging, shipping, receiving, storage, and handling activities have been incorporated and that they can be accomplished as specified.

2.2 Procedures and Instructions

Procedures and instructions shall be generated, used, and maintained current; these shall contain sufficient detail to provide for the listed items (see Subsection 2.1 of this Standard) a basis for packaging design, shipping requirements, receiving, storage and handling procedures, implementation thereof, and inspection, in accordance with this standard.

2.3 Results

Inspection and test results shall be documented in a suitable test report or data sheet. Each report shall identify the item to which it applies, the procedures or instruction followed in performing the task and the identification of the following:

- (1) Conditions encountered which were not

PACKAGING, SHIPPING, RECEIVING, STORAGE AND HANDLING OF ITEMS FOR NUCLEAR POWER PLANTS

(During the Construction Phase)

1. INTRODUCTION

1.1 Scope

This standard defines requirements for packaging, shipping, receiving, storage, and handling of nuclear power plant items. These items include the parts of structures, systems, and components whose satisfactory performance is required for the plant to operate reliably, to prevent accidents that could cause undue risk to the health and safety of the public, or to mitigate the consequences of such accidents if they were to occur. The requirements stated herein deal with the protection and control necessary to assure that the requisite quality of those important parts of the plant are preserved from the time items are fabricated until they are incorporated in the plant.

This standard is intended to be used in conjunction with ANSI N45.2, Quality Assurance Program Requirements for Nuclear Power Plants. The requirements may also be extended to other appropriate parts of nuclear power plants when specified in contract documents.

1.2 Applicability

The requirements of this standard apply to the work of any individual or organization that participates in the packaging, shipping, receiving, storage and handling of items to be incorporated into nuclear power plants as discussed in Subsection 1.1 of this standard. The extent to which the individual requirements of this standard shall apply will depend upon the nature and scope of the work to be performed and the importance of the item or service involved. The requirements are intended to assure that the quality of items is not degraded as a result of packaging, shipping, receiving, storage, and handling practices and techniques.

1.3 Responsibility

The organization or organizations responsible

for establishing the applicable requirements for the activities covered by this standard shall be identified and the scope of their responsibilities shall be documented. The work of establishing practices and procedures and providing the resources in terms of personnel, equipment and services necessary to implement the requirements of this standard may be delegated to other organizations and such delegation also shall be documented. However, it is the responsibility of each organization performing work covered by this standard to comply with the procedures and instructions issued for the project and to conform to the requirements of this standard applicable to his work.

The following shall be used as a guide in determining those responsibilities which shall be established and documented:

1. Classification of items (protection level)
2. Packaging design and methods
3. Shipping requirements and methods
4. Receiving requirements and methods
5. Storage requirements and procedures
6. Handling requirements and procedures
7. Records

1.4 Definitions

The following definitions are provided to assure a uniform understanding of select terms as they are used in this standard.

Barrier - A flexible material designed to withstand the penetration of water, water vapor, grease, or harmful gases.

Carrier - The transporting agency.

Classification - The organization of items according to their susceptibility to damage during shipping, receiving and storage only. It does not relate to the function of the item in the completed system.

Documentation - Any written or pictorial in-



REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

REGULATORY GUIDE 1.38

QUALITY ASSURANCE REQUIREMENTS FOR PACKAGING, SHIPPING, RECEIVING, STORAGE, AND HANDLING OF ITEMS FOR WATER-COOLED NUCLEAR POWER PLANTS

A. INTRODUCTION

Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," establishes overall quality assurance requirements for the design, construction, and operation of safety-related structures, systems, and components of nuclear power plants. This guide describes a method acceptable to the NRC staff of complying with the Commission's regulations with regard to the quality assurance requirements for the packaging, shipping, receiving, storage, and handling of items¹ for water-cooled nuclear power plants. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

Working Group N45-2.2 (formerly ad hoc committee N45-3.2) of the American National Standards Institute (ANSI) Standards Committee N45, Reactor Plants and Their Maintenance, has prepared a standard that includes quality assurance requirements for the packaging, shipping, receiving, storage, and handling of items for nuclear power plants. This standard was approved by subcommittee N45-2, Nuclear Quality Assurance Standards, of the ANSI Standards Committee N45 and by the full committee and its Secretariat. It was subsequently approved and designated N45.2.2-1972 by the American National Standards Institute on December 20, 1972.

* Lines indicate substantive changes from previous issue.

¹ As used in this guide, an "item" is defined as any level of unit assembly, including system, subsystem, component, part, or material.

The original issuance of this regulatory guide endorsed as acceptable the guidelines (indicated by the verb "should") as well as the requirements included in ANSI standard N45.2.2-1972. Some uncertainty arose with regard to the NRC staff's intent with this endorsement. As a result of this uncertainty, the staff reevaluated the guidelines contained in ANSI N45.2.2-1972 with respect to importance to safety. This guide has been revised to clarify NRC's position on the requirements and guidelines included in ANSI N45.2.2-1972. Where conformance to this regulatory guide is indicated in an application without further qualification, this means conformance with the requirements of ANSI N45.2.2-1972, as supplemented or modified by the regulatory position of this guide.

ANSI N45.2.2-1972 does not include the statement that is contained in other N45.2 series standards pertaining to its use for activities covered by the ASME Boiler and Pressure Vessel Code, Section III, Divisions 1 and 2, and Section XI. The NRC staff's review of the standard indicates that it should be applied to these Code-covered activities.

C. REGULATORY POSITION

1. The requirements for the packaging, shipping, receiving, storage, and handling of items for water-cooled nuclear power plants that are included in ANSI N45.2.2-1972, "Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants During the Construction Phase,"² are acceptable to the NRC staff and, when supplemented by the guidelines identified in Regulatory Position 2,

² Copies may be obtained from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, N.Y. 10017.

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Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience. This guide was revised as a result of substantive comments received from the public and additional staff review.

Comments should be sent to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch.

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provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50, subject to the following:

a. Subdivision 1.5 of ANSI N45.2.2-1972 states that other documents required to be included as a part of this standard are either identified at the point of reference or described in Section 9 of the standard. The specific acceptability of these listed documents has been or will be covered separately in other regulatory guides or in Commission regulations where appropriate.

b. Subdivision 7.3.4 of ANSI N45.2.2-1972 delineates requirements for re-rating hoisting equipment for special lifts. This subdivision requires that re-rated equipment be given a dynamic load test over the full range of the lift, using a test weight at least equal to the lift weight. In lieu of this requirement, the test weight used in temporarily re-rating hoisting equipment for special lifts in accordance with the provisions of subdivision 7.3.4 should be at least equal to 110% of the lift weight.

c. Subdivision A.3.6.3(1) of ANSI N45.2.2-1972 permits desiccants and desiccant bag materials containing not more than 0.25% halogens to be used with austenitic stainless steels. In lieu of this requirement, desiccants and the materials for the desiccant bags, when used with austenitic stainless steel or nickel alloy materials, should not be compounded from or treated with chemical compounds containing elements in such quantities that harmful concentrations could be leached or be released by breakdown of the compounds under expected environmental conditions (e.g., by radiation). Examples of such compounds are those containing fluorides, chlorides, sulfur, lead, zinc, copper, and mercury.

d. Although ANSI N45.2.2-1972 is entitled "Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants During the Construction Phase," the requirements included in the standard are considered to be applicable during the operation phase and should be used, where applicable, consistent with the recommendations of this regulatory guide.

e. Notwithstanding the provisions of subdivision 1.2 of ANSI N45.2.2-1972 with respect to the applicability of this standard and the definition of carrier contained in subdivision 1.4 of ANSI N45.2.2-1972, nothing contained in Section 4, "Shipping," of ANSI N45.2.2-1972 should be deemed to require a common or contract carrier transporting or shipping byproduct, source, or special nuclear material in the ordinary course of its business to comply with the provisions set forth in this section of the standard. In this situation these carriers are exempt from NRC regulation under the provisions of 10 CFR §§ 30.13, 40.12, and 70.12. Therefore, the provisions of Section 4 of ANSI N45.2.2-1972 apply only to the extent that

they affect the activities of an NRC licensee (e.g., requirements related to shipping contained in 10 CFR Part 71) or a private carrier subject to NRC regulations.

2. The guidelines (indicated by the verb "should") of ANSI N45.2.2-1972 contained in the following section are considered to have sufficient safety importance to be treated the same as the requirements of the standard, subject to any exceptions noted:

a. Section 4.2.3—The guidelines concerning special shipments.

b. Section 4.3.6—The guideline that addresses written instructions on stacking.

c. Subdivision A.3.5.2(1)(a)—This guideline states that the halogen and sulfur content of tapes should not be in excess of 0.10% by weight when used in contact with austenitic stainless steel and nickel alloy surfaces. In lieu of this guideline, tapes, when used with austenitic stainless steel or nickel alloy materials, should not be compounded from or treated with chemical compounds containing elements in such quantities that harmful concentrations could be leached or be released by breakdown of the compound under expected environmental conditions (e.g., by radiation). Examples of such compounds are those containing fluorides, chlorides, sulfur, lead, zinc, copper, and mercury.

d. Subdivision A.3.5.2(3)—This guideline states that tapes should be brightly colored to preclude their loss into a system. In lieu of this guideline, tapes should be colored to contrast with the materials on which they are used.

e. Section A.3.6.2—This guideline states that the vapor barrier material should be brightly colored to preclude loss within a system. In lieu of this guideline, vapor barrier material should be colored to contrast with the materials on which they are used.

D. IMPLEMENTATION

The purpose of this section is to provide information to the applicants and licensees regarding the NRC staff's plans for using this regulatory guide. Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used in the evaluation of submittals for construction permit or operating license applications docketed after June 15, 1977. If an applicant whose application for a construction permit or operating license is docketed on or before June 15, 1977, wishes to use this regulatory guide in developing submittals for applications, the pertinent portions of the application will be evaluated on the basis of this guide.