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RECORD OF REVISIONS

Rev	Date	Description	POC	OIC
0	5/22/02	Initial issue.	Tobin Oruch, *FWO-SEM*	Kurt Beckman, *FWO-SEM*
1	6/9/04	Added elevator and crane material from Arch chapter; made standards tables required; other minor changes.	Charles DuPrè, *FWO-DECS*	Gurinder Grewal, *FWO-DO*
2	10/27/06	Administrative changes only. Organization and contract reference updates from LANS transition. IMP and ISD number changes based on new Conduct of Engineering IMP 341. Master Spec number/title updates. Other administrative changes.	Charles DuPrè, *FM&E-DES*	Kirk Christensen, *CENG*
3	9/29/09	Addressed tanks in rad service; administrative changes.	Charles DuPrè, *ES-DE*	Larry Goen, *ES-DO*
4	9/29/14	DOE O 420.1C and G 420.1-1A update, other admin and minor changes.	Michael Ladach, *ES-EPD*	Mel Burnett, *CENG*

CONTACT THE MECHANICAL STANDARDS POC AND COMMITTEE

for upkeep, interpretation, and variance issues

Ch. 6, D10+E10	**Mechanical POC and Committee**

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D10+E10 GENERAL

NOTE: See ESM Chapter 1 Section Z10 and Mechanical Chapter 6 Section D10-30GEN for additional requirements and definitions.

D10 CONVEYING

D1010 ELEVATORS AND LIFTS

1.0 GENERAL

A. Refer to ESM Architectural Chapter *(Section C-Interiors)* for additional requirements for elevators (potentially).

B. Elevator pit must have a sump, automatic pump, and piping per UPC directed to outside of building (or, with POC permission, location that will not cause a safety issue).[1]

C. Refer to the following LANL Master Specifications:

1. Section 14 2423, Hydraulic Passenger Elevators.
2. Section 14 2413, Hydraulic Freight Elevators.

D1090 OTHER CONVEYING SYSTEMS (PROGRAMMATIC & FACILITY)

1.0 CRANES

A. Refer to the following LANL Master Specifications:

1. Section 41 2225, Hoists and Trolleys.
2. Section 41 2213.13, Bridge Cranes.

B. *Guidance: Refer to P101-25, Cranes, Hoists, Lifting Devices, and Rigging Equipment, especially Appendix A, Overhead and Gantry Cranes; Appendix B, Overhead Hoists; and Appendix C, Mobile Cranes, Crawler, Locomotive, and Wheel-Mounted Cranes*

C. *For crane modifications, the LANL Crane Safety Program Owner in IHS should review proposed modifications that are proposed by a qualified mechanical engineer*

2.0 GENERAL

A. Follow the standards in Table D1090-1 below when designing/specifying conveying equipment. They represent the minimum acceptable methods.[2]

[1] ASME A17.1 2.2.2.4 and 5; all LANL elevators have Firefighters' Emergency Operation function; therefore, they are required to have sumps/pumps. Clean Water Act allows discharge of untested/treated firefighting water (ref. FedReg Vol 65 No. 210 10/30/2000 sections 64759-60, 64763, and 64807.
[2] Refer to ESM Chapter 1 Section Z10 on Code of Record for implementation schedule of 420.1C-driven requirements.

TABLE D1090-1

Standards for Material Handling Equipment

Function/ Component	***ML-3/4 General Service***	***ML-2/ Safety Significant (SS) ****	***ML-1/ Safety Class (SC) *****
Design Standards for Cranes and other Material Handling Equipment	CMAA 70, CMAA 74, and/or the applicable design standards referenced in DOE-STD-1090 (*2011, Section 14)* for other equipment.	Applicable CMAA Standards ASME B30.2 ASME NOG-1 Type II or ASME NUM-1 Type II ANSI 14.6 for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More. DOE-STD-1090	Applicable CMAA Standards ASME B30.2; ASME NOG-1 Type 1 or ASME NUM-1 Type 1 ANSI 14.6 for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More DOE-STD-1090
Operation, Inspection, Maintenance, and testing Standards	*DOE-STD-1090*	*Applicable CMAA Standards.* *ASME NOG-1, ASME NUM-1, ASME B30.2* *DOE-STD-1090* *DOE-STD-1090 or ANSI 14.6 for Special Lifting Devices for Shipping Containers Weighing 10 000 Pounds (4500 kg) or More*	*Applicable CMAA Standards* *ASME NUM-1, B30.2;* *DOE-STD-1090* *DOE-STD-1090 or ANSI 14.6 for Special Lifting Devices for Shipping Containers Weighing 10 000 Pounds (4500 kg) or More*

* ASME NOG-1 and NUM-1, Type II equipment is equipment that is <u>not</u> used to handle critical loads and is required to withstand a seismic event. A unique design is required if this is not the safety significant function.

** ASME NOG-1 and NUM-1, Type I equipment is equipment that is used to handle critical loads and is required to withstand a seismic event. A unique design is required if this is not the safety class function.

Titles for Table D1090-1

***ANSI N14.6**, Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More*
***ASME NOG-1**, Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)*
ASME NUM-1, Rules for Construction of Cranes, Monorails, and Hoists (with Bridge, Trolley or Hoist of the Underhung Type)
***CMAA** Specification 70, Specifications for Top Running Bridge & Gantry Type Multiple Girder Electric Overhead Traveling Cranes*
***CMAA** Specification 74, Specifications for Top Running & Under Running Single Girder Electric Traveling Cranes Utilizing Under Running Trolley Hoists*
***DOE-STD-1090**, Hoisting and Rigging*

3.0 SPECIAL REQUIREMENTS FOR NUCLEAR MATERIAL HANDLING EQUIPMENT

3.1 General Guidance

A. *Safety-significant and safety-class handling equipment (cranes, manipulators, etc.) are only classified as such if their failure would create a radiological material release exceeding the guidelines for either classification. The safety-significant classification, as a defense-in-depth provision, is the more common classification for remote material handling equipment.*

3.2 General Requirements

A. Failure modes for mechanical handling equipment used to move radioactive materials must address mid-operational failures, and designs must include recovery methods for such occurrences.

B. Designs must accommodate periodic maintenance and inspection.

E10 EQUIPMENT

E1020 INSTITUTIONAL EQUIPMENT (PROGRAMMATIC AND FACILITY)

1.0 GENERAL

A. Follow the standards in Table E1020-1 when designing/specifying equipment.

B. Follow DOE-STD-1132, Design Considerations, documenting any exceptions taken.

C. Also refer to Chapter 11, *Hazardous Process* and Chapter 12, *Nuclear* for additional requirements for such equipment.

TABLE E1020-1

Codes and Standards for Process Equipment			
Function/ Component	**ML-3/4 General Service**	**ML-2/ Safety Significant (SS)**	**ML-1/ Safety Class (SC)**
Pressure Vessels	ASME B&PVC, Section VIII; ESM Ch 17	ASME B&PVC, Section VIII, Division 1 or 2; ESM Ch 17	ASME B&PVC, Section III, Division 1 or 2 (Class II or Section VIII with QA enhancements[3]); ESM Ch 17
Tanks (0-15 psig) See note below table	API 620	API 620; ASME B&PVC Section VIII, Division 1 or 2 (even where they may be exempt due to pressure or other reason).	API 620; ASME B&PVC Section VIII, Division 1 or 2 (even where they may be exempt due to pressure or other reason).
Tanks (containing flammable liquids)	API 620 and 650; NFPA 30	API 620 and 650; NFPA 30	API 620 and 650; NFPA 30
Tanks (atmospheric pressure)	API 650; AWWA D100	API 650; AWWA D100	API 650; AWWA D100
Pumps	API series; ASME B73 series; ASME B&PVC, Section VIII; AWWA E101; Hydraulic Institute Standards	ASME B73.1, B73.2; ASME B&PVC, Section VIII; AWWA ; Hydraulic Institute Standards	ASME B73.1, B73.2; ASME B&PVC, Section VIII; AWWA; Hydraulic Institute Standards
Piping	ASME B31.3; ESM Ch 17 (*ref. REF-3, B31.3 Process Piping Guide)*	ASME B31.3; ESM Ch 17 (*ref. REF-3, B31.3 Process Piping Guide)*	ASME B31.3; ESM Ch 17 (*ref. REF-3, B31.3 Process Piping Guide)*
Valves	ASME B16.5, B31.3	ASME B16.5, B31.3; ANSI N278.1	ASME B16.5, B31.3; ANSI N278.1
Heat exchangers	ASHRAE Handbook; ASME B&PVC, Section VIII, Division 1; TEMA B, C, or R	ASHRAE Handbook; ASME B&PVC, Section VIII, Division 1; TEMA B, C, or R	ASHRAE Handbook; ASME B&PVC, Section VIII, Division 1; TEMA B, C, or R
Gloveboxes[4]	AGS Standards	AGS-G006, ASTM C852	AGS-G006, ASTM C852

[3] "Applicability of ASME Sections III and VIII and of B31.1 and B31.3 to DOE Facilities," George Antaki, Paper for the Fourth DOE Natural Phenomena Hazards Mitigation Conference, October 19-22, 1993, Atlanta. (EMref-18) (***Note:*** *EMref refers to an ESM team system for managing hard-to-find reference hardcopies.)*

[4] GB leak testing need not include rate-of-rise testing if helium mass spec testing achieving 10E-6 cc/sec sensitivity or better is performed in lieu of same, since this is more sensitive per ASNT's Nondestructive Testing Handbook, Volume 1 – Leak Testing's discussion on page 18 (see EMRef-70 for history of this determination by LANL and NNSA). Also, re AGS-G006, it is not practical to include GB or ventilation system controls that can respond to the different operating conditions between normal pressure control and breach pressure control that would limit credible breach face velocities to 125±25 ft/min. This is especially true for air GBs at TA-55 attached directly to the large trolley systems. In light of this limitation, LANL shall use only the criteria in ASTM C852 (breach velocities to be at least 125 ft/min). By doing so, as long as the ventilation system (e.g., Zone 1) is operating, any credible breach is in compliance with AGS's interpretation: "As long as the pressure inside the glovebox is maintained below the ambient pressure, and air is flowing into the glovebox, the intent of AGS-G006 is met..." See EMRef-71 for the AGS interpretation and correspondence from NNSA to LANL.

Titles for Table E1020-1

AGS G001, Guideline for Gloveboxes

AGS G002, Standard of Practice for Design and Fabrication of Glovebags

AGS G003, Standard of Practice for the Application of Linings to Gloveboxes

ANS 11.16 on gloveboxes if/when issued

API

610, Centrifugal Pumps for Petroleum, Heavy Duty Chemical, and Gas Industry Services

620, Design and Construction of Large, Welded, Low-Pressure Storage Tanks

650, Welded Steel Tanks for Oil Storage

674, Positive Displacement Pumps-Reciprocating

675, Positive Displacement Pumps-Controlled Volume

ASME (or ANSI/ASME)

B&PVC – Boiler and Pressure Vessel Code

B16.5, Pipe Flanges and Flanged Fittings

B31.3, Process Piping

B73.1M, Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process

ASME, Con't

B73.2M, Specification for Vertical In-Line Centrifugal Pumps for Chemical Process

B73.5M, Thermoplastic and Thermoset Polymer Material Centrifugal Pumps for Chemical Process
B96.1, Welded Aluminum-Alloy Storage Tanks

N278.1, Self-Operated and Power-Operated Safety-Related Valves Functional Specification Standard

ASTM C 852, Standard Guide for Design Criteria for Plutonium Gloveboxes

AWWA D100, Welded Steel Tanks for Water Storage

AWWA E101, Vertical Turbine Pumps - Line Shaft and Submersible Types

NFPA 30, Flammable and Combustible Liquids Code

NFPA 801, Standard for Fire Protection for Facilities Handling Radioactive Materials (National Fire Codes, vol. 11)

TEMA 1, Standards of the Tubular Exchanger Manufacturer's Association

2.0 GLOVEBOXES

A. Gloveboxes shall be designed, fabricated, and installed per LANL Master Specification Sections 11 5311.08, 11 5311.10, and 11 5311.12. (For non-nuclear application, delete those sections that do not apply).

3.0 SPECIAL REQUIREMENTS FOR NUCLEAR-SAFETY-RELATED PROCESS EQUIPMENT [5]

3.1 Confinement Guidance

A. *The usual safety function of process equipment is to provide primary confinement and prevent or mitigate radioactive and/or hazardous material releases to the environment. Process equipment that would be required to provide primary confinement includes the following: piping, tanks, pressure vessels, pumps, valves, hoods, and gloveboxes. These examples represent process system components that could be used to contain radioactive or toxic materials directly.*

[5] All nuclear-related material is based on Section 5.2 of DOE G 420.1-1A, *Nonreactor Nuclear Safety Design Criteria and Explosive Safety Criteria Guide for use with DOE O 420.1C, Facility Safety*. The recommended codes and standards tables from G 420.1-1A were updated and expanded to consider per practice.

B. *Process equipment for some applications can provide secondary confinement. Examples include double-walled piping systems, heat exchangers, double-walled tanks, and gloveboxes.*

C. *Primary confinement barrier(s) should be provided between the hazardous process material (gas, liquid or solid) and any auxiliary (e.g. a cooling system) to minimize risk of material transfer to an unsafe location or introduction of an undesirable medium into the process area. Differential pressure across the confinement barrier(s) should be used where appropriate.*

3.2 Confinement Requirements

A. Safety-class and safety-significant process equipment providing passive confinement (piping, tanks, pressure vessels, etc.) must be designed to suitably conservative criteria; redundancy in their design is typically not required. The need for redundancy is required to be evaluated to the design of safety-class SSCs that involve active confinement process equipment (e.g., pumps, valves, etc.).

B. *Guidance: The redundancy criteria should be considered in the design of safety-significant SSCs that involve active confinement process equipment.*