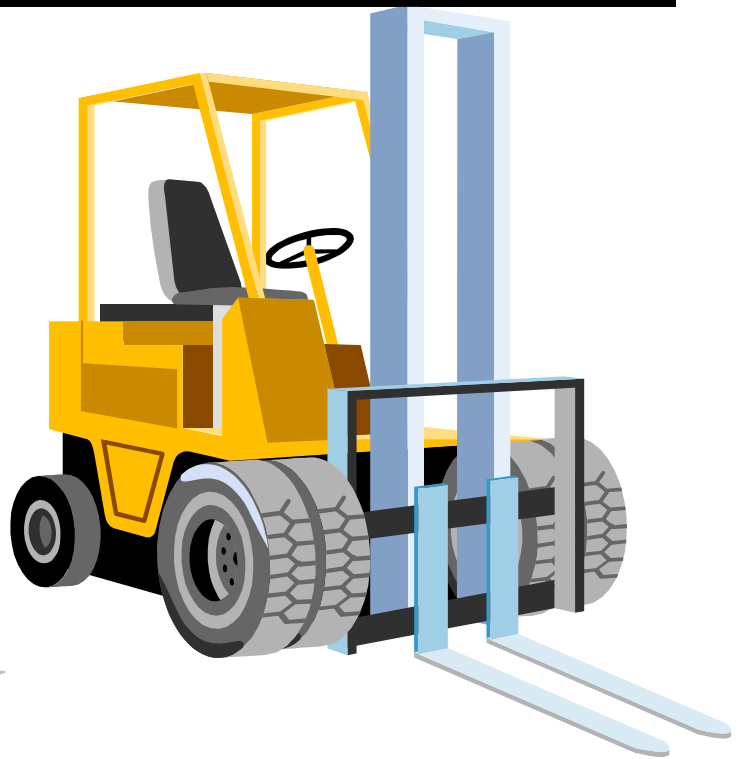


Powered Industrial Trucks Operator Training



AGENDA

- **Introductions**
- **Course Objectives**
- **Common Powered Industrial Truck Terminology**
- **NASA-STD-8719.9**
- **And the Relationship to:**
 - **OSHA 1910.178**
 - **ANSI/ITSDF B56.1-2009**
 - **ANSI/ITSDF B56.1-2005**
- **GPR 8719.1B**
- **GPR 8834.1B**
- **Pre-operational Inspection**
- **Forklift Accidents And Fatalities**
- **Video - Forklift Maneuvers (All The Right Moves**
- **Written Test**
- **Hand-On Test**



Lets see what we already know!!!

Major Parts of Powered Industrial Lift Truck





National Aeronautics and
Space Administration

Ex

HYBRID

Expiration Date: October 1, 2012

STANDARD FOR LIFTING DEVICES AND EQUIPMENT

NASA TECHNICAL STANDARD

STANDARD FOR LIFTING DEVICES AND EQUIPMENT

1. SCOPE

1.1 Scope. This standard applies to overhead and gantry cranes (including top running monorail, underhung, and jib cranes) mobile cranes, derricks, hoists, winches, special hoist supported personnel lifting devices, hydra-sets, load measuring devices, hooks, slings and rigging, mobile aerial platforms, powered industrial trucks, and jacks. This document does not include coverage for front-end loaders and elevators.

1.2 Purpose. This standard establishes NASA's minimum requirements for the design, testing, inspection, maintenance, personnel certification, and operation of lifting devices and equipment (LDE) described in paragraph 1.1.

1.3 Applicability. Compliance with this standard is mandatory for all NASA-owned and NASA contractor-supplied equipment used in support of NASA operations at NASA installations and NASA operations in host countries. The individual installation Lifting Devices and Equipment Manager (LDEM) and safety organizations are responsible for implementation and enforcement. This document establishes minimum requirements; NASA installations should assess their individual programs and develop additional requirements as needed. The need for compliance with this standard at contractor installations performing NASA work should be evaluated and made a contractual requirement where deemed necessary by the contracting officer and the responsible NASA installation/program safety office. Rented or leased LDE is exempt from this standard only by the decision of the contracting officer, the responsible NASA installation/program safety office, and the LDEM. If determined that rented or leased LDE will be used for a critical lift, this standard applies.

1.3.1 The testing, inspection, maintenance, operational, and operator and rigger certification/recertification/licensing requirements apply to new and existing lifting devices and equipment.

1.3.2 The design/hardware requirements contained in this document are applicable to new lifting devices/equipment purchased after 6 months from the issue date of this document. Existing equipment and that purchased during the first 6 months from issue of this document shall be reviewed for compliance with all design/hardware aspects of this standard within 12 months of its issue and the need to update such equipment shall be evaluated.

1.3.3 Deviations/waivers from the requirements of this document (including design/hardware requirements for both new and existing equipment) shall be approved as outlined in paragraph 1.7. The deviation/waiver documentation shall include any alternate or special criteria or procedures that will be imposed to ensure safe design and operations for those devices that do not meet the applicable requirements.

1.3.4 Portions of this standard refer to various national consensus codes/standards for equipment design/hardware requirements (e.g., ASME, CMAA, etc.). Lifting devices and equipment purchased after the initial review required in paragraph 1.3.2 shall comply with the specified codes/standards in effect at the time of manufacture. Each installation shall periodically review subsequent codes/standards and evaluate the need to update existing equipment. Based on an evaluation of NASA's overall safe lifting program and any significant changes in the consensus codes/standards, the NASA Safety and Risk Management Division

with concurrence from the field installations shall decide when the next complete review (as described in paragraph 1.3.2) is warranted.

1.4 Relation to Occupational and Safety Health Administration (OSHA) Requirements. This document is not a substitute for OSHA requirements. OSHA requirements apply to all NASA operations. This document meets or exceeds Federal OSHA requirements. Some States have their own OSHA programs that must comply with Federal OSHA and may be stricter. All NASA installations are responsible for keeping up to date with the Federal and State OSHA requirements that apply to their operations. This standard contains some OSHA requirements where deemed necessary to stress the importance of the requirement, clarify the requirement, document interpretation of the requirement, and/or define NASA's program for meeting the requirement. The NASA Safety and Risk Management Division, with assistance from the field installations, shall monitor subsequent OSHA requirements for any impact on NASA's safe lifting program.

1.5 Critical and Noncritical Lifting Operations. There are two categories of lifting operations for the purposes of this standard, critical and noncritical.

1.5.1 Critical lifts are lifts where failure/loss of control could result in loss of life, loss of or damage to flight hardware, or a lift involving special high dollar items, such as spacecraft, one-of-a-kind articles, or major facility components, whose loss would have serious programmatic or institutional impact. Critical lifts also include the lifting of personnel with a crane, lifts where personnel are required to work under a suspended load, and operations with special personnel and equipment safety concerns beyond normal lifting hazards. Personnel shall not be located under suspended or moving loads unless the operation adheres to the OSHA-approved NASA Alternate Standard for Suspended Load Operations (see Appendix A). Lifting of personnel with a crane shall be in accordance with 29 CFR 1926.550 (see Appendix C).

a. Each installation or program shall develop a process to identify critical lifting operations and lifting devices/equipment that must meet critical lift requirements. Input shall be gathered from facility, program, user, and assurance personnel. The results of the process shall be documented and approved, as a minimum, by the installation LDEM.

b. It is NASA policy that the comprehensive safeguards outlined in this standard be provided for critical lifting operations. This includes special design features, maintenance, inspection, and test intervals for the lifting devices/equipment used to make critical lifts.

c. Specific written procedures shall be prepared and followed for all critical lifts.

d. During critical lifts there shall be one person present (NASA or contractor) that is designated as responsible for the safety of the operations. That person may be a safety professional, a supervisor, an engineer, or a task leader.

1.5.2 Noncritical lifts typically involve routine lifting operations and are governed by standard industry rules and practices except as supplemented with unique NASA testing, operations, maintenance, inspection, and personnel licensing requirements contained in this standard.

1.5.3 The requirements for critical and noncritical lifts outlined in this standard shall be followed unless a specific deviation/waiver is approved as outlined in paragraph 1.7. Different levels of risks associated shall be evaluated using the risk determination criteria in NPG 8715.3.

1.6 Recordkeeping and Trend Analysis. A data collection system shall be established at each installation or location to support NASA-wide lifting device trend and data analysis. Data entered locally would typically be associated with type and manufacturer of the equipment, age, maintenance history, operational problems and their corrective actions, lifting mishaps, safety notices, inspection discrepancies, waivers, and proof and load test results.

1.7 Safety Variances.

1.7.1 If a mandatory requirement cannot be met, a safety variance shall be prepared in accordance with NPG 8715.3.

1.7.2 The NASA variance process does not apply to Federal and applicable State/local regulations (e.g., OSHA, Cal OSHA). Any variance of a Federal or State/local regulation must be approved by the appropriate Federal/State/local agency (e.g., NASA Alternate Safety Standard for Suspended Load Operations approved by OSHA). The NASA Safety and Risk Management Division shall review all proposed safety variances of Federal regulations before submittal for approval.

1.7.3 Example: A variance request to a requirement in this standard that uses the word shall would be routed through the Center Safety Director for concurrence and approved or denied by the Center Director. A copy would then be sent to the NASA Safety and Risk Management Division within 14 days along with detailed rationale for its approval and other documentation.

1.8 Lifting Devices and Equipment Committee.

1.8.1 NASA LDE Committee. Each installation Director shall designate in writing at least one person and an alternate, with appropriate background in lifting devices, lifting operations, lifting equipment industry standards and an understanding of lifting safety, as the installation LDEM, to participate as a member of the NASA LDE Committee. The committee is chaired by the Director, Safety and Risk Management Division, or designee, and is responsible for reviewing proposed changes to this standard and addressing general LDE safety issues. The LDEM is responsible for overall management of the installation LDE program, coordinating with appropriate personnel at their installation on lifting issues and providing the NASA LDE Committee with their installation's position on LDE issues.

1.8.2 Installation LDE Committee. Each installation shall establish a LDE Committee, to ensure this standard is understood and applied across other organizations at the installation and to resolve any issues and provide a forum to exchange information. The Installation LDE Committee shall be chaired by the LDEM, with representation from all organizations at the installation that are responsible for and/or involved with LDE.

1.9 Personnel Performing Nondestructive Testing. Personnel performing lifting devices and equipment nondestructive testing (NDT), including visual inspections, shall be qualified and certified in accordance with written practices meeting the requirements contained

in American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.

2. APPLICABLE DOCUMENTS

2.1 General. The applicable documents cited in this standard are listed in this section for reference only. The specified technical requirements listed in the body of this document must be met whether or not the source document is listed in this section.

2.2 Government Documents.

2.2.1 Specifications, Standards, and Handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issuances in effect on date of invitation for bids or request for proposal shall apply.

DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

OCCUPATIONAL SAFETY AND HEALTH STANDARD, 29 CFR 1910, Subpart I,
Personal Protective Equipment.

OCCUPATIONAL SAFETY AND HEALTH STANDARD, 29 CFR 1910.29,
Manually Propelled Mobile Ladder Stands and Scaffolds (Towers).

OCCUPATIONAL SAFETY AND HEALTH STANDARD, 29 CFR 1910.67,
Vehicle-Mounted Elevating and Rotating Work Platforms.

OCCUPATIONAL SAFETY AND HEALTH STANDARD, 29 CFR 1910.178,
Powered Industrial Trucks.

OCCUPATIONAL SAFETY AND HEALTH STANDARD, 29 CFR 1910.179,
Overhead and Gantry Cranes.

OCCUPATIONAL SAFETY AND HEALTH STANDARD, 29 CFR 1910.180,
Crawler, Locomotive, and Truck Cranes.

OCCUPATIONAL SAFETY AND HEALTH STANDARD, 29 CFR 1910.181,
Derricks.

OCCUPATIONAL SAFETY AND HEALTH STANDARD, 29 CFR 1910.184,
Slings.

OCCUPATIONAL SAFETY AND HEALTH STANDARD, 29 CFR 1926.550,
Cranes and Derricks.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA Specifications Kept Intact (SPECSINTACT), Standard Construction
Specification System.

NASA SPECSINTACT, Section 14370, Monorails and Hoists.

NASA SPECSINTACT, Section 14380, Electric Overhead Cranes.

(Copies of OSHA standards are available at: <http://www.osha.gov/comp-links.html>,
copies of NASA Standards are available at <http://standards.nasa.gov>.)

2.2.2 Other Government Documents, Drawings, and Publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issuances in effect on date of invitation for bids or request for proposal shall apply.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA Procedures and Guidelines 8715.3, NASA Safety Manual.

NASA Procedures and Guidelines 8820.2C, Facility Project Implementation Handbook.

(Copies of NASA directives are available at <http://nodis.hq.nasa.gov/Welcome.html>.)

2.3 Non-Government Publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issuances in effect on date of invitation for bids or request for proposals shall apply.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

“Manual of Steel Construction,” 400 North Michigan Avenue, Chicago, Illinois 60611.

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING

SNC-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME), AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.22, Safety Requirements for Rope Guided and Nonguided Worker’s Hoists.

ANSI/SIA A92.2, Vehicle Mounted Elevating and Rotating Aerial Devices.

ANSI/SIA A92.3, Manually Propelled Elevating Aerial Platforms.

ANSI/SIA A92.5, Boom Supported Elevating Work Platforms.

ANSI/SIA A92.6, Self Propelled Elevating Work Platforms.

ANSI/ISA S84.01, Electrical, Electronic, Programmable Electronic Systems in Safety Applications.

ASME B30.1, Jacks.

- ASME B30.2, Overhead and Gantry Cranes.
- ASME B30.3, Construction Tower Cranes.
- ASME B30.4, Portal, Tower, and Pedestal Cranes.
- ASME B30.5, Mobile and Locomotive Cranes.
- ASME B30.6, Derricks.
- ASME B30.7, Base Mounted Drum Hoists.
- ASME B30.8, Floating Cranes and Floating Derricks.
- ASME B30.9, Slings.
- ASME B30.10, Hooks.
- ASME B30.11, Monorails and Underhung Cranes.
- ASME B30.12, Handlings Loads Suspended from Rotorcraft.
- ASME B30.14, Side Boom Tractors.
- ASME B30.16, Overhead Hoists.
- ASME B30.17, Overhead and Gantry Cranes.
- ASME B30.19, Cableways.
- ASME B30.20, Below-the-Hook Lifting Devices.
- ASME B30.21, Manually Lever Operated Hoists.
- ASME B30.22, Articulating Boom Cranes.
- ASME B30.23, Personnel Lifting Systems.
- ASME B56.1, Safety Standard for Low Lift and High Lift Trucks.
- ASME HST-1, Performance Standard for Electric Chain Hoists.
- ASME HST-2, Performance Standard for Hand Chain Manually Operated Chain Hoists.
- ASME HST-3, Performance Standard for Manually Lever Operated Chain Hoists.
- ASME HST-4, Performance Standard for Overhead Electric Wire Rope Hoists.
- ASME HST-5, Performance Standard for Air Chain Hoists.

ASME HST-6, Performance Standard for Air Wire Rope Hoists.

AMERICAN WELDING SOCIETY

D1.1, Structural Welding and Cutting Code.

D1.2, Structural Welding Code – Aluminum.

D14.1, Specifications for Welding Industrial and Mill Cranes.

CRANE MANUFACTURERS ASSOCIATION OF AMERICA (CMAA)

CMAA Specification No. 70, Specifications for Electric Overhead Traveling Cranes.

CMAA Specification No. 74, Specification for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA No. 70, National Electric Code.

POWER CRANE AND SHOVEL ASSOCIATION (PCSA)

PCSA, Standards No. 4 and No. 5.

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J765, Crane Load Stability Test Code.

WIRE ROPE TECHNICAL BOARD

Wire Rope Users Manual

Wire Rope Sling Users Manual

2.4 Order of Precedence. Where this document is adopted or imposed by contract on a program or project, the technical guidelines of this document take precedence, in the case of conflict, over the technical guidelines cited in other referenced documents.

3. DEFINITIONS AND ACRONYMS

3.1 Definitions Used in this Standard

3.1.1 Brake: A device used for retarding or stopping motion.

3.1.2 Certification: That situation when the lifting device or equipment maintenance, test, or other operational checks have been performed and are current.

~~obstructed path of travel, unstable footing, and other possible hazardous conditions. The operator shall establish appropriate safety zones before initiating operations.~~

~~e. The equipment shall not be loaded beyond its rated load (capacity) except for required testing.~~

~~f. The operator shall ensure the equipment is within inspection and testing intervals by examination of the periodic recertification tags and/or documentation.~~

~~g. Operator discipline shall be maintained at all times. There shall be no eating, drinking, or rowdiness during mobile aerial platform operations. Personnel shall keep all parts of the body, tools, and equipment inside the work platform periphery during raising, lowering, and traveling operations.~~

~~h. Fall protection is required for personnel using mobile aerial platforms that can tilt, as covered by ANSI/SIA A92.2 and A92.5.~~

~~i. Tools and other objects shall be carried in canvas bags or by other methods that free both hands and do not present a snagging hazard. Alternate methods of tool delivery beside mobile aerial platforms should be investigated.~~

~~j. For work on or near electrical distribution and transmission lines, mobile aerial platforms shall be operated in accordance with paragraphs 5.7 as, 5.7 at, and 5.7 au of this standard and the applicable ANSI/SIA standard.~~

~~k. Insulated mobile aerial platforms shall be tested and inspected in accordance with ANSI/SIA.~~

~~l. Outdoor mobile aerial platform operations should not commence if winds are above 20 knots steady state (23 mph, 37 km/hr) or if gusts exceed 25 knots (29 mph, 46 km/hr) or as recommended by the manufacturer. Consideration shall also be given to weather conditions such as lightning or snow before commencing operations.~~

~~m. The requirements of this section apply to all uses of mobile aerial platforms; e.g., movement for storage/repositioning and use of the platform close to ground level.~~

12. POWERED INDUSTRIAL TRUCKS

12.1 General. This section establishes minimum standards for the design, testing, inspection, maintenance, personnel certification, and operation of powered industrial trucks (forklifts). This section applies to those platforms covered by ASME B56.1, "Safety Standard For Low Lift and High Lift Trucks."

12.2 Safety and Design Aspects. High quality off-the-shelf OEM type equipment is acceptable for critical and noncritical lifts if it is designed, maintained, and operated according to this standard.

12.2.1 Design criteria/general design requirements that should be emphasized for powered industrial trucks are contained in ASME B56.1. It is the responsibility of the applicable engineering, operations/maintenance, and safety organizations to ensure the design, testing, maintenance, inspection, and operation complies with this standard, the manufacturers' recommendations, ASME B56.1, and OSHA 1910.178.

12.2.2 Labeling/Tagging of Powered Industrial Trucks.

- a. The rated load/applicable capacity ratings shall be clearly marked on the powered industrial truck.
- b. A standard system of labeling shall be established and used throughout the installation.
- c. A standard lockout/tagout system shall be established and used throughout the installation to indicate equipment that is not to be used due to inspection discrepancies, ongoing maintenance, mishaps, or other reason.
- d. Certification/recertification tags are required as described in paragraph 12.3.4.

12.2.3 Safety Analysis and Documentation of Powered Industrial Trucks. A recognized safety hazard analysis such as fault tree analysis, FMEA, O&SHA shall be performed on all powered industrial trucks used for lifts where failure/loss of control could result in loss of or damage to flight hardware. The analysis shall, as a minimum, determine potential sources of danger, identify failure modes, and recommend resolutions and a system of risk acceptance for those conditions found in the hardware-facility-environment-human relationship that could cause loss of life, personal injury, and loss of or damage to the powered industrial truck, facility, or load. The analysis shall be done as part of the initial activation process, included in the equipment documentation, and updated as required to reflect any changes in operation and/or configuration.

12.3 Testing. Testing of powered industrial trucks shall be performed according to this section, the manufacturers' recommendations, and the applicable OSHA and ASME standards. Three types of tests are required for powered industrial trucks: proof load tests, periodic load tests, and operational tests. All load and operational tests shall be performed by qualified personnel according to written (specific or general) technical operating procedures. An inspection of the powered industrial truck and its components shall be performed after each load test and prior to the truck being released for service to ensure there is no damage. The acceptable tolerance for load test accuracy is +5/-0 percent unless otherwise specified. The periodic load test requirement may be fulfilled by a concurrently performed proof load test.

12.3.1 Proof Load Test. Proof load tests and operational tests shall be performed prior to first use for new or extensively repaired or altered components directly in the powered industrial truck load path in accordance with the manufacturers' instructions and the applicable ASME standard. Repairs or alterations to non-lifting or non-holding components do not require a load test, although a functional check should be performed to determine if the repairs or alterations are acceptable. A proof load test may also be performed when there is a question in design, previous testing, or to ensure system integrity.

12.3.2 Periodic Load Test. For powered industrial trucks used where failure/loss of control could result in loss of or damage to flight hardware, a periodic load and operational test shall be performed at least once every year with a load equal to the rated load.

12.3.3 Operational Test. Together with proof load and periodic load tests, the following shall be performed with a dummy rated load unless otherwise specified:

- a. Perform all functions in a loaded condition including tilt operation. Ensure the load is secured and will not move during tilting operations.
- b. Hold the load for a minimum of 5 minutes and verify drift does not exceed that specified by the responsible engineering organization.
- c. The operational test for a modified powered industrial truck can be tailored to test only those portions of the equipment that were modified/repared only if the rated and operational test interval has not expired.

12.3.4 Test Reports and Periodic Recertification Tags. After each test, designated personnel shall prepare written, dated, and signed test reports. Inadequacies shall be documented and, if determined to be a hazard corrected prior to further use. These reports shall be kept on file for a minimum of two test cycles and shall be made readily available. Following the periodic load test, powered industrial trucks shall be given a permanently affixed tag identifying the equipment and stating the next required periodic load test date or load test expiration date.

12.4 Inspection.

12.4.1 Inspections shall be performed on all powered industrial trucks. Inspections shall be performed according to this section, the manufacturers' recommendations, and ASME B56.1. Inadequacies discovered during an inspection shall be documented and, if determined to be a hazard, the truck will be tagged out and the inadequacy corrected prior to further use. Inspections shall be performed by qualified personnel according to approved technical operating procedures.

12.4.2 All new, extensively repaired, or modified powered industrial trucks shall be inspected to the requirements of both daily and periodic inspections prior to first use. For component repair on powered industrial trucks, only the inspections that apply to the repaired portion need to be performed prior to first use unless a periodic inspection interval expires during the downtime (see paragraph 12.4.5).

12.4.3 Powered industrial trucks in regular service (used at least once a month) shall be inspected as required in paragraphs 12.4.4 and 12.4.5. Idle and standby powered industrial trucks shall be inspected according to paragraph 12.4.6.

12.4.4 Daily Inspections. These inspections shall be performed by the operator prior to each shift the truck is used. Inspect:

- a. Warning and safety devices for malfunction (to include the horn).
- b. Condition of tires (if pneumatic tires, check inflation pressures).

- c. Lights.
- d. Hydraulic system for observable deterioration or leakage and check for proper oil level if suspect.
- e. Electrical equipment for signs of malfunction, signs of deterioration, and dust and moisture accumulation.
- f. Chains and cables for wear or distortion.
- g. Battery, connections, and load test.
- h. Control mechanisms.
- i. Lift and tilt systems.
- j. Load engaging means.
- k. Brakes.
- l. Steering mechanism.
- m. Fuel systems.
- n. Engine oil and pressure.
- o. Manufacturing plates, tags, or decals in legible condition.

12.4.5 Periodic Inspections. The following inspections shall be performed at least once per year or more frequently as required by the manufacturer, ASME B56.1, users' experience gained, severity of service, environment, and criticality. Inspect:

- a. The items listed in paragraph 12.4.4.
- b. Forks for damage, deformation, cracks, straightness of blade, fork angle, difference in height of fork tips, positioning lock, and legibility of fork marking.
- c. Frame members.
- d. Critical welds.
- e. Axle stops.
- f. Safe operating features or devices designed and approved for hazardous area operations.
- g. Motors.
- h. Electrical conductors and connections.

12.4.6 Idle and Standby Powered Industrial Trucks. Idle and standby powered industrial trucks shall be inspected prior to first use according to the requirements of paragraphs 12.4.4 and 12.4.5 unless these daily and periodic inspections were performed at required intervals and recorded during the idle/standby period.

12.4.7 Inspection Reports. After each formal periodic inspection, qualified personnel shall prepare written, dated, and signed inspection reports, including procedure reference and adequacy of components. Inadequacies shall be documented and, if determined to be a hazard, corrected prior to further use. These reports shall be filed and be made readily available by the organizational element responsible for powered industrial trucks.

12.5 Maintenance. A maintenance program based on manufacturers' recommendations, integrating proactive, reactive, preventive, and predictive maintenance shall be established to increase the probability the powered industrial truck will function in the required manner over its design life cycle with a minimum of maintenance. The program shall include procedures and a scheduling system for normal periodic maintenance items, adjustments, replacements, and repairs. The program also shall ensure that records are kept and unsafe test and inspection discrepancies are documented and corrected. Any powered industrial truck found in an unsafe operating condition shall be tagged out and removed from service until repaired. All repairs shall be made by qualified personnel in accordance with the manufacturers' instructions.

12.5.1 Maintenance Procedures. Before maintenance, adjustments, repairs, and replacements are made, the following safety precautions shall be taken:

- a. Move the powered industrial truck to a designated area where maintenance activities will not interfere with other operations and there is proper ventilation.
- b. When lifting trucks for repair, trucks shall be lifted in a safe, secure, stable manner. The drive wheels will be raised free of the floor or the battery will be disconnected.
- c. Chocks or other positive truck positioning devices will be used.
- d. Block load engaging means, innermasts(s), or chassis before working on them.
- e. Before disconnecting any part of the engine fuel system of gasoline powered trucks with gravity feed fuel systems, take precaution to eliminate any possibility of unintentional fuel escape.
- f. Before disconnecting any part of the engine fuel system of LP gas powered trucks, close LP tank valve and run engine until fuel in system is depleted and engine stops.
- g. Disconnect the battery before working on the electrical system.
- h. The charger connector shall be plugged only into the battery connector and never into the truck connector.

12.5.2 Adjustments. Based upon the manufacturers documentation and/or experience gained, adjustments shall be made to ensure that all powered industrial trucks function properly, paying particular attention to:

- a. Brakes.
- b. Control systems.
- c. Limit switches.
- d. Steering mechanisms.
- e. Hazardous area operation devices.
- f. Motors.

12.5.3 Repair/Replacement.

- a. Modifications and additions that affect truck capacity (to include addition of counterweight) and safe truck operation shall not be performed without manufacturer approval.
- b. Replacement parts, including tires, shall be interchangeable with the original parts and of a quality at least equal to that provided in the original equipment.
- c. Replacement parts are to be installed per manufacturers procedures.
- d. No repairs shall be made in Class I, II, and III locations (ref. OSHA 1910.178).
- e. Replacement batteries shall be of the service weight that falls within the minimum/maximum range specified on the truck nameplate by the truck manufacturer.

12.6 Personnel Certification. Only certified (licensed) and trained operators shall be authorized to operate powered industrial trucks. A training, examination, and licensing program shall be established or made available. For those NASA installations that do not have a training program, all powered industrial truck operators shall be trained and certified by a recognized certification organization that normally performs this function. The basic certification program will include the following:

12.6.1 Training.

- a. Classroom training in safety, lifting equipment emergency procedures, general performance standards, requirements, pre-operational checks, and safety-related defects and symptoms (for initial certification and as needed).
- b. Hands-on training (for initial certification and as needed).

- c. An annual review of items listed in paragraphs 12.6.1a and 12.6.1.b above. (This may be conducted informally by local supervisory personnel.)

12.6.2 Examination.

- a. Physical examination (criteria to be determined by the cognizant medical official and should comply with ASME B56.1).
- b. Written/oral examination.
- c. Operational demonstration.
- d. Proficiency examination for recertification.

12.6.3 Licensing. An organizational element shall be designated to issue operator licenses/certifications. Provisions shall be made to revoke licenses/certifications for negligence, violations of safety requirements, or failure to meet medical standards. Provisions shall be made for periodic checks of operators to verify they have licenses in their possession. The licenses shall indicate the type of powered industrial truck the holder is qualified to operate. Alternately, the organizational element may elect to maintain a master list of licensed operators instead of issuing individual licenses, providing copies of the list are readily available to assurance and supervisory personnel at the work site.

12.6.4 Renewal. Licenses or certifications will expire every 3 years. Renewal shall require demonstration of proficiency or approval of supervision that proficiency is adequate and current. Renewal procedures will be established by each licensing organization, but as a minimum, will include items in paragraphs 12.6.1 and 12.6.2. Renewal or refresher training will be provided to operators within the three year certification period when:

- a. The operator has been observed operating the truck in an unsafe manner.
- b. The operator has been involved in an accident or near miss incident.
- c. The operator has received an evaluation that reveals that the operator is not operating the truck safely.
- d. The operator is assigned to drive a different type of truck.
- e. A condition in the workplace changes in a manner that could effect safe operation of the truck.

12.7 Operations.

12.7.1 Powered industrial trucks shall be operated according to this section, the manufacturers' recommendations, and ASME B56.1. The following practices shall be followed for powered industrial truck operations:

- a. General operating procedures describing powered industrial truck operations, emergency steps, communication requirements, and special requirements including checklists and inspection requirements shall be prepared,

approved and followed for each area powered industrial truck operations are performed and shall include each type of truck. There must be a formal system for review, approval, and update to maintain valid operating procedures.

b. Operations shall be analyzed for hazards. The analysis shall consider the environment in which the operation occurs, hazards associated with lift truck maintenance, and, in general, a systems safety analysis of the equipment, facility, load, and interfaces as a whole in support of the lift truck operation.

c. Before each operation or series of operations, the operator shall perform a pre-operational check to demonstrate operational readiness of the truck. If controls do not operate properly, the operator is responsible for notifying the supervisor. Repairs and adjustments shall be made before operations begin.

d. Before each use, the operator shall survey the area for applicable hazards such as overhead obstructions, debris, bumps and loose obstructions, drop-offs and holes, ditches, obstructed path of travel, unstable ground, and other possible hazardous conditions. The operator shall establish appropriate safety zones before initiating operations.

e. The equipment shall not be loaded beyond its rated load (capacity) except for required testing.

f. The operator shall ensure the equipment is within inspection and testing intervals by examination of the periodic recertification tags and/or documentation. The operator shall adhere to all tags on the controls.

g. Operator discipline shall be maintained at all times. There shall be no eating, drinking, or rowdiness during powered industrial truck operations.

h. Operators shall keep all parts of the body inside the operator compartment during operations.

i. Never put any part of the body into the mast structure or between the mast and truck.

j. Do not start or operate the truck or any of its attachments from any place other than from the operators position.

k. Trucks shall not be driven up to anyone standing in front of an object.

l. Operators shall ensure other personnel are not in the swing radius prior to performing turning maneuvers.

m. Operators shall sound the horn when approaching cross aisles, doorways and other locations where pedestrians may step into the path of truck travel.

n. No person is allowed to stand or pass under the elevated portion of any truck, empty or loaded.

- o. Unauthorized personnel shall not be permitted to ride on powered industrial trucks. A safe place to ride shall be provided where riding of trucks is authorized.
- p. A powered industrial truck is attended when the operator is less than 25 feet (7.6 m) from the truck and it is in his view.
- q. A powered industrial truck is unattended when the operator is more than 25 feet (7.6 m) from the truck or the truck is not in the operator's view.
- r. Before leaving the operator's position or dismounting from the truck, while still attending the truck, the operator shall:
 - (1) Bring the truck to a complete stop.
 - (2) Place the directional controls in neutral.
 - (3) Apply the parking brake.
 - (4) Fully lower the load engaging means.In addition, when leaving the truck unattended:
 - (5) Stop the engine or turn off the controls.
 - (6) If the truck must be left on an incline, block the wheels.
- s. The operator shall maintain a safe distance from the edge of ramps, platforms and other similar working surfaces.
- t. When powered industrial trucks are driven on and off highway trucks or trailers, the brakes on the highway trucks or trailers shall be applied and wheels chocked or other positive mechanical means shall be used to prevent unintentional truck or trailer movement. Fixed jacks should be placed under trailers not coupled to a tractor.
- u. Provision shall be made to prevent railroad cars from being moved during loading and unloading. Wheel stops, hand brakes, or other recognized positive means shall be used to prevent movement of the railroad cars.
- v. Operators shall verify sufficient headroom under overhead installations, lights, wiring, pipes, sprinkler systems, or other.
- w. An overhead guard shall be used to protect against falling objects.
- x. A load backrest shall be used whenever necessary to minimize the possibility of the load or part of it from falling rearward.
- y. Only approved industrial trucks shall be used in areas classified as hazardous locations.

z. All accidents involving personnel, building structures, and equipment shall be reported to the supervisor.

aa. Industrial trucks shall not be parked where they block access to fire aisles, stairways, or fire equipment.

ab. Motorized hand trucks shall not be ridden unless they are of the hand/rider design.

ac. Whenever a truck is used to lift personnel and there are no controls that are elevatable with the lifting carriage or forks:

- (1) Use a securely attached platform.
- (2) Make sure the lifting mechanism is operating smoothly and properly.
- (3) Place the mast in a vertical position and never tilt forward or rearward when elevated.
- (4) Place the truck controls in neutral and set the brake.
- (5) Lift and lower smoothly and with caution.
- (6) Watch for overhead obstructions.
- (7) Keep hands and feet clear of controls other than those in use.
- (8) Move the truck only for minor adjustments in positioning when personnel are on the platform and never more than creep speed.
- (9) The operator is to remain in the control position on the truck.
- (10) Restraining means such as rails or chains shall be in place and personnel on the platform shall wear a body harness and lanyard or retractable safety device.
- (11) Personnel on the platform shall be certified in Fall Protection.

ad. While refueling, the engine shall be stopped and the operator shall not be on the truck.

ae. Spillage of oil or fuel shall be carefully and completely absorbed or evaporated and fuel tank cap replaced before restarting engine.

af. Open flames shall not be used to check electrolyte levels in storage batteries, liquid level in fuel tanks, or the condition of LPG fuel lines and connectors.

12.7.2 Traveling of Powered Industrial Trucks.

- a. Truck operators shall observe all traffic regulations including posted speed limits.
- b. Truck operators shall yield the right of way to pedestrians and emergency vehicles such as ambulances and fire trucks.
- c. Truck operators shall not pass another truck traveling in the same direction at intersections, blind spots, or other dangerous locations.
- d. Operators shall slow down and sound the horn, or audible warning device, at cross aisles and other locations where their view is obstructed.
- e. Railroad tracks will be crossed at an angle and trucks will not be parked closer than 6 feet to the nearest rail of a railroad track.
- f. Truck operators shall keep a clear view of the path of travel and observe for other traffic, personnel, and safe clearances.
- g. If the load being carried obstructs forward travel, the operator will travel with the load trailing.
- h. Truck operators shall ascend and descend grades slowly, with caution and by the following operations:
 - (1) Loaded rider trucks shall be driven with the load upgrade when ascending or descending grades in excess of 5%.
 - (2) Unloaded trucks should be operated on all grades with the load engaging means downgrade.
 - (3) On all grades the loads and load engaging means shall be tilted back and raised only as far as necessary to clear the road surface.
 - (4) Travel straight up and down and avoid turning on grades.
- i. Trucks shall be operated at a speed that will permit it to be brought to a stop in a safe manner.
- j. The truck shall be operated with the load engaging means or load low and where possible, tilted back. The load should not be elevated except during stacking.
- k. Starts, stops, turns, or direction reversals shall be in a smooth manner so as not to shift the load or overturn the truck.
- l. Horseplay and stunt driving will not be allowed.
- m. Operators will slow down for wet and slippery surfaces.

- n. Before driving over a dockboard or bridge plate, operators shall be sure it is properly secure and its rated capacity is not exceeded and shall drive across carefully and slowly.
- o. Operators shall avoid running over loose objects on the roadway surface.
- p. Operators shall reduce speed to a safe level when negotiating turns and shall reduce speed to be consistent with the environment.
- q. Seat belts, when provided, shall be used.
- r. The operator should stay with the truck if tipover occurs or if the truck falls off a loading dock or ramp. The operator should hold on firmly and lean away from the point of impact.

12.7.3 Loading Powered Industrial Trucks.

- a. Handle only stable and safely arranged loads.
- b. Handle only loads within the capacity of the truck.
- c. Handle loads only with the load engaging means and do not transport loads or miscellaneous items within the operator's compartment or other areas of the truck.
- d. When attachments are used, extra care shall be taken in securing, manipulating, positioning, and transporting the load.
- e. Trucks equipped with attachments shall be operated as partially loaded trucks when not handling a load.
- f. Loads shall be completely engaged with the load engaging means. Forks should be at least 2/3 of the load length.
- g. Where tilt is provided, carefully tilt the load backward to stabilize. Caution should be used in tilting with high or segmented loads.
- h. Do not tilt forward with load engaging means elevated except to pick up or deposit a load over a rack or stack.
- i. When stacking or tiering, use only enough back tilt to stabilize the load.

13. JACKS

13.1 General. This section establishes minimum standards for the design, testing, inspection, maintenance, personnel certification, and operation of jacks used to lift or support flight hardware or where failure/loss of control could result in loss of or damage to flight hardware.

13.2 Safety and Design Aspects. High quality off-the-shelf OEM type equipment is acceptable if it is designed, maintained, and operated according to this standard.

OSHA 1910.178

Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	N
• Subpart Title:	Materials Handling and Storage
• Standard Number:	1910.178
• Title:	Powered industrial trucks.
• Appendix:	A

[1910.178\(a\)](#)

General requirements.

1910.178(a)(1)

This section contains safety requirements relating to fire protection, design, maintenance, and use of fork trucks, tractors, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electric motors or internal combustion engines. This section does not apply to compressed air or nonflammable compressed gas-operated industrial trucks, nor to farm vehicles, nor to vehicles intended primarily for earth moving or over-the-road hauling.

[1910.178\(a\)\(2\)](#)

All new powered industrial trucks acquired and used by an employer shall meet the design and construction requirements for powered industrial trucks established in the "American National Standard for Powered Industrial Trucks, Part II, ANSI B56.1-1969", which is incorporated by reference as specified in § 1910.6, except for vehicles intended primarily for earth moving or over-the-road hauling.

1910.178(a)(3)

Approved trucks shall bear a label or some other identifying mark indicating approval by the testing laboratory. See paragraph (a)(7) of this section and paragraph 405 of "American National Standard for Powered Industrial Trucks, Part II, ANSI B56.1-1969", which is incorporated by reference in paragraph (a)(2) of this section and which provides that if the powered industrial truck is accepted by a nationally recognized testing laboratory it should be so marked.

[1910.178\(a\)\(4\)](#)

Modifications and additions which affect capacity and safe operation shall not be performed by the customer or user without manufacturers prior written approval. Capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly.

[1910.178\(a\)\(5\)](#)

If the truck is equipped with front-end attachments other than factory installed attachments, the user shall request that the truck be marked to identify the attachments and show the approximate weight of the truck and attachment combination at maximum elevation with load laterally centered.

1910.178(a)(6)

The user shall see that all nameplates and markings are in place and are maintained in a legible condition.

1910.178(a)(7)

As used in this section, the term, "approved truck" or "approved industrial truck" means a truck that is listed or approved for fire safety purposes for the intended use by a nationally recognized testing laboratory, using nationally recognized testing standards. Refer to 1910.155(c)(3)(iv)(A) for definition of nationally recognized testing laboratory.

1910.178(b)

Designations. For the purpose of this standard there are eleven different designations of industrial trucks or tractors as follows: D, DS, DY, E, ES, EE, EX, G, GS, LP, and LPS.

1910.178(b)(1)

The D designated units are units similar to the G units except that they are diesel engine powered instead of gasoline engine powered.

1910.178(b)(2)

The DS designated units are diesel powered units that are provided with additional safeguards to the exhaust, fuel and electrical systems. They may be used in some locations where a D unit may not be considered suitable.

1910.178(b)(3)

The DY designated units are diesel powered units that have all the safeguards of the DS units and in addition do not have any electrical equipment including the ignition and are equipped with temperature limitation features.

1910.178(b)(4)

The E designated units are electrically powered units that have minimum acceptable safeguards against inherent fire hazards.

1910.178(b)(5)

The ES designated units are electrically powered units that, in addition to all of the requirements for the E units, are provided with additional safeguards to the electrical system to prevent emission of hazardous sparks and to limit surface temperatures. They may be used in some locations where the use of an E unit may not be considered suitable.

1910.178(b)(6)

The EE designated units are electrically powered units that have, in addition to all of the requirements for the E and ES units, the electric motors and all other electrical equipment completely enclosed. In certain locations the EE unit may be used where the use of an E and ES unit may not be considered suitable.

1910.178(b)(7)

The EX designated units are electrically powered units that differ from the E, ES, or EE units in that the electrical fittings and equipment are so designed, constructed and assembled that the units may be used in certain atmospheres containing flammable vapors or dusts.

1910.178(b)(8)

The G designated units are gasoline powered units having minimum acceptable safeguards against inherent fire hazards.

1910.178(b)(9)

The GS designated units are gasoline powered units that are provided with additional safeguards to the exhaust, fuel, and electrical systems. They may be used in some locations where the use of a G unit may not be considered suitable.

1910.178(b)(10)

The LP designated unit is similar to the G unit except that liquefied petroleum gas is used for fuel instead of gasoline.

1910.178(b)(11)

The LPS designated units are liquefied petroleum gas powered units that are provided with additional safeguards to the exhaust, fuel, and electrical systems. They may be used in some locations where the use of an LP unit may not be considered suitable.

1910.178(b)(12)

The atmosphere or location shall have been classified as to whether it is hazardous or nonhazardous prior to the consideration of industrial trucks being used therein and the type of industrial truck required shall be as provided in paragraph (d) of this section for such location.

1910.178(c)

Designated locations.

1910.178(c)(1)

The industrial trucks specified under subparagraph (2) of this paragraph are the minimum types required but industrial trucks having greater safeguards may be used if desired.

1910.178(c)(2)

For specific areas of use see Table N-1 which tabulates the information contained in this section. References are to the corresponding classification as used in subpart S of this part.

1910.178(c)(2)(i)

Power-operated industrial trucks shall not be used in atmospheres containing hazardous concentration of acetylene, butadiene, ethylene oxide, hydrogen (or gases or vapors equivalent in hazard to hydrogen, such as manufactured gas), propylene oxide, acetaldehyde, cyclopropane, diethyl ether, ethylene, isoprene, or unsymmetrical dimethyl hydrazine (UDMH).

1910.178(c)(2)(ii)

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1910.178(c)(2)(ii)(a)

Power-operated industrial trucks shall not be used in atmospheres containing hazardous concentrations of metal dust, including aluminum, magnesium, and their commercial alloys, other metals of similarly hazardous characteristics, or in atmospheres containing carbon black, coal or coke dust except approved power-operated industrial trucks designated as EX may be used in such atmospheres.

1910.178(c)(2)(ii)(b)

In atmospheres where dust of magnesium, aluminum or aluminum bronze may be present, fuses, switches, motor controllers, and circuit breakers of trucks shall have enclosures specifically approved for such locations.

1910.178(c)(2)(iii)

Only approved power-operated industrial trucks designated as EX may be used in atmospheres containing acetone, acrylonitrile, alcohol, ammonia, benzene, benzol, butane, ethylene dichloride, gasoline, hexane, lacquer solvent vapors, naphtha, natural gas, propane, propylene, styrene, vinyl acetate, vinyl chloride, or xylenes in quantities sufficient to produce explosive or ignitable mixtures and where such concentrations of these gases or vapors exist continuously, intermittently or periodically under normal operating conditions or may exist frequently because of repair, maintenance operations, leakage, breakdown or faulty operation of equipment.

1910.178(c)(2)(iv)

Power-operated industrial trucks designated as DY, EE, or EX may be used in locations where volatile flammable liquids or flammable gases are handled, processed or used, but in which the hazardous liquids, vapors or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in the case of abnormal operation of equipment; also in locations in which hazardous concentrations of gases or vapors are normally prevented by positive mechanical ventilation but which might become hazardous through failure or abnormal operation of the ventilating equipment; or in locations which are adjacent to Class I, Division 1 locations, and to which hazardous concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clear air, and effective safeguards against ventilation failure are provided.

TABLE N-1. -- SUMMARY TABLE ON USE OF INDUSTRIAL TRUCKS
IN VARIOUS LOCATIONS

Classes	Unclassified	Class I	Class II	Class III
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		locations	locations	locations
Description of classes.	Locations not possessing atmospheres as described in other columns.	Locations in which flammable gases or vapors are, or may be, present in the air in quantities sufficient to produce explosive or ignitable mixtures.	Locations which are hazardous because of the presence of combustible dust.	Locations where easily ignitable fibers or flyings are present but not likely to be in suspension in quantities sufficient to produce ignitable mixtures.

Groups in classes	None	A	B	C	D
Examples of locations or atmospheres in classes and groups.	Piers and wharves inside and outside general storage, general industrial or commercial properties.	Acetylene	Hydrogen	Ethyl ether	Gasoline Naphtha Alcohols Acetone Lacquer solvent Benzene

(Continued)

E	F	G	None
Metal dust	Carbon black coal dust, coke dust	Grain dust, flour dust, starch dust, organic dust.	Baled waste, cocoa fiber, cotton, excelsior, hemp, istle, jute, kapok,

oakum, sisal,
 Spanish moss,
 synthetic fibers,
 tow.

		1	2
Divisions (nature of hazardous conditions)	None	Above condition exists continuously, intermittently, or periodically under normal operating conditions.	Above condition may occur accidentally as due to a puncture of a storage drum.

(Continued)

1	2	1	2
Explosive mixture may be present under normal operating conditions, or where failure of equipment may cause the condition to exist simultaneously with arcing or sparking of electrical equipment, or where dusts of an electrically conducting nature may be present.	Explosive mixture not normally present, but where deposits of dust may cause heat rise in electrical equipment, or where such deposits may be ignited by arcs or sparks from electrical equipment.	Locations in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.	Locations in which easily ignitable fibers are stored or handled (except in the process of manufacture).

Authorized uses of trucks by types in groups of classes and divisions

Groups in classes	None	A	B	C	D	A	B	C
Type of truck authorized:								
Diesel:								
Type D	D** ...	.....	.....	.....	.....	.....	.....	.....
Type DS .....	.....	.....	.....	.....	.....	.....	.....	.....
Type DY .....	.....	.....	.....	.....	.....	.....	.....	.....
Electric:								
Type E	E** ...	.....	.....	.....	.....	.....	.....	.....
Type ES .....	.....	.....	.....	.....	.....	.....	.....	.....
Type EE .....	.....	.....	.....	.....	.....	.....	.....	.....
Type EX .....	.....	.....	.....	.....	EX .	.....	.....	.....
Gasoline:								
Type G	G** ...	.....	.....	.....	.....	.....	.....	.....
Type GS .....	.....	.....	.....	.....	.....	.....	.....	.....
LP-Gas:								
Type LP	LP** ..	.....	.....	.....	.....	.....	.....	.....
Type LPS .....	.....	.....	.....	.....	.....	.....	.....	.....
Paragraph	210.211		201		203		209	
Ref. in			(a)		(a)		(a)	
No. 505.								

(Continued)

Authorized uses of trucks by types in groups of classes and divisions

Groups in classes	D	E	F	G	E	F	G	None	None
Type of truck authorized:									
Diesel:									
Type D .....	.....	.....	.....	.....	.....	.....	.....	.....
Type DS	DS .	.....	.....	.....	.....	.....	DS .	.....	DS
Type DY	DY .	.....	.....	.....	.....	.....	DY .	DY .	DY

Electric:

Type E E
Type ES ES ES
Type EE EE EE
Type EX EX EX

Gasoline:

Type G
Type GS GS GS

LP-Gas:

Type LP
Type LPS LPS LPS

Paragraph	204	202	205	209	206	207	208
Ref. in	(a),	(a)	(a)	(a)	(a),	(a)	(a)
No. 505.	(b)				(b)		

** Trucks conforming to these types may also be used
-- see subdivision (c)(2)(x) and (c)(2)(xii) of this section.

1910.178(c)(2)(v)

In locations used for the storage of hazardous liquids in sealed containers or liquified or compressed gases in containers, approved power-operated industrial trucks designated as DS, ES, GS, or LPS may be used. This classification includes locations where volatile flammable liquids or flammable gases or vapors are used, but which, would become hazardous only in case of an accident or of some unusual operating condition. The quantity of hazardous material that might escape in case of accident, the adequacy of ventilating equipment, the total area involved, and the record of the industry or business with respect to explosions or fires are all factors that should receive consideration in determining whether or not the DS or DY, ES, EE, GS, LPS designated truck possesses sufficient safeguards for the location. Piping without valves, checks, meters and similar devices would not ordinarily be deemed to introduce a hazardous condition even though used for hazardous liquids or gases. Locations used for the storage of hazardous liquids or of liquified or compressed gases in sealed containers would not normally be considered hazardous unless subject to other hazardous conditions also.

1910.178(c)(2)(vi)

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1910.178(c)(2)(vi)(a)

Only approved power operated industrial trucks designated as EX shall be used in atmospheres in which combustible dust is or may be in suspension continuously, intermittently, or periodically under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures, or where mechanical failure or abnormal operation of machinery or equipment might cause such mixtures to be produced.

1910.178(c)(2)(vi)(b)

The EX classification usually includes the working areas of grain handling and storage plants, room containing grinders or pulverizers, cleaners, graders, scalpers, open conveyors or spouts, open bins or hoppers, mixers, or blenders, automatic or hopper scales, packing machinery, elevator heads and boots, stock distributors, dust and stock collectors (except all-metal collectors vented to the outside), and all similar dust producing machinery and equipment in grain processing plants, starch plants, sugar pulverizing plants, malting plants, hay grinding plants, and other occupancies of similar nature; coal

pulverizing plants (except where the pulverizing equipment is essentially dust tight); all working areas where metal dusts and powders are produced, processed, handled, packed, or stored (except in tight containers); and other similar locations where combustible dust may, under normal operating conditions, be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

1910.178(c)(2)(vii)

Only approved power-operated industrial trucks designated as DY, EE, or EX shall be used in atmospheres in which combustible dust will not normally be in suspension in the air or will not be likely to be thrown into suspension by the normal operation of equipment or apparatus in quantities sufficient to produce explosive or ignitable mixtures but where deposits or accumulations of such dust may be ignited by arcs or sparks originating in the truck.

1910.178(c)(2)(viii)

Only approved power-operated industrial trucks designated as DY, EE, or EX shall be used in locations which are hazardous because of the presence of easily ignitable fibers or flyings but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures.

1910.178(c)(2)(ix)

Only approved power-operated industrial trucks designated as DS, DY, ES, EE, EX, GS, or LPS shall be used in locations where easily ignitable fibers are stored or handled, including outside storage, but are not being processed or manufactured. Industrial trucks designated as E, which have been previously used in these locations may be continued in use.

1910.178(c)(2)(x)

On piers and wharves handling general cargo, any approved power-operated industrial truck designated as Type D, E, G, or LP may be used, or trucks which conform to the requirements for these types may be used.

1910.178(c)(2)(xi)

If storage warehouses and outside storage locations are hazardous only the approved power-operated industrial truck specified for such locations in this paragraph (c) (2) shall be used. If not classified as hazardous, any approved power-operated industrial truck designated as Type D, E, G, or LP may be used, or trucks which conform to the requirements for these types may be used.

1910.178(c)(2)(xii)

If general industrial or commercial properties are hazardous, only approved power-operated industrial trucks specified for such locations in this paragraph (c) (2) shall be used. If not classified as hazardous, any approved power-operated industrial truck designated as Type D, E, G, or LP may be used, or trucks which conform to the requirements of these types may be used.

1910.178(d)

Converted industrial trucks. Power-operated industrial trucks that have been originally approved for the use of gasoline for fuel, when converted to the use of liquefied petroleum gas fuel in accordance with paragraph (q) of this section, may be used in those locations where G, GS or LP, and LPS designated trucks have been specified in the preceding paragraphs.

1910.178(e)

Safety guards.

1910.178(e)(1)

High Lift Rider trucks shall be fitted with an overhead guard manufactured in accordance with paragraph (a) (2) of this section, unless operating conditions do not permit.

1910.178(e)(2)

If the type of load presents a hazard, the user shall equip fork trucks with a vertical load backrest extension manufactured in accordance with paragraph (a) (2) of this section.

1910.178(f)

Fuel handling and storage.

1910.178(f)(1)

The storage and handling of liquid fuels such as gasoline and diesel fuel shall be in accordance with NFPA Flammable and Combustible Liquids Code (NFPA No. 30-1969), which is incorporated by reference as specified in Sec. 1910.6.

1910.178(f)(2)

The storage and handling of liquefied petroleum gas fuel shall be in accordance with NFPA Storage and Handling of Liquefied Petroleum Gases (NFPA No. 58-1969), which is incorporated by reference as specified in Sec. 1910.6.

1910.178(g)

Changing and charging storage batteries.

1910.178(g)(1)

Battery charging installations shall be located in areas designated for that purpose.

1910.178(g)(2)

Facilities shall be provided for flushing and neutralizing spilled electrolyte, for fire protection, for protecting charging apparatus from damage by trucks, and for adequate ventilation for dispersal of fumes from gassing batteries.

1910.178(g)(3)

[Reserved]

1910.178(g)(4)

A conveyor, overhead hoist, or equivalent material handling equipment shall be provided for handling batteries.

1910.178(g)(5)

Reinstalled batteries shall be properly positioned and secured in the truck.

1910.178(g)(6)

A carboy tilter or siphon shall be provided for handling electrolyte.

1910.178(g)(7)

When charging batteries, acid shall be poured into water; water shall not be poured into acid.

1910.178(g)(8)

Trucks shall be properly positioned and brake applied before attempting to change or charge batteries.

1910.178(g)(9)

Care shall be taken to assure that vent caps are functioning. The battery (or compartment) cover(s) shall be open to dissipate heat.

1910.178(g)(10)

Smoking shall be prohibited in the charging area.

1910.178(g)(11)

Precautions shall be taken to prevent open flames, sparks, or electric arcs in battery charging areas.

1910.178(g)(12)

Tools and other metallic objects shall be kept away from the top of uncovered batteries.

1910.178(h)

Lighting for operating areas.

1910.178(h)(1)

[Reserved]

1910.178(h)(2)

Where general lighting is less than 2 lumens per square foot, auxiliary directional lighting shall be

provided on the truck.

1910.178(i)

Control of noxious gases and fumes.

1910.178(i)(1)

Concentration levels of carbon monoxide gas created by powered industrial truck operations shall not exceed the levels specified in 1910.1000.

1910.178(j)

Dockboards (bridge plates). See 1910.30(a).

1910.178(k)

Trucks and railroad cars.

1910.178(k)(1)

The brakes of highway trucks shall be set and wheel chocks placed under the rear wheels to prevent the trucks from rolling while they are boarded with powered industrial trucks.

1910.178(k)(2)

Wheel stops or other recognized positive protection shall be provided to prevent railroad cars from moving during loading or unloading operations.

1910.178(k)(3)

Fixed jacks may be necessary to support a semitrailer and prevent upending during the loading or unloading when the trailer is not coupled to a tractor.

1910.178(k)(4)

Positive protection shall be provided to prevent railroad cars from being moved while dockboards or bridge plates are in position.

1910.178(l)

Operator training.

1910.178(l)(1)

Safe operation.

1910.178(l)(1)(i)

The employer shall ensure that each powered industrial truck operator is competent to operate a powered industrial truck safely, as demonstrated by the successful completion of the training and evaluation specified in this paragraph (1).

1910.178(l)(1)(ii)

Prior to permitting an employee to operate a powered industrial truck (except for training purposes), the employer shall ensure that each operator has successfully completed the training required by this paragraph (1), except as permitted by paragraph (1)(5).

1910.178(l)(2)

Training program implementation.

1910.178(l)(2)(i)

Trainees may operate a powered industrial truck only:

1910.178(l)(2)(i)(A)

Under the direct supervision of persons who have the knowledge, training, and experience to train operators and evaluate their competence; and

1910.178(l)(2)(i)(B)

Where such operation does not endanger the trainee or other employees.

1910.178(l)(2)(ii)

Training shall consist of a combination of formal instruction (e.g., lecture, discussion, interactive computer learning, video tape, written material), practical training (demonstrations performed by the

trainer and practical exercises performed by the trainee), and evaluation of the operator's performance in the workplace.

1910.178(l)(2)(iii)

All operator training and evaluation shall be conducted by persons who have the knowledge, training, and experience to train powered industrial truck operators and evaluate their competence.

1910.178(l)(3)

Training program content. Powered industrial truck operators shall receive initial training in the following topics, except in topics which the employer can demonstrate are not applicable to safe operation of the truck in the employer's workplace.

1910.178(l)(3)(i)

Truck-related topics:

1910.178(l)(3)(i)(A)

Operating instructions, warnings, and precautions for the types of truck the operator will be authorized to operate;

1910.178(l)(3)(i)(B)

Differences between the truck and the automobile;

1910.178(l)(3)(i)(C)

Truck controls and instrumentation: where they are located, what they do, and how they work;

1910.178(l)(3)(i)(D)

Engine or motor operation;

1910.178(l)(3)(i)(E)

Steering and maneuvering;

1910.178(l)(3)(i)(F)

Visibility (including restrictions due to loading);

1910.178(l)(3)(i)(G)

Fork and attachment adaptation, operation, and use limitations;

1910.178(l)(3)(i)(H)

Vehicle capacity;

1910.178(l)(3)(i)(I)

Vehicle stability;

1910.178(l)(3)(i)(J)

Any vehicle inspection and maintenance that the operator will be required to perform;

1910.178(l)(3)(i)(K)

Refueling and/or charging and recharging of batteries;

1910.178(l)(3)(i)(L)

Operating limitations;

1910.178(l)(3)(i)(M)

Any other operating instructions, warnings, or precautions listed in the operator's manual for the types of vehicle that the employee is being trained to operate.

1910.178(l)(3)(ii)

Workplace-related topics:

1910.178(l)(3)(ii)(A)

Surface conditions where the vehicle will be operated;

1910.178(l)(3)(ii)(B)

Composition of loads to be carried and load stability;

1910.178(l)(3)(ii)(C)

Load manipulation, stacking, and unstacking;

1910.178(l)(3)(ii)(D)

Pedestrian traffic in areas where the vehicle will be operated;

1910.178(l)(3)(ii)(E)

Narrow aisles and other restricted places where the vehicle will be operated;

1910.178(l)(3)(ii)(F)

Hazardous (classified) locations where the vehicle will be operated;

1910.178(l)(3)(ii)(G)

Ramps and other sloped surfaces that could affect the vehicle's stability;

1910.178(l)(3)(ii)(H)

Closed environments and other areas where insufficient ventilation or poor vehicle maintenance could cause a buildup of carbon monoxide or diesel exhaust;

1910.178(l)(3)(ii)(I)

Other unique or potentially hazardous environmental conditions in the workplace that could affect safe operation.

1910.178(l)(3)(iii)

The requirements of this section.

1910.178(l)(4)

Refresher training and evaluation.

1910.178(l)(4)(i)

Refresher training, including an evaluation of the effectiveness of that training, shall be conducted as required by paragraph (l)(4)(ii) to ensure that the operator has the knowledge and skills needed to operate the powered industrial truck safely.

1910.178(l)(4)(ii)

Refresher training in relevant topics shall be provided to the operator when:

1910.178(l)(4)(ii)(A)

The operator has been observed to operate the vehicle in an unsafe manner;

1910.178(l)(4)(ii)(B)

The operator has been involved in an accident or near-miss incident;

1910.178(l)(4)(ii)(C)

The operator has received an evaluation that reveals that the operator is not operating the truck safely;

1910.178(l)(4)(ii)(D)

The operator is assigned to drive a different type of truck; or

1910.178(l)(4)(ii)(E)

A condition in the workplace changes in a manner that could affect safe operation of the truck.

1910.178(l)(4)(iii)

An evaluation of each powered industrial truck operator's performance shall be conducted at least once every three years.

1910.178(l)(5)

Avoidance of duplicative training. If an operator has previously received training in a topic specified in paragraph (l)(3) of this section, and such training is appropriate to the truck and working conditions encountered, additional training in that topic is not required if the operator has been evaluated and found competent to operate the truck safely.

1910.178(l)(6)

Certification. The employer shall certify that each operator has been trained and evaluated as required by this paragraph (l). The certification shall include the name of the operator, the date of the training, the date

of the evaluation, and the identity of the person(s) performing the training or evaluation.

1910.178(l)(7)

Dates. The employer shall ensure that operators of powered industrial trucks are trained, as appropriate, by the dates shown in the following table.

If the employee was hired:	The initial training and evaluation of that must be completed:
Before December 1, 1999 ...	By December 1, 1999.
After December 1, 1999	Before the employee is assigned to operate a powered industrial truck.

1910.178(l)(8)

Appendix A to this section provides non-mandatory guidance to assist employers in implementing this paragraph (l). This appendix does not add to, alter, or reduce the requirements of this section.

1910.178(m)

Truck operations.

1910.178(m)(1)

Trucks shall not be driven up to anyone standing in front of a bench or other fixed object.

1910.178(m)(2)

No person shall be allowed to stand or pass under the elevated portion of any truck, whether loaded or empty.

1910.178(m)(3)

Unauthorized personnel shall not be permitted to ride on powered industrial trucks. A safe place to ride shall be provided where riding of trucks is authorized.

1910.178(m)(4)

The employer shall prohibit arms or legs from being placed between the uprights of the mast or outside the running lines of the truck.

1910.178(m)(5)

-

1910.178(m)(5)(i)

When a powered industrial truck is left unattended, load engaging means shall be fully lowered, controls shall be neutralized, power shall be shut off, and brakes set. Wheels shall be blocked if the truck is parked on an incline.

1910.178(m)(5)(ii)

A powered industrial truck is unattended when the operator is 25 ft. or more away from the vehicle which remains in his view, or whenever the operator leaves the vehicle and it is not in his view.

1910.178(m)(5)(iii)

When the operator of an industrial truck is dismounted and within 25 ft. of the truck still in his view, the load engaging means shall be fully lowered, controls neutralized, and the brakes set to prevent movement.

1910.178(m)(6)

A safe distance shall be maintained from the edge of ramps or platforms while on any elevated dock, or platform or freight car. Trucks shall not be used for opening or closing freight doors.

1910.178(m)(7)

Brakes shall be set and wheel blocks shall be in place to prevent movement of trucks, trailers, or railroad

cars while loading or unloading. Fixed jacks may be necessary to support a semitrailer during loading or unloading when the trailer is not coupled to a tractor. The flooring of trucks, trailers, and railroad cars shall be checked for breaks and weakness before they are driven onto.

1910.178(m)(8)

There shall be sufficient headroom under overhead installations, lights, pipes, sprinkler system, etc.

1910.178(m)(9)

An overhead guard shall be used as protection against falling objects. It should be noted that an overhead guard is intended to offer protection from the impact of small packages, boxes, bagged material, etc., representative of the job application, but not to withstand the impact of a falling capacity load.

1910.178(m)(10)

A load backrest extension shall be used whenever necessary to minimize the possibility of the load or part of it from falling rearward.

1910.178(m)(11)

Only approved industrial trucks shall be used in hazardous locations.

1910.178(m)(12)

[Removed and Reserved]

1910.178(m)(13)

[Reserved]

1910.178(m)(14)

Fire aisles, access to stairways, and fire equipment shall be kept clear.

1910.178(n)

Traveling.

1910.178(n)(1)

All traffic regulations shall be observed, including authorized plant speed limits. A safe distance shall be maintained approximately three truck lengths from the truck ahead, and the truck shall be kept under control at all times.

1910.178(n)(2)

The right of way shall be yielded to ambulances, fire trucks, or other vehicles in emergency situations.

1910.178(n)(3)

Other trucks traveling in the same direction at intersections, blind spots, or other dangerous locations shall not be passed.

1910.178(n)(4)

The driver shall be required to slow down and sound the horn at cross aisles and other locations where vision is obstructed. If the load being carried obstructs forward view, the driver shall be required to travel with the load trailing.

1910.178(n)(5)

Railroad tracks shall be crossed diagonally wherever possible. Parking closer than 8 feet from the center of railroad tracks is prohibited.

1910.178(n)(6)

The driver shall be required to look in the direction of, and keep a clear view of the path of travel.

1910.178(n)(7)

Grades shall be ascended or descended slowly.

1910.178(n)(7)(i)

When ascending or descending grades in excess of 10 percent, loaded trucks shall be driven with the load upgrade.

1910.178(n)(7)(ii)

[Reserved]

1910.178(n)(7)(iii)

On all grades the load and load engaging means shall be tilted back if applicable, and raised only as far as necessary to clear the road surface.

1910.178(n)(8)

Under all travel conditions the truck shall be operated at a speed that will permit it to be brought to a stop in a safe manner.

1910.178(n)(9)

Stunt driving and horseplay shall not be permitted.

1910.178(n)(10)

The driver shall be required to slow down for wet and slippery floors.

1910.178(n)(11)

Dockboard or bridgeplates, shall be properly secured before they are driven over. Dockboard or bridgeplates shall be driven over carefully and slowly and their rated capacity never exceeded.

1910.178(n)(12)

Elevators shall be approached slowly, and then entered squarely after the elevator car is properly leveled. Once on the elevator, the controls shall be neutralized, power shut off, and the brakes set.

1910.178(n)(13)

Motorized hand trucks must enter elevator or other confined areas with load end forward.

1910.178(n)(14)

Running over loose objects on the roadway surface shall be avoided.

1910.178(n)(15)

While negotiating turns, speed shall be reduced to a safe level by means of turning the hand steering wheel in a smooth, sweeping motion. Except when maneuvering at a very low speed, the hand steering wheel shall be turned at a moderate, even rate.

1910.178(o)

Loading.

1910.178(o)(1)

Only stable or safely arranged loads shall be handled. Caution shall be exercised when handling off-center loads which cannot be centered.

1910.178(o)(2)

Only loads within the rated capacity of the truck shall be handled.

1910.178(o)(3)

The long or high (including multiple-tiered) loads which may affect capacity shall be adjusted.

1910.178(o)(4)

Trucks equipped with attachments shall be operated as partially loaded trucks when not handling a load.

1910.178(o)(5)

A load engaging means shall be placed under the load as far as possible; the mast shall be carefully tilted backward to stabilize the load.

1910.178(o)(6)

Extreme care shall be used when tilting the load forward or backward, particularly when high tiering. Tilting forward with load engaging means elevated shall be prohibited except to pick up a load. An elevated load shall not be tilted forward except when the load is in a deposit position over a rack or stack. When stacking or tiering, only enough backward tilt to stabilize the load shall be used.

1910.178(p)

Operation of the truck.

1910.178(p)(1)

If at any time a powered industrial truck is found to be in need of repair, defective, or in any way unsafe, the truck shall be taken out of service until it has been restored to safe operating condition.

1910.178(p)(2)

Fuel tanks shall not be filled while the engine is running. Spillage shall be avoided.

1910.178(p)(3)

Spillage of oil or fuel shall be carefully washed away or completely evaporated and the fuel tank cap replaced before restarting engine.

1910.178(p)(4)

No truck shall be operated with a leak in the fuel system until the leak has been corrected.

1910.178(p)(5)

Open flames shall not be used for checking electrolyte level in storage batteries or gasoline level in fuel tanks.

1910.178(q)

Maintenance of industrial trucks.

1910.178(q)(1)

Any power-operated industrial truck not in safe operating condition shall be removed from service. All repairs shall be made by authorized personnel.

1910.178(q)(2)

No repairs shall be made in Class I, II, and III locations.

1910.178(q)(3)

Those repairs to the fuel and ignition systems of industrial trucks which involve fire hazards shall be conducted only in locations designated for such repairs.

1910.178(q)(4)

Trucks in need of repairs to the electrical system shall have the battery disconnected prior to such repairs.

1910.178(q)(5)

All parts of any such industrial truck requiring replacement shall be replaced only by parts equivalent as to safety with those used in the original design.

1910.178(q)(6)

Industrial trucks shall not be altered so that the relative positions of the various parts are different from what they were when originally received from the manufacturer, nor shall they be altered either by the addition of extra parts not provided by the manufacturer or by the elimination of any parts, except as provided in paragraph (q)(12) of this section. Additional counterweighting of fork trucks shall not be done unless approved by the truck manufacturer.

1910.178(q)(7)

Industrial trucks shall be examined before being placed in service, and shall not be placed in service if the examination shows any condition adversely affecting the safety of the vehicle. Such examination shall be made at least daily. Where industrial trucks are used on a round-the-clock basis, they shall be examined after each shift. Defects when found shall be immediately reported and corrected.

1910.178(q)(8)

Water mufflers shall be filled daily or as frequently as is necessary to prevent depletion of the supply of water below 75 percent of the filled capacity. Vehicles with mufflers having screens or other parts that may become clogged shall not be operated while such screens or parts are clogged. Any vehicle that emits hazardous sparks or flames from the exhaust system shall immediately be removed from service, and not returned to service until the cause for the emission of such sparks and flames has been eliminated.

1910.178(q)(9)

When the temperature of any part of any truck is found to be in excess of its normal operating temperature, thus creating a hazardous condition, the vehicle shall be removed from service and not returned to service until the cause for such overheating has been eliminated.

1910.178(q)(10)

Industrial trucks shall be kept in a clean condition, free of lint, excess oil, and grease. Noncombustible agents should be used for cleaning trucks. Low flash point (below 100 deg. F.) solvents shall not be used. High flash point (at or above 100 deg. F.) solvents may be used. Precautions regarding toxicity, ventilation, and fire hazard shall be consonant with the agent or solvent used.

1910.178(q)(11)

[Reserved]

1910.178(q)(12)

Industrial trucks originally approved for the use of gasoline for fuel may be converted to liquefied petroleum gas fuel provided the complete conversion results in a truck which embodies the features specified for LP or LPS designated trucks. Such conversion equipment shall be approved. The description of the component parts of this conversion system and the recommended method of installation on specific trucks are contained in the "Listed by Report."

[39 FR 23502, June 27, 1974, as amended at 40 FR 23073, May 28, 1975; 43 FR 49749, Oct. 24, 1978; 49 FR 5322, Feb. 10, 1984; 53 FR 12122, Apr. 12, 1988; 55 FR 32015, Aug. 6, 1990; 61 FR 9227, March 7, 1996; 63 FR 66270, Dec. 1, 1998; 68 FR 32638, June 2, 2003; 71 FR 16672, April 3, 2006]

Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	N
• Subpart Title:	Materials Handling and Storage
• Standard Number:	1910.178 App A
• Title:	Powered industrial trucks.

Appendix A -- Stability of Powered Industrial Trucks (Non-mandatory Appendix to Paragraph (I) of This Section)

A-1. Definitions.

The following definitions help to explain the principle of stability:

Center of gravity is the point on an object at which all of the object's weight is concentrated. For symmetrical loads, the center of gravity is at the middle of the load.

Counterweight is the weight that is built into the truck's basic structure and is used to offset the load's weight and to maximize the vehicle's resistance to tipping over.

Fulcrum is the truck's axis of rotation when it tips over.

Grade is the slope of a surface, which is usually measured as the number of feet of rise or fall over a

hundred foot horizontal distance (the slope is expressed as a percent).

Lateral stability is a truck's resistance to overturning sideways.

Line of action is an imaginary vertical line through an object's center of gravity.

Load center is the horizontal distance from the load's edge (or the fork's or other attachment's vertical face) to the line of action through the load's center of gravity.

Longitudinal stability is the truck's resistance to overturning forward or rearward.

Moment is the product of the object's weight times the distance from a fixed point (usually the fulcrum). In the case of a powered industrial truck, the distance is measured from the point at which the truck will tip over to the object's line of action. The distance is always measured perpendicular to the line of action.

Track is the distance between the wheels on the same axle of the truck.

Wheelbase is the distance between the centerline of the vehicle's front and rear wheels.

A-2. General.

A-2.1. Determining the stability of a powered industrial truck is simple once a few basic principles are understood. There are many factors that contribute to a vehicle's stability: the vehicle's wheelbase, track, and height; the load's weight distribution; and the vehicle's counterweight location (if the vehicle is so equipped).

A-2.2. The "stability triangle," used in most stability discussions, demonstrates stability simply.

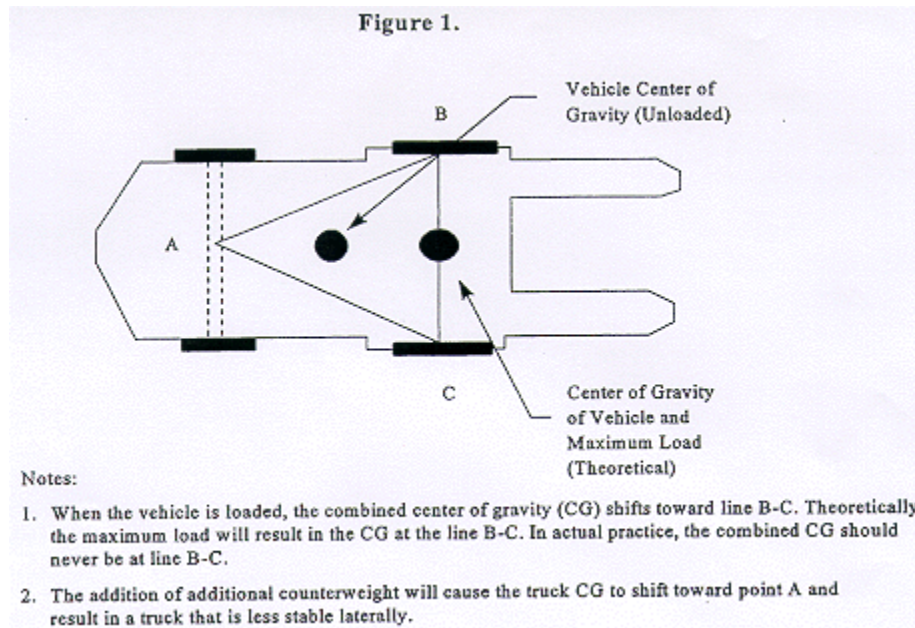
A-3. Basic Principles.

A-3.1. Whether an object is stable depends on the object's moment at one end of a system being greater than, equal to, or smaller than the object's moment at the system's other end. This principle can be seen in the way a see-saw or teeter-totter works: that is, if the product of the load and distance from the fulcrum (moment) is equal to the moment at the device's other end, the device is balanced and it will not move. However, if there is a greater moment at one end of the device, the device will try to move downward at the end with the greater moment.

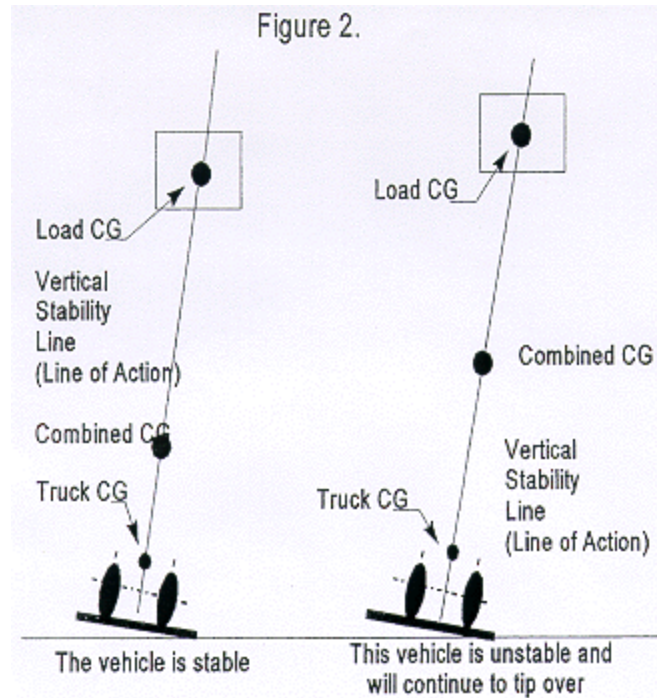
A-3.2. The longitudinal stability of a counterbalanced powered industrial truck depends on the vehicle's moment and the load's moment. In other words, if the mathematic product of the load moment (the distance from the front wheels, the approximate point at which the vehicle would tip forward) to the load's center of gravity times the load's weight is less than the vehicle's moment, the system is balanced and will not tip forward. However, if the load's moment is greater than the vehicle's moment, the greater load-moment will force the truck to tip forward.

A-4. The Stability Triangle.

A-4.1. Almost all counterbalanced powered industrial trucks have a three-point suspension system, that is, the vehicle is supported at three points. This is true even if the vehicle has four wheels. The truck's steer axle is attached to the truck by a pivot pin in the axle's center. When the points are connected with imaginary lines, this three-point support forms a triangle called the stability triangle. Figure 1 depicts the stability triangle.



A-4.2. When the vehicle's line of action, or load center, falls within the stability triangle, the vehicle is stable and will not tip over. However, when the vehicle's line of action or the vehicle/ load combination falls outside the stability triangle, the vehicle is unstable and may tip over. (See Figure 2.)



A-5. Longitudinal Stability.

A-5.1. The axis of rotation when a truck tips forward is the front wheels' points of contact with the pavement. When a powered industrial truck tips forward, the truck will rotate about this line. When a truck is stable, the vehicle-moment must exceed the load-moment. As long as the vehicle-moment is equal to or exceeds the load-moment, the vehicle will not tip over. On the other hand, if the load moment slightly exceeds the vehicle-moment, the truck will begin to tip forward, thereby causing the rear to lose contact with the floor or ground and resulting in loss of steering control. If the load-moment greatly exceeds the vehicle moment, the truck will tip forward.

A-5.2. To determine the maximum safe load-moment, the truck manufacturer normally rates the truck at a maximum load at a given distance from the front face of the forks. The specified distance from the front face of the forks to the line of action of the load is commonly called the load center. Because larger trucks normally handle loads that are physically larger, these vehicles have greater load centers. Trucks with a capacity of 30,000 pounds or less are normally rated at a given load weight at a 24-inch load center. Trucks with a capacity greater than 30,000 pounds are normally rated at a given load weight at a 36- or 48-inch load center. To safely operate the vehicle, the operator should always check the data plate to determine the maximum allowable weight at the rated load center.

A-5.3. Although the true load-moment distance is measured from the front wheels, this distance is greater than the distance from the front face of the forks. Calculating the maximum allowable load-moment using the load-center distance always provides a lower load-moment than the truck was designed to handle. When handling unusual loads, such as those that are larger than 48 inches long (the center of gravity is greater than 24 inches) or that have an offset center of gravity, etc., a maximum allowable load-moment should be calculated and used to determine whether a load can be safely handled. For example, if an operator is operating a 3000 pound capacity truck (with a 24-inch load center), the maximum allowable

load-moment is 72,000 inch-pounds (3,000 times 24). If a load is 60 inches long (30-inch load center), then the maximum that this load can weigh is 2,400 pounds (72,000 divided by 30).

A-6. Lateral Stability.

A-6.1. The vehicle's lateral stability is determined by the line of action's position (a vertical line that passes through the combined vehicle's and load's center of gravity) relative to the stability triangle. When the vehicle is not loaded, the truck's center of gravity location is the only factor to be considered in determining the truck's stability. As long as the line of action of the combined vehicle's and load's center of gravity falls within the stability triangle, the truck is stable and will not tip over. However, if the line of action falls outside the stability triangle, the truck is not stable and may tip over. Refer to Figure 2.

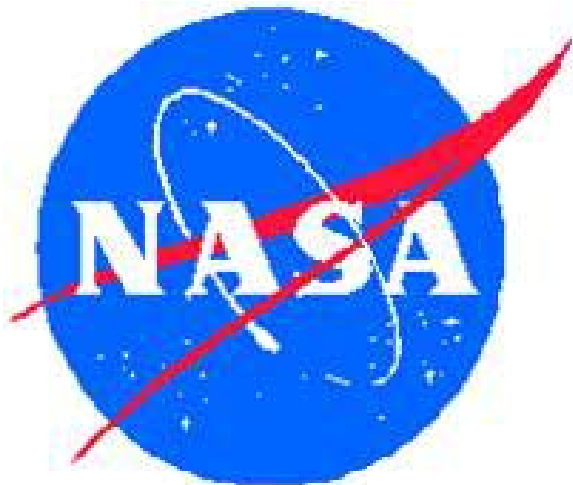
A-6.2. Factors that affect the vehicle's lateral stability include the load's placement on the truck, the height of the load above the surface on which the vehicle is operating, and the vehicle's degree of lean.

A-7. Dynamic Stability.

A-7.1. Up to this point, the stability of a powered industrial truck has been discussed without considering the dynamic forces that result when the vehicle and load are put into motion. The weight's transfer and the resultant shift in the center of gravity due to the dynamic forces created when the machine is moving, braking, cornering, lifting, tilting, and lowering loads, etc., are important stability considerations.

A-7.2. When determining whether a load can be safely handled, the operator should exercise extra caution when handling loads that cause the vehicle to approach its maximum design characteristics. For example, if an operator must handle a maximum load, the load should be carried at the lowest position possible, the truck should be accelerated slowly and evenly, and the forks should be tilted forward cautiously. However, no precise rules can be formulated to cover all of these eventualities.

Goddard Procedural Requirement GPR 8719.1B Certification and Recertification of Lifting Devices and Equipment and Its Operators





Goddard Procedural Requirements (GPR)

DIRECTIVE NO. GPR 8719.1B **APPROVED BY Signature:** Original Signed By
EFFECTIVE DATE: May 29, 2012 **NAME:** Dennis Andrucyk
EXPIRATION DATE: May 29, 2017 **TITLE:** Director of AETD

COMPLIANCE IS MANDATORY

Responsible Office: 540/Mechanical Systems Division

Title: Certification of Lifting Device Equipment and Its Operators

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1.2 RECERT Manager

1.3 Deputy RECERT Manager/WFF

1.4 LDE Owners and/or Division Offices

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CHECK THE GSFC DIRECTIVES MANAGEMENT SYSTEM AT
<http://gdms.gsfc.nasa.gov> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

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- 5.1 Center LDEC
- 5.2 LDEC Chairperson
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- 5.5 Committee Members

Table 1 Load Test Requirements for New, Repaired, or Modified LDs

Appendix A DEFINITIONS

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PREFACE

P.1 PURPOSE

This directive implements the requirements of NASA Standard 8719.9 “Standard for Lifting Devices and Equipment” for the GSFC Recertification Program (RECERT) in providing Center organizations with frequent and periodic inspection, certification, and recertification of lifting devices and equipment (LDE). Requirements are established for LDE Operators of cranes, mobile aerial platforms (MAP), and powered industrial trucks (PIT), and Critical Lift Coordinator (CLC) training and certification. This Center program improves safety, and minimizes or prevents potential personnel injury or fatality, and damage or loss of hardware and facilities.

This directive is not a substitute for applicable Occupational Safety and Health Administration (OSHA) and national consensus codes and standards (NCS) requirements. OSHA and NCS requirements apply to all GSFC LDE, LDE Operators, and their respective operations.

P.2 APPLICABILITY

- a. This directive is applicable to all LDE at Greenbelt, Wallops Flight Facility (WFF), and other areas under GSFC cognizance, regardless of ownership, that are operated or used by NASA employees or GSFC support services contractors, to the extent required in their respective contracts, unless specifically excluded by this directive or by the RECERT Manager.
- b. When invoked as a contractual requirement by a project, this directive is applicable to the extent specified in the contract for off-site contractor installations supporting GSFC activities.
- c. Lifting operations under privatization clauses shall be subjected to the provisions of this directive to the extent provided by the contract, and the requirements shall be clearly specified therein.
- d. The responsible Contracting Officer and the Project Manager shall apply requirements of this directive to any contractor, tenant, or customer if non-NASA lifting operations place NASA personnel, facilities, or equipment at risk through incorporation into their respective contracts.

P.3 AUTHORITIES

NASA-STD-8719.9, Standard for Lifting Devices and Equipment

P.4 APPLICABLE DOCUMENTS

The references as listed within the NASA-STD 8719.9 are applicable:

- a. 29 CFR 1926.1400, OSHA, Cranes & Derricks in Construction
- b. 29 CFR 1910, Occupational Safety and Health Standards
- c. NASA-STD 1800.1, NASA Occupational Health Program Procedures

- d. NASA-STD-8709.20. Management of Safety and Mission Assurance Technical Authority (SMATAA) Requirements
- e. NASA-STD 8709.22, Safety and Mission Assurance Acronyms, Abbreviations, and Definitions
- f. GPR 1400.1, Waiver Processing
- g. GPR 1700.5 Control of Hazardous Energy (Lockout/Tagout)
- h. GPR 3410.2I, Employee Task-Specific, Required and Mandatory Training Requirements
- i. GPR 8621.4, Mishap Preparedness and Contingency Plan
- j. GPR 8715.3 Fall Protection Requirements for GSFC
- k. GPR 8834.1, Lifting Operations Requirements
- l. 540-WI-8719.1.3, Sample Lifting Device Inspection Forms
- m. ASME PALD, Safety Standard for Portable Automotive Lifting Devices
- n. ASME B30 Safety Standards for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings

P.5 CANCELLATION

GPR 8719.1A, Certification and Recertification of Lifting Devices and Equipment and its Operators

P.6 SAFETY

Detailed safety requirements are contained in applicable test and inspection procedure.

P.7 TRAINING

Training requirements are specified in Section 3.

P.8 RECORDS

Record Title	Record Custodian	Retention
Test & Inspection Reports for: <ul style="list-style-type: none"> ▪ LDE 	RECERT Manager at Greenbelt, Deputy RECERT Manager at WFF	Permanent – pending approval of record schedule. *NRRS 8/56.5A
Operator Certifications: <ul style="list-style-type: none"> ▪ LDE ▪ CLC 	RECERT Manager at Greenbelt, Deputy RECERT Manager at WFF	*NRRS 3/33G Destroy 5 years after separation of employee or when no longer needed.
Jack Operator Training	Operator Supervisor	*NRRS 3/33G Destroy 5 years after separation of employee or when no longer needed.
Completed Daily Checklists	Property Custodian	Permanent. NRRS 8/56.5D
RECERT documentation	RECERT Manager	*NRRS 3/33G
Safety Analysis	Property Custodian	Permanent. NRRS 8/56.5D
LDEC Meeting Minutes	RECERT Manager	Permanent. *NRRS 1/14B (1) (a)

DIRECTIVE NO. GPR 8719.1B
EFFECTIVE DATE: _____
EXPIRATION DATE: _____

		Retire to FRC when 2 years old. Transfer to NARA when 20 years old.
GSFC 17-112, Employee Task-Specific Training Requirement for civil servant employees	Supervisor	Permanent – Maintained in the Employee Performance File in the IDP/Training Related Information section on the right side.

*NRRS – NASA Records Retention Schedules (NPR 1441.1)

P.9 MEASUREMENT/VERIFICATION

The RECERT Manager shall document the percentage of scheduled test and inspections completed, and the pass/fail percentage of LDE.

PROCEDURES

In this document, a requirement is identified by “shall,” a good practice by “should,” permission by “may” or “can,” expectation by “will” and descriptive material by “is.”

1. Responsibilities

1.1 Center Director appoints the RECERT Manager and Deputy RECERT Manager/WFF for LDE.

1.2 RECERT Manager shall

- a. Maintain overall responsibility for the management, implementation, and enforcement of the Center’s LDE Program;
- b. Provide direction to the Deputy RECERT Manager;
- c. Tasks the RECERT Support Contractor in the maintenance of Section 1.2 of this directive;
- d. Serve as the GSFC interface with NASA Headquarters (HQ) and other NASA Centers on matters pertaining to LDE;
- e. Serve as the GSFC representative on the NASA LDE committee;
- f. Chair the Center LDE Committee;
- g. Serve as the Certifying Authority for the certification and recertification of LDE to which this directive is applicable;
- h. Serve as the final authority on interpretation of, and compliance with, this directive and its references;
- i. Establish and maintain a system for periodic inspection of LDE including review of logbooks, daily inspection forms, identification of deficiencies, and completion of corrective actions;
- j. Ensure that certification and/or recertification tests and inspections are performed by personnel properly trained and qualified in accordance with applicable codes and standards;

- k. Provide consultation to the center for design, specification, testing, maintenance, operation, and modification of LDE to owners and operators;
- l. Approve the re-rating of LDs;
- m. Review and concur/non-concur with waiver requests per GPR 1400.1;
- n. Review and concur/non-concur with specifications prior to procurement of LDs;
- o. Establish and maintain a RECERT configuration management system for LDE;
- p. Review, approve, and monitor the training courses for qualifying LDE Operators, and define their training and retraining requirements;
- q. Certify and recertify LDE Operators;
- r. Perform compliance spot checks of LDE Operators to ensure that the requirements of this GPR are being followed;
- s. Provide Division Offices with an inventory of Division LDs for review and update, when requested;
- t. Coordinate with affected Center safety offices on issues of mutual interest;
- u. Coordinates with the Office of Human Capital Management (OHCM) to ensure all RECERT training classes are entered in SATERN at least 30 days prior to the start of each class.
- v. Notify supervisors of training and certification requirements for civil servant employees to be documented on the GSFC 17-112, Employee Task-Specific Training Requirements Form
- w. Maintain oversight, for safety and compliance, of all Lifting Devices, including mobile cranes brought onsite, for lifting, setting and delivering equipment to center; and
- x. Review the use of lifting equipment (slings, strong-backs, etc.) brought onsite to support the lifting device operations delineated in item u, above.

1.3 Deputy RECERT Manager/WFF

The Deputy RECERT Manager shall serve as the RECERT Manager's alternate and represent the RECERT Manager at WFF for day-to-day operations by performing duties in Section 1.2.

1.4 LDE Owners and/or Division Offices shall

- a. Ensure documented compliance to this directive by maintaining records of LDE and the Operators;
- b. Submit LDE specifications to the RECERT Manager for review and concurrence prior to purchase;
- c. Ensure that LDEs are certified by the RECERT Manager prior to use;
- d. Provide resources for training and ensure that LDE operators are certified;
- e. Ensure that LDE for which the division is responsible is appropriately certified for critical or noncritical lifts, and notify RECERT, as required by NASA-STD 8719.9;
- f. Determine the appropriate LD usage category, i.e., Active, Standby, or Idle; and classification, i.e., Critical or Noncritical, based on current and projected operational requirements;
- g. Maintain a current inventory of LDE (including slings, shackles, turnbuckles, D-rings, load measuring devices, and other LE) owned and operated by the division;
- h. Manage and control uncertified or expired LDE to preclude inadvertent use;
- i. Request that RECERT perform certification of new or transferred LDE from offsite locations prior to their use;

- j. Notify the RECERT Manager immediately of all LDE deficiencies and failures, and initiate the appropriate Incident/Mishap Report in accordance with GPR 8621.4;
- k. Initiate repair for LDE deficiencies found during OSHA and NASA-STD 8719.9 required tests and inspections;
- l. Ensure that Original Equipment Manufacturer (OEM)-recommended maintenance is performed on LDE and that the daily checklist conforms with the OEM;
- m. Submit requirements to the appropriate budget to bring Division LDE into compliance with this directive;
- n. Maintain responsibility for day-to-day operations of LDE under their cognizance;
- o. Coordinate outages for load testing and inspections of inventoried LDE with RECERT to minimize conflicts with ongoing operations;
- p. Notify RECERT of any LDE that is removed from service or any change in use status per Section 2.3.2 of this directive;
- q. Perform daily LDE inspections and document such inspections on the Daily Checklist;
- r. Establish administrative controls over their LDE to preclude unauthorized operation. Such controls may include administratively controlling access to areas in which LDE are located, or administratively locking out LDE to all but authorized users by using GSFC Administrative locking procedures as defined in GPR 1700.5;
- s. Require civil servant supervisors to document task-specific training requirements on the GSFC 17-112, Employee Task-Specific Training Requirements Form for civil servant employees as required by GPR 3410.2;
- t. Notify RECERT Manager when rented or leased equipment is brought on center; and
- u. Review and document operator training of Overhead Crane, Mobile Crane, MAP, and PIT assigned to the division on an annual basis and submit to RECERT manager for review.

1.5 Occupational Safety and Health Division/Code 350 and Wallops Safety Office/Code 803 shall:

- a. Notify RECERT Manager if construction activities are not in compliance with OSHA (as it relates to LDE) and NASA-STD 8719.9 requirements.
- b. Provide comments on construction lift plans as requested by the RECERT Manager.

1.6 Medical and Environmental Management Division/Code 250

Shall provide medical expertise via the Medical Director to establish LDE operator medical examination criteria using applicable NASA and American National Standards Institute requirements.

1.7 Facilities Management Division (FMD)

FMD shall notify, in writing, the RECERT Manager of any planned LDE acquisition, installation, upgrade, and/or removal as part of a FMD facilities project. To ensure compliance and certifiability, all LDE designs and specifications shall be supplied to the RECERT Manager for review and approval prior to contract implementation. Assure that mobile cranes coming on center for facility construction

comply with OSHA 1926.1400. Notify the RECERT Manager and Safety (Code 350/803) of any construction activities requiring the use of a leased/rented LDE.

1.8 Office of Human Capital Management (OHCM)

- a. Coordinate with RECERT Manager to document training offerings in SATERN;
- b. Coordinate with RECERT Manager in approving participants in SATERN;
- c. Provide RECERT manager official training roster for each training offered; and
- d. Update SATERN to ensure civil servant participants receive training credit and it is properly recorded in their learning history

1.9 Certified Crane Operators shall

- a. Ensure that the load is properly and safely rigged;
- b. Verify the GSFC RECERT certification status of the LDE is current before commencing lifting operations (using uncertified LDE is a violation of Center policy);
- c. Perform crane daily inspections and tests in accordance with RECERT approved procedures;
- d. Perform LE inspection before use;
- e. Provide entry in the LD (including Hydra-set) log book for all inspections, tests, and operations; and
- f. Perform LDE lock out procedures in accordance with GSFC Administrative locking procedures as defined in GPR 1700.5, if any deficiencies are observed and immediately enter the deficiencies into the log book, and notify the RECERT Manager; and
- g. Have the final approval on the lift. If the Crane Operator is not comfortable or satisfied that all aspects are correct or complete prior to the lift, the Crane Operator does not have to perform the lift, and shall contact the RECERT manager immediately.

1.10 Certified Critical Lift Coordinators (CLC)

Certified CLC's may be responsible for directing and giving commands to the Crane Operator during a lifting operation if so designated in the Critical Lift Procedure. If the CLC is in charge of the lifting operation, they shall, in a pre-lift briefing, instruct personnel in the proper preparation, rigging, lifting, and final positioning of the load. Coordination for directing the lifting operation shall be delineated in the Critical Lift Procedure and re-emphasized in the pre-lift briefing. A CLC shall not perform rigging activities or hands-on operation of LDs.

1.11 Certified MAP and PIT Operators and Authorized Jack (Critical) Operators shall

- a. Verify the GSFC RECERT certification status of equipment is current before commencing operations (using uncertified LDE is a violation of Center policy);
- b. Perform daily inspection in accordance with daily checklist before operation;
- c. Provide entries in the equipment log book for all inspections, tests, and operations; and
- d. If any deficiencies are observed, lock out the equipment using GSFC Administrative locking procedures as defined in GPR 1700.5, immediately enter the deficiencies into the log book, and notify the RECERT Manager.

2. Equipment Requirements

2.1 Types and Traceability

2.1.1 Items Subject to RECERT. The following items are included in the RECERT Program and shall be subjected to formal certification and recertification. Other items may be included if deemed necessary by the RECERT Manager.

- Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist, and Jib Cranes)
- Mobile Cranes**
- Base Mounted Drum Hoists
- Monorails and Under hung Cranes and Hoists
- Manually Operated Level Hoists
- Special Hoist-Supported Personnel Lifting Devices
- Hydra-sets
- Crane Hooks
- Wire Rope Slings
- Alloy Steel Chain Slings
- Metal Mesh Slings
- Synthetic Slings
- Structural Slings
- Lifting assemblies
- Shackles, Turnbuckles, Swivel Joints, Connecting Links, and other lifting hardware components
- Load Measuring Devices*
- MAPs including Attachments
- PITs including Fork Extensions and Attachments
- Jacks
- Shop cranes (Portable Automotive Lifting Devices)

***Load Measuring Devices are verified by RECERT for structural integrity in the load path. Calibration of these devices shall be the owner's responsibility.**

**** Mobile cranes used strictly for construction activities are exempt from meeting GSFC RECERT requirements but must meet OSHA requirements.**

2.1.2 Traceability to Original Equipment Manufacturer (OEM).

- a. All LE hardware components shall be traceable to a credible source of information, such as OEM for certifiability.
- b. Fork extensions and attachments to PITs that affect capacity and/or stability shall be OEM equipment; or approved by the OEM in writing for its design and fabrication. In all cases, a tag or notice shall be affixed to the equipment clearly showing the new CG and capacity restrictions.

- c. All LDE shall be used consistent with their intended purpose per OEM recommendations. The use of LDE that is contrary to OEM instructions or recommendations is not permitted, unless approved by the RECERT manager and complies with the applicable ASME/ANSI B30 series documents.

2.2 LDE Certification and Safety Analyses

2.2.1 LDE Certification

- a. LDE shall be certified, before first use, by the RECERT Manager based upon verification and acceptance of design safety factor, load testing, and nondestructive testing reports, if applicable, and by compliance with NASA-STD-8719.9 and this directive. It shall then be recertified thereafter in accordance with NASA-STD-8719.9 and this directive.
- b. The RECERT Manager shall re-certify altered LDE assemblies as a system unless specifically exempted by a safety variance reviewed and approved in accordance with Section 4 of this directive. Alteration includes the extension, modification, addition, replacement, or deletion of components to the original certified configuration . All components comprising a critical LE assembly shall be uniquely identified and controlled, and should not be interchanged for use elsewhere. Replacement by identical, individually certified and tagged components of equal or greater load rating is permissible without having to recertify the LE assembly.
- c. The RECERT Manger may authorize the applicable contractor organization to perform LDE test and inspections at Government Owned, Contractor Operated facilities by the applicable contractor organization provided the contractor has a test and inspection plan satisfactorily addressing GSFC requirements, including personnel qualifications, and the contractor’s plan has been reviewed and approved by the RECERT Manager.
- d. Owners and/or divisions responsible for LDE shall forward copies of all LDE test and inspection reports, including those for applicable off-site operations and applicable contractor installations, shall be forwarded to the RECERT Manager for annual re-certification and record keeping.

2.2.2 LDE Safety Analyses

- a. A recognized Safety Analysis, such as a Fault Tree Analysis, a Failure Modes and Effects Analysis, or an Operating and Support Hazard Analysis shall be performed by the owning organization on critical LDE’s (including jacks, as defined in NASA-STD-8719.9). The critical or non-critical category determination shall be performed in accordance with Appendix C of GPR 8834.1, Lifting Operations Requirements. The analysis shall, as a minimum, determine potential sources of danger, identify failure modes, and recommend resolutions and a system of risk acceptance for those conditions that could cause loss of life, personal injury, and loss of or damage to the equipment, facility, or load.
- b. Safety Analyses shall be reviewed and approved by the RECERT Manager.

2.3 Operational Requirements

2.3.1 Criticality Determination. The owning organizations shall specify the category of operations to be performed by their LDE, i.e., critical or noncritical, so that the RECERT Manager may provide the requisite compliance requirements for the LDE. Appendix C of GPR 8834.1 must be completed, submitted, and approved by the RECERT Manager, for non-critical lifts that are non-institutional by nature.

2.3.2 LD (except MPJ) Inspection Requirements. Inspection requirements are based on the usage categories of LDs. “Daily” inspection requirements are generated by the LD owner. “Frequent” or “Periodic” inspections are defined in RECERT approved procedures.

2.3.2.1 Active LDs – These are devices that are available for unlimited daily use and:

- The Certified LDE Operator shall perform, prior to initial use, Daily Inspections and limit switch tests and record entry in the logbook in accordance with RECERT approved procedures.
- RECERT Frequent Inspections shall be performed at monthly intervals in accordance with NASA-STD 8719.9.
- RECERT Periodic Inspections for recertification shall be performed once a year in accordance with NASA-STD 8719.9.

2.3.2.2 Standby LDs – These devices are to be secured from use by using GSFC Administrative locking procedures as defined in GPR 1700.5 and operation shall be resumed only after an inspection by RECERT that allows unlimited use for a 1-month period as an Active LD. After that the LD shall be secured again. Additionally:

- RECERT Frequent Inspections shall be performed at 6-month intervals.
- RECERT Periodic Inspections shall be performed once a year in accordance with NASA-STD 8719.9.

2.3.2.3 Idle LDs: – These devices are to be secured from use by using GSFC Administrative locking procedures as defined in GPR 1700.5 and there is no planned use of the LD for the next 12 months. When LDs are idle more than 6 months, the LD shall be recertified prior to use. Additionally:

- RECERT tests and inspections are not required during an idle period.
- RECERT shall perform required tests and inspections prior to returning the LD to service.

2.3.3 Re-rating

Owner organizations may request that RECERT re-rate their LDs. Re-rating of LDs and the subsequent recertification shall be accomplished as follows:

- a. Engineering analyses shall be performed in accordance with OSHA, NASA, and NCS requirements to validate that the LD can be used at the new re-rated load. Building structural support system(s)

shall also be validated in terms of the new re-rated load. Re-rating resulting in higher equipment capacity shall require RECERT Manager's approval prior to modification.

- b. Certify the LD and clearly display re-rated capacity with a tag or marking.

2.3.4 Transfer of LDE

- a. LDE and associated certification documentation transferred to GSFC shall be reviewed for certification by the RECERT Manager.
- b. Certification documentation shall accompany LDE permanently transferred from GSFC to other locations.

2.3.5 LDE (Re) Certification Tagging

Tags shall indicate the (re)certification and NDT, if applicable, status of all LDE. The tagging shall be done in accordance with a Work Instruction(s) describing the tags for each application. Unless indicated, all LDE tags shall expire on the last day of the month, one year from the month in which the tag was issued.

- a. One load test tag (re)certification is applied to an assembly where the individual items are color-coded, tethered, or otherwise controlled as an assembly, and there are no plans to disassemble the assembly or to rearrange the configuration. The assembly is load tested as a unit with each item being individually NDT, if applicable, inspected and tagged as such.
- b. Load test (re)certification tags are applied to each component for an assembly that will be disassembled and where the individual items are not color-coded, tethered, or otherwise controlled as an assembly. The assembly may be load tested as a unit or each component load tested individually with each item being individually NDT, if applicable, inspected and tagged as such.
- c. One load test (re)certification tag per configuration is applied to an assembly where the configuration will be rearranged. The assembly is load tested in all applicable configurations with each item being individually NDT, if applicable, inspected and tagged as such. Note that there may be variations in the number of tags depending upon the similarities among the different configurations.
- d. For loose, individual components, each component is load test (re)certification tagged and NDT, if applicable, inspected and tagged.

2.4 LDE Testing

2.4.1 Load Testing

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New or modified LDs and MPJ shall be proof load tested in accordance with Table 1 and in accordance with NASA Standard 8719.9. For periodic recertification, LDs shall be tested to 100% of their rated load. New or modified LE shall be tested in accordance with NASA Standard 8719.9

Certified test weights or calibrated load cells and test equipment shall be used for all LDE load-testing activities.

2.4.2 Nondestructive Testing (NDT)

NDT shall be performed in accordance with NASA Standard 8719.9.

3. Personnel Qualification and Certification Requirements

3.1 Personnel Performing NDT

Personnel performing NDT shall meet the requirements of NASA Standard 8719.9.

3.2 Crane Operators

3.2.1 Crane Operator Certification Requirements

All Crane Operator candidates shall obtain formal training in LD operations and rigging as specified in NASA-STD-8719.9. Formal training may be available through the GSFC RECERT Program and other recognized sources and includes classroom instructions, written examination, and hands-on proficiency demonstration. The RECERT Manager shall evaluate and determine the acceptability of the syllabus of all training courses for which Operator candidates claim credit. In addition, all Crane Operator candidates shall pass the RECERT written examination and an applicable medical examination (in accordance with NASA-Standard 1800.1). The following training course topics shall be included as a minimum:

- a. NASA-specific requirements
- b. GSFC-specific requirements
- c. Safe rigging procedures
- d. Safe crane operations
- e. Safety and emergency procedures
- f. General performance standards
- g. Pre-operational checks
- h. Safety-related defects and symptoms
- i. Specific hazards
- j. Special procedures associated with critical lifts (critical lift operator training only)
- k. Use of standard hand signals
- l. Lessons learned

Upon successful completion of the required training, the certification records are updated and an individual license will be issued, or in some instances a roster of Certified Crane Operators, is prepared. The licenses or the Operator roster shall be signed by the RECERT Manager and issued to the Operator, or, in the case of the Operator roster, to the appropriate supervisory personnel. It is the crane Operator's responsibility to notify the RECERT Manager prior to expiration.

3.2.2 Categories of Crane Operator Licenses.

There are three categories of Crane Operator Permits and Licenses:

- a. **Apprentice Permit:** Apprentice permits are typically issued with a required 40 hours of noncritical lift operation (minimum 20 hours Hands-On Crane Operation) and rigging to be attained under the direction of a licensed Crane Operator. Both the licensed operator and the candidate's supervisor shall attest to the attainment of these hours. On a case-by-case basis, for candidates with prior crane operation experience seeking GSFC Operator certification, the 40 hour apprenticeship requirement may be adjusted at the discretion of the RECERT Manager based on the recommendation of the trainer. The candidate shall complete the required hours of operation within 24 months from the Apprentice Permit issuance to prevent expiration of the Apprentice Permit. Upon completion of the required hours and attendance at a Noncritical Lift Crane Operator refresher class, the apprentice will be certified as a Noncritical Lift Crane Operator.
- b. **Noncritical Lift Crane Operator License:** This license authorizes the Operator to use only the types of Cranes and Hoists listed thereon, and rigging for noncritical lifts only. Noncritical operators are not permitted to use Hydra-sets, unless permitted by the RECERT manager.
- c. **Critical Lift Crane Operator License:** This license authorizes the operator to use Cranes and Hoists and rig for both noncritical and critical lifts, including Hydra-sets. The prerequisite for obtaining a Critical Lift Crane Operator License is that the candidate possesses a Noncritical Lift Crane Operator License and completes 40 hours of critical lift operation (minimum 20 hours Hands-On Crane Operation) and rigging under the direction of a licensed Critical Lift Crane Operator. Upon completion of the required 40 hours and attendance at a Critical Lift Crane Operator class, the Operator will be certified as a Critical Lift Crane Operator. Exceptions to the prerequisite may be reviewed and granted by the RECERT Manager on a case-by-case basis.

3.2.3 Crane Operator Recertification

All Certified Crane Operators shall be recertified and a new license issued based on providing evidence of completion of refresher training, including written examination and hands-on training. A new license will be issued to the Operator, or the Operator roster will be updated and sent to the appropriate supervisory personnel.

Critical and Noncritical Lift Crane Operators shall recertify every two years and provide evidence of successfully completing a medical examination in accordance with NASA Standard 1800.1.

3.3 Requirements for MAP and PIT Operator Certification and Jack Operator Authorization

3.3.1 MAP and PIT Operator Certification Requirements.

All MAP and PIT Operator candidates shall obtain formal training as specified in NASA-STD-8719.9. Formal training may be available through the GSFC RECERT Program or the RECERT Manager may evaluate and determine the acceptability of the syllabus of all training courses for which Operator candidates claim credit. In addition, all MAP and PIT Operator candidates shall pass a written exam, hands on proficiency demonstration, and the applicable medical examination per NASA-STD 1800.1. For MAP operator certification, the candidate must provide proof of successful completion of fall protection training in accordance with GPR 8715.8. A written RECERT exam shall be given to verify the adequacy of the commercial training that the operator candidate claims credit. The following training course topics shall be included as a minimum:

- a. NASA-specific requirements
- b. GSFC-specific requirements
- c. Safe operations
- d. Safety and emergency procedures
- e. General performance standards
- f. Pre-operational checks
- g. Safety-related defects and symptoms
- h. Specific hazards
- i. Lessons learned

Upon successful completion of the required training, the certification records are updated and an individual license, or in some instances a roster of Certified MAP or PIT Operators is prepared. The licenses or the Operator roster shall be signed by the RECERT Manager and issued to the Operator, or, in the case of the Operator roster, to the appropriate supervisory personnel.

3.3.2 Jack Operator Authorization.

Operators of jacks shall be instructed in their proper use per NASA-STD-8719.9 and shall be designated and authorized to operate by their supervisor. The supervisor shall be responsible for retaining documentation of this training.

3.3.3 MAP and PIT Operator Recertification

All Certified MAP and PIT Operators shall be recertified every two years by providing evidence of completion of refresher training, including written examination and hands-on training. Evidence of completing a satisfactory medical examination shall be provided to the RECERT Manager every two years. For MAP operator certification, the candidate must provide proof of successful fall protection refresher training in accordance with GPR 8715.8. A new license will be issued to the Operator, or, in the case of the Operator roster update, to appropriate supervisory personnel.

3.4 Critical Lift Coordinators

3.4.1 CLC Certification Requirements

All CLC candidates shall attend a classroom training session equivalent to the training for critical lift crane operators (reference Section 3.2.1). All CLC candidates shall pass a written examination equivalent to that for critical lift operator certification but are excluded from hands-on proficiency demonstration and the medical examination requirement. Upon successful completion of CLC training and written examination requirements, the RECERT Manager shall certify CLC's by issuance of a signed license or a signed roster.

3.4.2 CLC Recertification

Recertification shall be granted upon successful completion of refresher training and applicable examinations every two years.

3.5 Reciprocity with Licensing Authorities.

At the RECERT Manager's discretion, a temporary Crane, MAP, or PIT Operator License may be issued to personnel on temporary assignment to GSFC provided that the candidate:

- a. Possesses a valid Crane, MAP, or PIT operator license or equivalent issued by another Licensing Authority in compliance with requirements contained in NASA-STD-8719.9; and
- b. The candidate's license or equivalent remains valid for the duration of the candidate's assignment at GSFC.

Temporary Crane, MAP, or PIT Operator Licenses will be valid for the duration of the candidate's assignment at GSFC, but shall not exceed 90 days. Thereafter, a GSFC Crane, MAP, or PIT Operator License will be required.

3.6 License Revocation

The RECERT Manager may revoke Crane Operator Licenses, CLC Licenses, MAP Operator Licenses, or PIT Operator Licenses for any of the following reasons:

- a. Recommendations by an appointed panel of inquiry or Mishap Investigation Board.
- b. Violations of, or noncompliance with, any of the safety requirements in the documented procedures.
- c. Failure of supervisor providing annual documentation on reviewing of training per Section 1.4 of this document.
- d. Failure to meet RECERT-required refresher training or medical examination requirements.

Revoked Operator Licenses shall be returned to the RECERT Manager within 3 business days, and may be reinstated upon satisfactory completion of applicable refresher training or other remedial action

deemed appropriate by the RECERT Manager. License extensions may be granted up to but not exceeding 30 days to allow for project demands and class scheduling flexibility. To be eligible for a license extension the operator must request the extension prior to the expiration date of the license and have a current medical examination. Extensions will not be granted if the license or medical examination has expired.

4. Waivers

- a. Waivers to the requirements of this directive shall be prepared and approved as outlined in NASA-STD 8709.20 and GPR 1400.1 prior to operation.
- b. If a mandatory requirement of this directive cannot be met, a detailed waiver request package shall be prepared by the requesting organization in accordance with NASA-STD 8709.20 and GPR 1400.1. The waiver request package shall be reviewed and the risk accepted by the initiating Division Office and forwarded to the RECERT Manager for review and concurrence/non concurrence.
- c. The RECERT Manager will submit the waiver request package to other authorities as stipulated in GPR 1400.1. Waiver requests approved by the Center shall be forwarded to NASA HQ within 14 days.

5. LDE Committee

5.1 A Center LDE Committee (LDEC) shall be established by the RECERT Manager via the Goddard Safety Committee (GSC) to ensure that LDE governing standards are understood and applied across all organizational elements at GSFC. In addition, the LDEC shall resolve LDE-related issues and provide a forum to exchange information. The RECERT Manager shall serve as the Chairperson of the Committee. The Deputy RECERT Manager/WFF shall serve as the Vice Chairperson of the Committee.

5.2 The LDEC Chairperson shall:

- a. Accept appointees from the Directorates as Committee Members.
- b. Include representatives from organizations conducting or having an interest in lifting operations.
- c. Establish the Committee meeting schedule.
- d. Conduct quarterly meetings, or more frequently as required.
- e. Appoint an Executive Secretary for the Committee.
- f. Report as required to the GSC regarding the activities of the Committee.

5.3 The Vice Chairperson shall:

- a. Chair the Committee meeting in the absence of the Chairperson.
- b. Report as required to the WFF Executive Safety Council regarding the activities of the Committee.

5.4 The Executive Secretary shall:

- a. Assist the Chairperson in preparing and distributing meeting agenda, minutes, and related materials.
- b. Assist the Chairperson in coordinating Committee-related activities.

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- c. Track action items and their status.
- d. Maintain meeting minutes and make available for review by management and safety and health offices.

5.5 The Committee Members shall:

- a. At least one member from each directorate, that have LDE, shall represent his/her Directorate in the Committee's scheduled meetings. Invite other interested personnel to the meeting, including supporting contractors, as appropriate. Membership will be on a 2-year renewable term.
- b. Bring Directorate issues/concerns relating to LDE and LDE operations to the Committee.
- c. Serve as the information conduit between the LDEC and his/her Directorate organizations.
- d. Provide input/closure of the action items assigned by the Chairperson.
- e. Review and provide input to the Chairperson on LDE variance requests as required.
- f. Review close call and mishaps and provide recommendations for preventive measures.

TABLE 1
Load Test Requirements for New, Repaired, or Modified LDs

	Proof Load		Rated Load		Requirement
	Periodicity ¹	Percentage	Periodicity	Percentage	
Cranes					
Overhead (Non-Critical)	New, Altered	125% (+0%/-5%)	Every Four Years	100% (+5%/-0%)	NASA-STD-8719.9-4.3
Overhead (Critical)	New, Altered	125% (+0%/-5%)	Every Year	100% (+5%/-0%)	NASA-STD-8719.9-4.3
Mobile (Non-Critical)	New, Altered	110% (+0%/-5%)	Every Four Years	100% (+5%/-0%)	NASA-STD-8719.9-5.3
Mobile (Critical)	New, Altered	110% (+0%/-5%)	Every Year	100% (+5%/-0%)	NASA-STD-8719.9-5.3
MAPs (Non-Critical)	New, Altered	N/A ²	Every Year	100% (+5%/-0%)	NASA-STD-8719.9-11.3
MAPs (Critical)	New, Altered	N/A ²	Every Year	100% (+5%/-0%)	NASA-STD-8719.9-11.3
PITs (Non-Critical)	New, Altered	N/A ²	Every Four Years	100% (+5%/-0%)	NASA-STD-8719.9-12.3
PITs (Critical)	New, Altered	N/A ²	Every Year	100% (+5%/-0%)	NASA-STD-8719.9-12.3
Jacks (Flight Hardware)	New, Altered	120% (+0%/-5%)	Every Year	100% (+5%/-0%)	NASA-STD-8719.9-13.3

¹ “New, Altered” in the column entitled “Periodicity” means new, reinstalled, altered, repaired, rerated, reconditioned, and/or modified

² Load test shall be done in accordance with manufacturer’s instructions and applicable ASME standard. In a case where both sources are silent, 100% of the rated capacity shall be used.

Appendix A – Definitions

Most of the terms used in this directive are defined in NASA-STD-8719.9 or NASA-STD-8709.22. Those that are critical and or unique to this directive are listed below.

- A.1 Certification/Recertification – Written documentation that a set of requirements has been, and continues to be, met. As used in this GPR, certification and recertification is: 1) a process performed by the RECERT Manager that leads to the initial, or continuation of, certification that LDE is safe to use within specific certification parameters, and includes, but is not limited to LDE compliance and documentation reviews, tests, inspections, nondestructive testing, and analyses; 2) a license issued and renewed by the RECERT Manager for operation of LDE; and 3) a memo or license issued to perform the duties of a CLC.
- A.2 Critical Hardware – Hardware whose loss would have serious programmatic or institutional impact and that has been identified by the installation, directorate, or project as being critical.
- A.3 Critical Lift – A lift where failure/loss of control could result in loss of life, loss of or damage to critical hardware or other items such as spacecraft, one-of-a-kind articles, or major facility components whose loss or damage would have serious programmatic or institutional impact. Operations involving the lifting of personnel with a crane, and lifts where personnel are required to work under a suspended load, shall be defined as critical lifts (see NASA-STD-8719.9). Operations with special personnel and equipment safety concerns beyond normal lifting hazards shall also be designated as critical.
- A.4 Critical Lift Coordinator (CLC) – An individual who is assigned or demonstrates a need to direct critical lift activities due to specific project requirements and who has obtained the necessary training and is certified by the RECERT Manager. The CLC is an optional position, used only when a project desires to have its own lifting expert. The role of the CLC shall be specified in the Critical Lift Procedure.
- A.5 Daily Checklist – An inspection and/or test performed, prior to use, on a daily basis only for those days while in use.
- A.6 Division Office – For the purposes of this GPR, use of the term “Division Office” includes Project Offices, Program Offices, Supervisors, and Owner of Equipment.
- A.7 Flight Hardware – Hardware designed and fabricated for ultimate use in a vehicle intended to fly.
- A.8 Institutional Lift – A lift performed as part of the day-to-day operations of the Center, such as lifting a section of pipe or moving a pallet of office supplies. It is not a manual lift, although a manual lift may be included as part of an institutional lift. NOTE: an Institutional Lift can also be classified as “critical,” depending on the hardware involved.

- A.9 Lifting Devices (LD) and Equipment (LE) collectively (LDE) – LDE comprises LD such as overhead and gantry cranes (including top running monorail, under-hung, and jib), mobile cranes, derricks, hoists, winches, special hoist supported personnel lifting devices, mobile aerial platforms (MAP), powered industrial trucks (PIT), and jacks; and LE such as Hydrasets, load measuring devices, hooks, slings and rigging used for lifting and support of flight hardware or personnel..
- A.10 LDE Operator Certification – The documented status of LDE operators (Crane Operator, MAP Operator, and PIT Operator) validating that they are trained and qualified in accordance with NASA-STD-8719.9 and certified by the RECERT Manager. For the purposes of the GSFC LDE RECERT Program, an individual certified as a Crane Operator is concurrently certified as a Rigger, and references to Crane Operators include Riggers. Jack Operators shall be designated and authorized by the equipment owning organization.
- A.11 MPJ – For the purposes of this directive, the collective term “MPJ” refers to MAPs, PITs and Jacks as defined in NASA-STD-8719.9.
- A.12 RECERT Documentation – Files that are maintained for LDE that may include, but are not limited to, manufacturer’s/fabricator’s documents, field test data, safety analyses, results of engineering analyses, repair history, facility descriptions, record of all safety variances, re-rating, and correspondence.
- A.12 RECERT Approved Procedure – Owner generated, RECERT generated, or OEM-provided documentation that describes the specific steps needed to inspect, test, or operate LDE that is approved by the RECERT Manager.
- A.14 RECERT Manager and Deputy RECERT Manager/WFF – Positions appointed by the Center Director to implement and enforce the Center’s LDE Program meeting NASA-STD-8719.9 requirements.
- A.15 Rigger – An individual who selects and attaches LE to an item to be lifted.
- A.16 Support Services Contractors – Contract personnel who are based on-site and participate in on-going daily operations at GSFC.

Appendix B – Acronyms

Most of the acronyms used in this directive are defined in NASA-STD-8719.9 or NASA-STD-8709.22. Those that are critical and or unique to this directive are listed below.

CG	Center of Gravity
CLC	Critical Lift Coordinator
FMD	Facilities Management Division
GPR	Goddard Procedural Requirements
GSC	Goddard Safety Committee
GSFC	Goddard Space Flight Center
HQ	NASA Headquarters
IAW	In Accordance With
IDP	Individual Development Plan
LD	Lifting Device
LDE	Lifting Devices and Equipment
LDEC	LDE Committee
LDEM	LDE Manager
LE	Lifting Equipment
LOTO	Lockout Tagout
MAP	Mobile Aerial Platform
MPJ	Mobile Aerial Platform, Powered Industrial Truck, and Jack collectively (see Appendix A)
NDT	Nondestructive Testing
NRRS	NASA Records Retention Schedules
OEM	Original Equipment Manufacturer
OHCM	Office of Human Capital and Management
OSHA	Occupational Safety and Health Administration (29 CFR 1910, 29 CFR 1926)
PIT	Powered Industrial Truck
RECERT	Goddard Recertification Program
SATERN	System for Administration, Training and Educational Resources, for NASA
WFF	Wallops Flight Facility

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CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	11/23/04	Initial Release
Baseline	10/27/05	Administratively changed to reflect responsible office change from Code 540, Mechanical Systems Division, to Code 250, Safety and Environmental Division.
A	05/08/09	Responsible office was changed from Code 250, Safety and Environmental Division, to Code 540, Mechanical Systems Division. Revised nomenclature to be consistent with latest HQ requirements in Paragraph 4. Added Paragraph 5, LDE Committee. General editorial changes for consistency with GPR 8834.1.
B	5/29/12	Added GID changes; Under Section 1, changed Occupational Safety to Code 350; under P.1 reflected that this directive is implementing the NASA Standard; under P.2a added additional references; reworded Section 1.2 to reflect current contract; ; Section 1.4 added to reflect owners responsible to control LDE; Section 1.4 added to reflect NASA Standard; Section 1.8 added to give LDE operator authority; Section 2.1.2.3 wording added for ANSI requirements; Section 2.4.2 changed to optional; Section 3.2.3 period of recertification changed to reflect NASA Standard. A note was added to Section 3.6 License Revocation. All definitions and acronyms were moved to the end of the document.

Goddard Procedural Requirement

GPR 8834.1B

Lifting Operations Requirements





Goddard Procedural Requirements (GPR)

DIRECTIVE NO. GPR 8834.1B **APPROVED BY Signature:** *Original signed by*
Arthur F. Obenschain for
EFFECTIVE DATE: September 29, 2009 **NAME:** Robert Strain
EXPIRATION DATE: September 29, 2014 **TITLE:** Director

COMPLIANCE IS MANDATORY

Responsible Office: 540/Mechanical Systems Division

Title: Lifting Operations Requirements

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PREFACE

P.1 PURPOSE

The purpose of this GPR is to define the process, requirements, and responsibilities for conducting safe lifting operations at Goddard Space Flight Center (GSFC).

P.2 APPLICABILITY

- a. This directive is applicable to all operations associated with Lifting Devices and Equipment (LDE), including rented or leased LDE and LDE provided by on-site Support Services Contractors to the extent provided in their contracts, at Greenbelt, Wallops Flight Facility (WFF), and other areas under GSFC cognizance unless specifically excluded by this directive. It also applies to institutional lifts and manual lifts.
- b. This directive does not apply to tenants and their contract personnel operating in facilities exclusively used for non-NASA operations and controlled by the tenant under a Center-level agreement provided NASA personnel are not placed at risk.
- c. When invoked as a contractual requirement by the applicable project, this directive is applicable to the extent specified in the contract for off-site contractor installations supporting GSFC activities.
- d. Lifting operations under privatization clauses shall be subjected to the provisions of this directive to the extent provided by the contract, and the requirements shall be clearly specified therein.
- e. The responsible Contracting Officer and the Project Manager shall apply requirements of this directive to any contractor, tenant, or customer if non-NASA lifting operations place NASA personnel, facilities, or equipment at risk.

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- f. This directive does not apply to contractor lifting operations using contractor-provided LDE which are exclusively associated with facility construction activities where the activities take place exclusively within an area to which access by the general population of NASA employees is excluded.

P.3 AUTHORITY

NASA-STD-8719.9, Standard for Lifting Devices and Equipment

P.4 REFERENCES

- a. NPR 8715.3, NASA General Safety Program Requirements
- b. GPR 1400.1 Waiver Processing
- c. GPR 1410.2, Configuration Management
- d. GPR 5330.1, Product Processing, Inspection and Test
- e. GPR 8621.1, Reporting of Mishaps and Close Calls
- f. GPR 8719.1, Certification and Recertification of Lifting Devices and Equipment
- g. GSFC WM-001, Workmanship Manual for Electrostatic Discharge (ESD) Control
- h. GSFC Form 23-60, Task Safety Analysis Worksheet
- i. NASA-STD-8719.9, Standard for Lifting Devices and Equipment
- j. Department of Health and Human Services (DHHS)/National Institute for Occupational Safety and Health (NIOSH) Publication No. 94-110, Applications Manual for the Revised NIOSH Lifting Equation
- k. OSHA 1910.135 (a)(1), Head Protection
- l. ASME B30.23, Personnel Lifting Systems

P.5 CANCELLATION

GPR 8834.1A, Lifting Operations Requirements

P.6 SAFETY

Safety requirements are described throughout this GPR.

P.7 TRAINING

Supervisors shall ensure that:

- a. Personnel involved in manual lifts are trained or briefed on proper lifting techniques;
- b. All individuals designated to participate in a lifting operation are qualified to perform their role safely and effectively, based on training, prior experience, and physical ability to do the operation. This includes designated observers, safety representatives, LDE operators, communicators, and all other participants; and

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c. LDE Operators are trained and certified in accordance with GPR 8719.1 for the type of lifting operations required, and that training and certifications are current.

P.8 RECORDS

Record Title	Record Custodian	Retention
Critical Lift Procedure(s)	Project Office	* NRRS 8/103: <u>Temporary</u> . Destroy/delete between 5 and 30 years after program/project termination.
Completed checklists	Project Office	* NRRS 8/103
Stress/Stability Analyses	Project Office	* NRRS 8/103
Variances/Waivers	Project Office	* NRRS 8/103
User documents (e.g., technical interface information, analyses, problem records, and other relevant lift-specific information)	Project Office	* NRRS 8/103
Audit results (see P.9 Metrics) and corrective actions	Applicable Safety Office	* NRRS 8/103
RECERT follow-up actions to metrics	RECERT	* NRRS 8/103

*NRRS – NASA Records Retention Schedules ([NPR 1441.1](#))

Contractors generating records as required by this procedure shall retain the records and turn them over to NASA as specified in the contract.

P.9 METRICS

Safety organizations shall, on an annual basis, audit an appropriate number of executed lift procedures (and associated documentation) of different projects and activities under their cognizance for compliance with this Directive. Each applicable safety office shall determine which procedures to audit, such that the audit results will, in their judgment, give good representation of typical lift activities. Audit results shall be analyzed by the safety organization for continual improvement. Corrective actions shall be implemented by the affected project/organization, and tracked to closure by the safety organization. Audit results shall be submitted to the Recertification Program (RECERT) Manager for appropriate follow up actions, such as trend analysis, lessons learned dissemination, and directive revision.

P.10 DEFINITIONS

Most of the terms used in this directive are defined in NPR 8715.3, NASA-STD-8719.9, and GPR 8719.1. Those that are unique or essential to this directive are listed below.

- a. Certified – An individual who has documented evidence that he/she has completed required training, and has specific knowledge or proficiency in a skill that has been demonstrated, documented, and approved by an accepted authority. Certification expires after a specified time period and must be renewed to remain current. Certification, in the context of this GPR, requires approval by the RECERT Manager.
- b. Critical Hardware – Hardware whose loss would have serious programmatic or institutional impact, and has been identified by the directorate, or project as being critical.
- c. Critical Lift Coordinator (CLC) – An individual who is assigned to direct and give instructions to the crane operator during critical crane operations due to specific project requirements, and who has obtained the necessary training and is certified by the RECERT Manager. The CLC is an optional position, used only when a project desires to have its own lifting expert. The role of the CLC shall be specified in the Critical Lift Procedure.
- d. Critical Lift Procedure – A specific step-by-step procedure to be followed by the lift team to perform a Critical Lift operation. The procedure also defines the roles and responsibilities of all lift team members, and pertinent items to be verified prior to the lift. See Section 3.3.
- e. Customer – A non-NASA, government or private sector entity or organization that owns, sponsors, or otherwise champions a project brought onto GSFC property by a current NASA contractor exercising a contractual provision permitting such an arrangement for the purposes of utilizing NASA facilities and/or test equipment on a lease or rental basis.
- f. Flight Hardware – Hardware designed and fabricated for ultimate use in a vehicle intended to fly.
- g. Hazardous Operating Procedures (HOP) – Detailed, documented procedures listing step-by-step functions or tasks to be performed on a system or equipment to ensure safe and efficient operations. A HOP may address such topics as special precautions, start and stop times or conditions, necessary sequences of steps, approving official(s), etc.
- h. Institutional Lift – A lift performed as part of the day-to-day operations of the Center, such as lifting a section of pipe or moving a pallet of office supplies. It is not a manual lift, although a manual lift may be included as part of an institutional lift. NOTE: an Institutional Lift can also be classified as “critical,” depending on the hardware involved.
- i. LDE Certification – The documented status of LDE that a set of requirements have been and continues to be met. As used in this GPR, certification and recertification is a process performed by the RECERT Manager that leads to the initial, or continuation of, certification that LDE is safe to use within specific certification parameters, and includes, but is not limited to, LDE compliance and documentation reviews, tests, inspections, nondestructive testing, and analyses.

- j. LDE Operator Certification – The documented status of LDE operators validating that they are trained and qualified in accordance with NASA-STD-8719.9 and GPR 8719.1, and certified by the RECERT Manager at Greenbelt or the Deputy RECERT Manager at Wallops.
- k. Lift Analysis – Analysis performed to determine the maximum load the LDE is expected to experience during the worst case lift.
- l. Lift Categories – The category of lifting operations determines the number and qualifications of personnel involved, documentation requirements, and safety requirements. The following categories of lifts are addressed:
 - (1) Critical Lift – A lift where failure/loss of control could result in loss of life, loss of or damage to critical hardware, or other items such as spacecraft, one-of-a-kind articles, or major facility components whose loss would have serious programmatic or institutional impact. Operations involving the lifting of personnel with a crane, and lifts where personnel are required to work under a suspended load, shall always be defined as critical lifts (see NASA-STD-8719.9). Operations with special personnel and equipment safety concerns beyond normal lifting hazards shall also be designated as critical. See Appendix C for a “Process for Lifting Category Determination.”
 - (2) Non-Critical Lift – A lift involving routine lifting operations governed by standard industry rules and practices except as supplemented with unique NASA testing, operations, maintenance, inspection, and personnel licensing requirements contained in NASA-STD-8719.9 and this directive.
- m. Lifting Devices and Equipment (LDE) – The collective term that includes both Lifting Devices (LD) and Lifting Equipment (LE). LDs are machines such as overhead and gantry cranes (including top running, monorail, underhung, and jib cranes), mobile cranes, derricks, gantries, hoists, winches, special hoist-supported personnel lifting devices, Hydra Sets, mobile aerial platforms, powered industrial trucks, and jacks. LE includes the slings and sling assemblies, strongbacks, shackles, load-measuring devices, and hardware components used to attach the load(s) to the lifting device(s).
- n. Manual Lift – A lift where a person lifts, holds, and/or moves an item.
- o. Mechanical Lift – A lift that employs the use of equipment (e.g., crane, chain fall, fork lift, etc.) to raise, lower, or move loads.
- p. Off Load Operation with Constraints (OLOC) – A handling operation where LDE is used to relieve a portion of the weight of a constrained load, i.e., a piece of hardware or an item to be lifted, due to the impossibility of safe blocking or support of the load from the ground or floor. An example would be off-loading the weight of a piece of hardware attached to a handling/holding fixture (i.e., constrained) prior to releasing the attachment fasteners. See Section 2.6, Special Requirements for OLOC.

- q. Person in Charge (PIC) – The individual designated by the Lifting Service User to be in charge of the operation. .
- r. Personal Protective Equipment (PPE) – Safety equipment such as hard hats, goggles, steel-toed shoes, etc.
- s. Pre-lift Briefing – A briefing of involved personnel held prior to the commencement of a critical lift or other designated lift.
- t. RECERT – An established GSFC process that provides certification and recertification expertise, management, and oversight for lifting devices and equipment at GSFC or by GSFC contractors (see P.2). The RECERT manager has overall responsibility for RECERT functions. The processes of certification/recertification of LDE and operators are described in GPR 8719.1.
- u. Rigger – An individual who selects and attaches lifting equipment to an item to be lifted. At GSFC, a rigger is a certified LDE operator.
- v. Safety Representative – An individual who is selected to make judgments concerning personnel, equipment, or systems safety. The safety representative shall be qualified on the basis of a certificate, professional standing, and/or demonstrated competence in the types of lifts they take part in. The Safety Representative shall be selected by mutual agreement of the Lifting Service Provider (LSP) and User, who together determine the necessary qualifications for the assigned task. The applicable safety organization (Safety and Environmental Division, Systems Reliability and Safety Office, or the Wallops Safety Office) shall concur with or deny the selected Safety Representative.
- w. Tenant – A non-NASA entity or organization that has obtained GSFC’s permission to reside on Center. The entity or organization has total control of, and responsibility for, its own operations and activities within the agreed-upon boundaries, as long as NASA personnel or property are not put at risk.
- x. Waiver/Variance – Written authorization to depart from a specific requirement.

P.11 ACRONYMS

ASME	American Society of Mechanical Engineers
CLC	Critical Lift Coordinator
CG	Center of Gravity
CMS	Constant Micro Speed
DHHS	Department of Health and Human Services
DOT	Department of Transportation
EED	Electro-Explosive Device
ESD	Electrostatic Discharge
FOM	Facility Operations Manager

GSFC	Goddard Space Flight Center
HOP	Hazardous Operating Procedures
LD	Lifting Device
LDE	Lifting Devices and Equipment
LE	Lifting Equipment
LSP	Lifting Service Provider
NIOSH	National Institute for Occupational Safety and Health
OEM	Original Equipment Manufacturer
OLOC	Off Load Operation with Constraints
OSHA	Occupational Safety and Health Administration
PIC	Person In Charge
PPE	Personal Protective Equipment
QA	Quality Assurance
RECERT	Recertification Program
SWL	Safe Working Load
WFF	Wallops Flight Facility
WOA	Work Order Authorization

PROCEDURES

In this document, a requirement is identified by “shall,” a good practice by “should,” permission by “may” or “can,” expectation by “will” and descriptive material by “is.”

This directive establishes GSFC requirements for lifting operations. It complements NASA-STD-8719.9 to ensure the safety of all personnel and equipment involved in lifting operations at all levels of complexity.

For use at a contractor’s facility, the requirements of this directive may be tailored and reissued as a project document and controlled in accordance with GPR 1410.2, and invoked in the applicable contract(s).

1.0 RESPONSIBILITIES

1.1 Lifting Service Provider (LSP)

The LSP is the organization that provides a lifting service to a user, and is usually the owner/operator of the facility where the lift service is performed. The LSP may provide their own LDE and/or operators, or task supporting organizations or contractors to provide LDE and/or operators. The LSP shall be responsible for the following:

- a. Verifying that LDE operators and supporting personnel are properly designated, authorized, trained, and certified (see GPR 8719.1) at the time lifting operations are performed;
- b. Verifying that lift procedures and checklists, when needed (see Section 3.1), are available and understood for lifting operations;

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- c. Verifying that deficient LDE or other lifting equipment that is removed from service is locked out or tagged out-of-service, and that RECERT is promptly notified;
- d. Coordinating outages for load testing and inspections of lifting devices with RECERT to minimize conflicts with ongoing operations;
- e. Providing lifting devices and/or lifting equipment, when requested by the Lifting Service User, appropriate for the lifting operation, i.e., certified for critical (and non-critical) lifts, or certified for non-critical lifts only;
- f. Notifying the Facility Operations Manager (FOM) of any operations that may have unusual hazards or safety implications (see 1.11); and
- g. Safe conduct of all lifting operations.

For **Critical Lifts**, the LSP shall also:

- h. Provide expert advice and assistance on lifting operations;
- i. Support the User in developing the Critical Lift Procedure(s) for User equipment;
- j. Support the User in developing variance requests, when required;
- k. Verify that all required LDE and associated tools are available, in correct operating condition, and certified as required;
- l. Review and verify lift and critical lift procedures with the User prior to the lift operation; and
- m. Certify, to the User, that all above requirements have been met prior to the lift operation.

1.2 Lifting Service User

The Lifting Service User (hereinafter referred to as “User”) is the Program or Project Manager or their Representative that is the owner of the hardware being lifted or handled. The User is ultimately responsible for their hardware, and therefore has key responsibilities in the lifting operations. Users shall coordinate closely with the LSP for the conduct of lifting operations that affect their hardware.

Many Users are flight projects that use special lifting devices or fixtures and require specialized engineering support. They may provide their own lifting equipment and/or operators, or task supporting organizations or contractors to provide equipment and/or operators.

Users shall be responsible for the following for all lifting operations of their hardware:

- a. Providing input to the RECERT Manager to identify the category of lifts for their hardware, i.e., critical or non-critical, so that compliance requirements for lifting operations can be established. Appendix C “Process for Lifting Category Determination” shall be used for this determination and input shall be obtained from the LSP, the applicable safety organization(s), and facility personnel (if appropriate);
- b. Selecting LDE for a lift based upon the maximum load it would experience in the worst case scenario during the lift;
- c. Developing or verifying availability of lifting procedures and HOPs that address the safety of their personnel and hardware (see Section 3.1). For lifting or handling equipment not covered by NASA-

- STD-8719.9, consult and follow the equipment manufacturers' recommendations with documented concurrence from the applicable safety representative;
- d. Designating a Person In Charge with the responsibilities described in 1.4 below;
 - e. Developing and approving Critical Lift Procedure(s) prior to beginning lift operations, and concurring with changes during the lift;
 - f. Verifying that the LSP's LDE and operators have current certifications as required by GPR 8719.1 for the type of lifting operations required;
 - g. Verifying that all applicable safety analyses (e.g., stability analysis, lift analysis, etc.) or assessments are completed and are sufficient per the requirements of NASA-STD-8719.9, and that lift points are above the established Center of Gravity (CG);
 - h. Initiating a Waiver/Variance request if any NASA or GSFC safety requirements are not met, in accordance with NPR 8715.3 or GPR 1400.1 as applicable;
 - i. Providing engineering support as needed by the LSP for User hardware;
 - j. Providing for appropriate Safety Representative support as described in Section 1.5;
 - k. Providing Work Order Authorization(s) (WOAs) as required by GPR 5330.1;
 - l. Notifying the FOM of any operations that may have unusual hazards or safety implications (see 1.11);
 - m. Stopping lifting operations in the event of an actual or reported failure or unsafe condition;
 - n. Providing concurrence to resume operations once failures or unsafe conditions are corrected;
 - o. Determining the applicability of NASA-STD-8719.9 and this procedure to off-site contractors, and ensure that sufficient requirements are invoked in the contracts; and
 - p. The safe conduct of all lifting operations.

1.3 Person In Charge (PIC)

The PIC shall take overall responsibility for the conduct of the lifting operation. The PIC shall be from the User organization or the LSP, and may be an I&T Manager, Lead Engineer, LDE Operator, the Rigger, a Critical Lift Coordinator (CLC), supervisor, or any other individual selected and specified in the critical lift or other applicable procedure. The PIC shall:

- a. Verify that all involved parties meet the lift requirements;
- b. Verify that all tools and equipment are adequate for the lift requirements;
- c. Fill out Appendix C "Process for Lifting Category Determination";
- d. For any critical lift, or for any lift determined by the LSP or User to need a pre-lift briefing and walk-through, conduct a pre-lift briefing/walk-through with all required participants. See Section 2.3;
- e. Verify that adequate communications and direction are available, particularly for the LDE operator(s); and
- f. Manage the lifting operation.

1.4 Safety Representative(s)

The qualified safety representative(s) shall be responsible for the following:

- a. Maintaining qualification in terms of competence, experience, training, etc.;

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- b. Verifying that all applicable safety analyses or assessments are completed in accordance with requirements of NASA-STD-8719.9;
- c. Advising all personnel involved in the lifting operations of any additional hazard(s) and appropriate methods of hazard control prior to and throughout the entire lifting operation;
- d. Verifying that Incident/Mishap Reports are initiated and submitted in accordance with this document and the requirements of GPR 8621.1;
- e. Providing input to the User organization to identify the lifting operations as critical or non-critical;
- f. Reviewing and approving all critical lift procedures, HOPs, and WOAs pertaining to critical lifting operations;
- g. Ensuring appropriate hazard controls have been addressed in the HOPs and/or WOAs;
- h. Ensuring that the lifting operation adheres to this directive and all applicable NASA, Occupational Safety and Health Administration (OSHA), and processing facility safety regulations (where appropriate);
- i. Providing concurrence to proceed with a hazardous lifting operation and, upon completion, concurrence to open the controlled area and resume normal operations; and
- j. Reviewing and concurring with/denying project-initiated safety waiver/variance requests (see NPR 8715.3 or GPR 1400.1) prior to submittal to the RECERT Manager.

1.5 Lift Team Members

Lift team members shall:

- a. Participate in Pre-Lift Briefings as described in Section 2.3;
- b. Understand their roles and the roles of other lift team members for a given operation;
- c. Ensure that they fully understand all applicable procedures and safety requirements; and
- d. Wear the appropriate Personal Protective Equipment (PPE).

1.6 Office of System Safety and Mission Assurance at Greenbelt and the Safety Office at Wallops

The Office of System Safety and Mission Assurance at Greenbelt and the Safety Office at Wallops shall:

- a. Audit executed lift procedures and associated documentation as specified in Section P.9;
- b. Concur with/deny Waiver/Variance requests submitted; and
- c. Concur with/deny selected Safety Representative.

1.7 Safety and Environmental Division at Greenbelt and the Safety Office at Wallops

The Safety and Environmental Division at Greenbelt and the Safety Office at Wallops shall:

- a. Provide oversight for Center industrial or institutional lifting operations for compliance with GSFC, NASA, and OSHA requirements;
- b. Monitor compliance of institutional lifting operations and operators to the requirements herein;
- c. Monitor compliance to institutional safety requirements;

- d. Audit executed lift procedures and associated documentation as specified in Section P.9;
- e. Concur with/deny Waiver/Variance requests submitted; and
- f. Concur with/deny selected Safety Representative.

1.8 RECERT Manager

The RECERT Manager shall, in addition to the responsibilities described in GPR 8719.1, be responsible for:

- a. All RECERT functions described herein;
- b. Reviewing results of executed lift procedure audits by the safety offices, and implementing appropriate follow-up actions as required by Section P.9;
- c. Reviewing and concurring or denying safety waiver/variance requests prior to the originator's submittal to other appropriate authorities and Center Director for approval; and
- d. Receiving input from facility, program, user, and safety assurance personnel regarding the lifting operation to identify the category of a lift as either critical or non-critical.

1.9 Deputy RECERT Manager.

The Deputy RECERT Manager shall serve as the RECERT Manager's alternate and represent the RECERT Manager at WFF for day-to-day operations by performing the duties in Section 1.9.

1.10 Building Facility Operations Manager (FOM).

FOMs are responsible for notifying building occupants of potential safety hazards in and around facilities under their cognizance. When notified by the LSP or User of a lifting operation with unusual hazards or safety implications (i.e., potential to affect occupants beyond the immediate lift area), he/she shall review the proposed lifting operation(s) and concur prior to commencing the lifting operation(s).

1.11 Certified Critical Lift Coordinator (CLC).

CLCs shall be responsible for:

- a. Maintaining a current certification as required by GPR 8719.1;
- b. Coordinating the preparation and execution of the lift(s) with the PIC; and
- c. When indicated in the Critical Lift Procedure, directing and commanding the lifting operation for their organization's hardware.

2.0 REQUIREMENTS

2.1 General Requirements for All Lifting Operations

2.1.1 Prior to any lifting operation:

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a. The LDE operator shall:

- (1) Inspect all LDE in accordance with NASA-STD-8719.9, manufacturers recommendations, and GSFC procedures;
- (2) Verify appropriate PPE (e.g., hard hats, eye protection, etc.) are available and used properly; and
- (3) Verify the load's weight and the location of the CG.

b. The PIC shall:

- (1) Analyze the lift for all unmitigated hazards, including lift stability. For non-hazardous mechanical lifts, a Job Hazards Analysis or checklist may be used to document hazards in lieu of a lift stability analysis; GSFC Form 23-60 may be used to satisfy this requirement. For routine hazardous lifts, a one-time analysis can be done where risk mitigation controls are written into a standard procedure for the operation;
- (2) Verify that the operational requirements for the type of lifting devices and/or equipment being used comply with NASA-STD-8719.9;
- (3) Verify that all LDE are certified as described in GPR 8719.1 for the category of lift to be performed; and
- (4) Verify that all operators and riggers involved in the lift are certified for the category of lift to be performed.

2.1.2 Suspended load operations

Suspended load operations, as defined in NASA-STD-8719.9, are discouraged at GSFC. However, if a suspended load operation cannot be avoided, the operation shall comply with NASA-STD-8719.9, Appendix A, "NASA Alternate Standard for Suspended Load Operations." Prior to any suspended load operation, the User shall prepare analysis documentation of the operation (see NASA-STD-8719.9) and submit it to the RECERT Manager for concurrence. The RECERT Manager shall, in turn, consult with the NASA HQ Office of Safety and Mission Assurance per HQ requirements.

2.1.3 Loads Containing Components Sensitive to Electrostatic Discharge (ESD)

The User shall be responsible for ESD protection of the load. The User shall address and coordinate ESD protection with the LSP to ensure that the ESD requirements of the load are fully understood and protective measures are taken. If special handling requirements are needed to ensure ESD protection, they shall be addressed in documented procedures (see Section 3.1). Procedures shall address and comply with the requirements of NASA-STD-8719.9 and GSFC WM-001.

2.1.4 Loads Containing Explosives or Electro-Explosive Devices (EEDs)

The User shall be responsible for all lifting operations involving loads containing explosives or EEDs. Such lifts shall be classified as critical unless a documented risk assessment is performed that indicates otherwise and is concurred by responsible user management and the applicable safety representative. If it is indicated as non-critical, it shall be classified as hazardous.

2.1.5 Loads Containing Pressurized Containers

The User shall be responsible for all lifting operations involving loads containing pressurized containers which do not conform to the Department of Transportation (DOT) or the American Society of Mechanical Engineers (ASME) requirements. Such lifts shall be classified as critical unless a documented risk assessment is performed that indicates otherwise and is concurred to by responsible user management and the applicable safety representative. If it is indicated as non-critical and the pressure containers do not conform to DOT or ASME requirements, it shall be classified as hazardous.

2.1.6 Loads Containing Hazardous Materials

The User shall be responsible for all lifting operations involving loads containing hazardous materials which are contained in containers which do not conform to DOT or ASME requirements or the hazardous material has been removed from the Original Equipment Manufacturer's (OEM) packaging. Such lifts shall be classified as critical unless a documented risk assessment is performed that indicates otherwise and is concurred to by responsible user management and the applicable safety representative. If it is indicated as non-critical and the containers do not conform to DOT or ASME requirements, or if the hazardous material has been removed from the OEM packaging, it shall be classified as hazardous.

2.1.7 Hazardous Lifting Operations

The User shall be responsible for all hazardous lifting operations. Hazardous lifting operations shall be conducted in accordance with the requirements of sections 3.8 and 7.4 of NPR 8715.3A.

2.1.9 Use of Hard Hats

In accordance with OSHA 1910.135 (a)(1), hard hats shall be worn when working in areas where there is a potential for injury to the head from falling objects. However, the use of hard hats may introduce risk of damage to the load from contact with a hard hat. The PIC shall examine each situation and ensure steps (e.g., chin straps or tethering) are taken to mitigate the risk.

2.2 Special Requirements for Critical Lifts

The requirements for critical lifts detailed in NASA-STD 8719.9 shall be followed in their entirety and Appendix C "Process for Lifting Category Determination" shall have been completed. The following specific requirements apply, whether the critical lift is project equipment or otherwise:

- a. Prior to any critical lifting operations, the PIC shall:
 - 1) Verify that the LE is certified per GPR 8719.1 for critical lifts.
 - 2) Verify the weight and CG location to ensure that the payload maintains stability during the lift.
 - 3) Verify that the Critical Lift Procedures, including any required waivers/variances, are complete and approved as described in Section 3 herein.

- 4) Perform a pre-lift briefing (see Section 2.3 of the lift team) including the User's designated representatives, Safety Representatives, and others as appropriate to review the planned lifting operation.
- b. The lifting procedure shall contain a tabulation of LDE, including slings, hoist rings, shackles, turnbuckles, spreader bars, lifting assemblies, Hydra Set, load-measuring devices, and any other hardware components used in the lifting operation. The following information shall be provided for each item attached in the load line: safe working load (SWL), expiration date, and RECERT control number;
- c. Videotaping of the Critical Lift shall be the User's responsibility. Videotaping is encouraged but not mandatory;
- d. A single person (NASA or contractor) shall be designated as responsible for the safety of the operation. This shall be the Safety Representative described in Section 1.5;
- e. A Critical Lift shall not commence unless all team members required by the Critical Lift Procedure are present, on station, and have received the pre-lift briefing;
- f. When so designated in the Critical Lift Procedure, CLCs shall be responsible for directing and giving commands to the LDE Operator during a lifting operation and;
 - (1) The CLC shall instruct all personnel involved in the proper preparation, lifting, and final positioning to be achieved, as a part of the pre-lift briefing.
 - (2) Coordination for directing the lifting operation shall be delineated in the Critical Lift Procedure and emphasized in the pre-lift briefing.
 - (3) Any transfer of responsibility for directing the lifting operation (e.g., from CLC to the rigger/crane operator or vice versa) shall be identified in the Critical Lift Procedure and emphasized in the pre-lift briefing.
 - (4) A CLC shall not perform rigging activities or hands-on operation of lifting devices.

Appendix A of this directive is a sample checklist for critical lifts.

2.3 Requirements for a Pre-Lift Briefing

A pre-lift briefing shall be performed whenever more than one person is involved in the activity, whenever a lift is considered critical, or whenever the PIC, a Safety Representative, or a supervisor in the LSP or User organization requests one. In these cases, the briefing shall be conducted, regardless of familiarization or experience of those performing the task or operation. The pre-lift briefing is generally useful for all but the most routine operations, and is primarily aimed at ensuring the safety and coordination of the personnel and equipment involved.

2.3.1 The PIC normally conducts the pre-lift briefing, although they may delegate this responsibility.

2.3.2 The pre-lift briefing shall be conducted prior to beginning lifting operations, and shall involve all personnel having a role in the operation. When Lift Team members arrive after the lift has begun, such as when a shift change occurs, the incoming personnel shall be sufficiently briefed to ensure that they fully understand their roles, the task(s) to be performed, and all relevant elements of the pre-lift briefing.

2.3.3 Prior to the Pre-Lift Briefing, the briefer shall:

- a. Check weather forecast and/or storm code panel for adverse conditions that could potentially affect the lift;
- b. Check LDE for proper criticality category and certification;
- c. Check LDE log book(s) to verify that there are no outstanding deficiencies;
- d. Verify that required lift procedures and WOAs have been approved and signed off with all required signatures;
- e. Verify that any required lift stability analyses, HOPs, stress analyses, etc., are completed and available;
- f. Verify that the CG and total weight of the load to be lifted are known and documented; and
- g. Verify that all 2-way radios to be used during lifting operations are fully charged, functioning properly, and do not produce radio interference with other equipment in the vicinity.

2.3.4 At the Pre-Lift Briefing, the briefer shall:

- a. Verify that all Lift Team members are present;
- b. Verify that all Lift Team members understand their roles and responsibilities;
- c. Perform a step-by-step review of the lifting operation;
- d. Explain the hardware to be lifted, associated Ground Support Equipment, configuration of lifting equipment, and associated hazards;
- e. Verify that all Lift Team members understand the PPE requirements and are prepared to meet them;
- f. Review any applicable safety requirements or procedures; and
- g. Emphasize that safety is the primary consideration during the lift.

2.4 Institutional Lifts

Institutional lifts are those lifts performed frequently and repetitively, often on a daily basis, and normally involve activities such as construction or maintenance, handling of shop materials, and other routine activities involved in the normal operation of the Center. In general, the LDE consists of cranes, forklifts, powered pallet jacks, and other material-handling equipment.

Supervisors shall require that LDE operators that perform institutional lifts are trained in the safe operation of the LDE in use, and certified or otherwise qualified as defined in GPR 8719.1. Supervisors shall also confirm that any special procedures necessary to protect personnel or high-value equipment are available and understood by operators.

If an institutional lift is determined to be a Critical Lift, Section 2.2 shall apply.

2.5 Manual Lifts

This section applies to those cases where one or more individuals manually supports or moves an object, with or without LDE. Manual lifts of small, lightweight critical items, such as circuit board panels, do not require all the safeguards described below. Other requirements may be determined by the supervisor

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or project manager. In such cases, supervisors or project managers shall be responsible to ensure that there is no compromise of safety to the personnel or equipment.

Manual lifts may range in complexity from handling a lightweight item of equipment to supporting an item of space flight hardware while LDE is repositioned. Operations as simple as helping someone move an item of office equipment are considered manual lifts.

2.5.1 The following safe lifting and handling load limits shall apply for each manual **critical** lift:

- a. 35 lbs of manageable shape and size for one person;
- b. 75 lbs of manageable shape and size for two people;
- c. 100 lbs of manageable shape and size for three people;
- d. No manual lift shall be performed for a load exceeding 100 lbs unless written concurrence from a qualified safety representative has been obtained; and
- e. All lifts shall be within limits of comfortable balance and control.

Supervisors shall determine and document weight limits for manual **non-critical** lifts. In making this determination, supervisors shall consider the guidelines of DHHS (NIOSH) Publication No. 94-110, Applications Manual for the Revised NIOSH Lifting Equation.

2.5.2 The following rules shall apply whenever performing a manual lift. These rules may be tailored based on the situation, but shall not compromise personnel or equipment safety or permit undue risk.

- a. Plan and walk through the entire lift prior to commencing the lifting operation;
- b. Visually inspect the area to identify any tripping hazards and remove them, if possible, prior to starting. If a trip hazard cannot be moved prior to starting, a spotter shall be used to guide the individual(s) performing the lift when approaching the hazard;
- c. Clear work area and translation path of personnel not involved in the lifting operation;
- d. Pick up the load correctly to avoid injury. Minimize unnecessary bending, twisting, and lifting above the shoulders;
- e. Make use of mechanical devices such as portable carts or dollies whenever possible. Inspect carts and dollies for any damage before use, and verify the device has a suitable load rating for the item to be moved;
- f. Ensure that the item being lifted can be handled manually without injury to personnel or damage to the hardware and/or facility;
- g. Ensure that a firm grip can be maintained from the beginning to the end of the lift;
- h. Ensure that the load destination is clear of obstacles and provides a stable base to support the load;
- i. When in doubt, STOP! Contact the appropriate safety representative or safety organization.

2.5.3 If a manual lift is considered complex, and high-value equipment and/or safety are at risk, a procedure and/or WOA shall be written and followed as required in Section 3. If the manual lift is considered a Critical Lift, Quality Assurance (QA) witnessing is required, but Safety witnessing is not. Manual lifts of small, lightweight critical items, such as circuit board panels, do not require QA or Safety witnessing.

2.6 Special Requirements for Off Load Operations with Constraints (OLOCs)

OLOCs (see Definitions P.10.p) present additional hazards to personnel and hardware and shall only be conducted when it is not possible to perform the same activity in a conventional, unconstrained manner. OLOCs shall be treated as critical lifts and shall comply with Section 2.2.

Since an OLOC is an unusual lift operation and poses additional risks to the hardware or item being handled, the Project Manager must assess, acknowledge and accept these risks before the operation is performed. A copy of this risk assessment shall be sent to the RECERT Manager for information purposes prior to performance of the OLOC.

An example of an OLOC (see Definitions P.10.p) would be off-loading the weight of a piece of hardware attached to a handling/holding fixture (i.e., constrained) prior to releasing the attachment fasteners. An OLOC must be treated as a critical lift and the total combined weight of the hardware handling/holding fixture, the hardware lifting equipment, and the hardware must be within the SWL of the LD (i.e., the crane or other facility equipment).

The following are additional requirements that shall apply to OLOCs to minimize the potential of hardware damage and/or exceeding the SWL of any LE or hardware component in the load path during the operation.

- 2.6.1 Two independent devices are required to measure the load and shall be monitored at all times by a member of the lift team other than the crane operator.
- 2.6.2 Crane hoist speed is absolutely critical for safe execution of the OLOC and must be able to be limited to .75 inches/minute. Thus cranes used for OLOC operations shall be equipped with a momentary ON button that controls the Constant Micro Speed (CMS) to this limit.
- 2.6.3 If proper CMS control is not available a Hydra Set shall be used for hoist operations. The User must be aware of potential Hydra Set issues such as hook height limitations, the lack of load release incremental control, and hydraulic fluid leaks.
- 2.6.4 If proper CMS control is not available and a Hydra Set cannot be used, the OLOC shall be engineered to provide another path to success – such as highly compliant LDE – and approached with extreme caution. Otherwise the OLOC must be abandoned.
- 2.6.5 Load measurement instrumentation configuration shall be documented in the procedure, including settings and a diagram of connections.
- 2.6.6 All equipment shall be used within the manufacture's specifications.
- 2.6.7 Personnel setting up, using, and monitoring the load measuring devices and Hydra Set shall be trained in the operation, use, and limitations of the equipment and shall be present during the operation.
- 2.6.8 Pre-Operation Checks

- a. Perform an accuracy verification check on the load measuring devices within 24 hours of the lift by lifting a known weight.
- b. Verify all settings and equipment configurations comply with the procedure.
- c. Perform a load test verification check on the Hydra Set within 24 hours of the lift by lifting a known weight.

3. DOCUMENTATION REQUIREMENTS

3.1 Required Procedures

Documented procedures shall be prepared, when required, for lifting operations as defined below. Procedures shall not rely on personnel to stabilize or support any portion of a load that exceeds the manual lift limits in 2.5.1, even in conjunction with LDE.

- a. Work Order Authorizations shall be processed and approved for project lifts as defined in GPR 5330.1.
- b. Procedures for routine, non-critical lifts shall be available and may be generic and not lift-specific. The requirement may be satisfied by adherence to overall standards, generic lifting procedures, standard operating procedures, and/or original equipment manufacturer's operating instructions, augmented by operator training and certification.
- c. Procedures for non-routine, non-critical lifts, such as a lift involving an unusually configured load with an off-center CG, shall require a stress/stability analysis and lift procedure prior to commencement of the lifting operation(s). The PIC shall determine the degree of detail and approvals required. Normally, these procedures may be similar to those described in 3.1.b, with additional detail added for non-routine situations.
- d. HOPs shall be required for all operations involving unusual hazards. HOPs may be stand-alone or incorporated in the body of other procedures. HOPs shall comply with the requirements of NPR 8715.3.
- e. Checklists are very effective, and their use is encouraged to supplement required procedures. Checklists for key items of LDE can reduce the work involved in producing procedures. A sample checklist for a critical lifting operation is given in Appendix A. A sample checklist for a non-critical lifting operation is given in Appendix B. Other checklists should list detailed steps in the operation. Appendix C "Process for Lifting Category Determination" is required when a decision concerning whether or not a lift is critical is to be made.
- f. Institutional lift procedures are usually as described in 3.1.b and 3.1.c. Supervisors shall ensure that adequate procedures are available, and shall produce a lifting procedure and perform a pre-lift briefing for lifts having an unusual level of risk.
- g. Critical Lift Procedures shall be developed for each critical lifting operation, except as provided in 2.5.

- h. Waiver/variance Documentation shall be prepared and approved in accordance with GPR 1400.1 and NPR 8715.3.

The following table serves as a guideline for determining the need for lift procedures.

Criticality	Type	Description	Lift Procedure Needed?
Non-Critical	LDE	Simple or routine	No
Non-Critical	LDE	Non-routine or complex	Yes
Non-Critical	LDE	Institutional with no risks except those inherent in any lifting operation	No
Non-Critical	LDE	Institutional with risks in addition to those inherent in any lifting operation	Yes
Non-Critical	Manual	Simple	No
Non-Critical	Manual	Complex	Yes
Non-Critical	Manual	High dollar	Yes
Non-Critical	Manual	Safety risk	Yes
Critical	All	All (see 3.1.g)	Yes

3.2 Non-Critical Lift Procedures

Procedures, when required (see Section 3.1), shall be available for all LDE citing general operating instructions, operator certification or training requirements, equipment certification requirements, and other information needed to ensure safe performance of lifting operations. Procedures may be generic, and may apply to multiple types of lifts for a given facility or LDE. These procedures need not be lift-specific. They should be sufficient to ensure safe handling of lifted and lifting equipment, ensure operator safety, and minimize or eliminate risk (Ref: NASA-STD-8719.9).

3.3 Critical Lift Procedures

Critical Lift Procedures are the responsibility of the User. As a minimum, the Critical Lift Procedure shall be reviewed and approved by the LSP, User, Safety Representative, and the PIC before the lifting operation. The procedures shall address the following:

- a. Description of the lift operation, location, and LDE to be used, including defining the safety keep-out zone for the operation;
- b. Identification of lift team members, their roles, and responsibilities;
- c. Degree and makeup of safety and mission assurance coverage;
- d. Sequential operational requirements;
- e. HOPs;
- f. Checklists and other required documents;

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- g. Emergency and contingency procedures (e.g., fire, power outage, lifting during an electrical storm, outdoor lifts under windy conditions, etc.);
- h. Special requirements for ESD, EEDs, and explosives;
- i. PPE;
- j. Contamination control requirements;
- k. Stability analyses, stress analyses, variance(s) (if required), and any other analyses determined by the LSP or User to be needed before the lift;
- l. Procedures for making and approving changes to the procedure after it has been approved;
- m. Description of the means of communications to be used; and
- n. Photo or videotape requirements.

3.4 Waiver/Variance Documentation

Safety waiver/variance Documentation, if needed, shall be prepared and approved in accordance with GPR 1400.1 and NPR 8715.3.

**APPENDIX A
SAMPLE CHECKLIST
FOR CRITICAL LIFTING OPERATIONS**

- 1. All Lift Team members are present.
- 2. The Lift Stability Analysis, Stress Analysis, and other required documentation are completed.
- 3. The Lift Procedure has been approved and has all required signatures.
- 4. The CG and total weight of load to be lifted are known and documented.
- 5. If 2-way radios are to be used, all units are fully charged, functioning properly, and do not produce radio interference with other equipment in the vicinity.
- 6. All team members are wearing appropriate PPE.
- 7. Weather forecast and/or storm code panel (if applicable) are checked for adverse conditions that could potentially affect the Lift.
- 8. LDE is certified for critical lifts.
- 9. The LDE Operator is certified for Critical Lifting.
- 10. The LDE Log Book indicates no outstanding deficiencies.
- 11. Conduct a Pre-Lift Briefing

Signed by:

Date

NOTE:

This is an example only. Developing custom checklists for lifts is encouraged because checklists aid in the planning process, they document that individual steps are taken, and they eliminate the possibility of omitting steps by mistake.

**APPENDIX B
SAMPLE CHECKLIST
FOR NON-CRITICAL LIFTING OPERATIONS**

- Determine whether the lift is simple or complex.
 - a. If the lift is simple and routine, the lift may be performed following industrial standards and practices, general guidelines, and operator training.
 - b. If the lift is complex and/or involves an unusual load configuration with an off-center CG, the PIC shall require that a stress/stability analysis and a lift procedure be developed and approved prior to the lifting operations. Also confirm the following, as appropriate:
 - All Lift Team members are present.
 - The Lift Procedure has been approved and signed off for all signature blocks.
 - The required stress/stability analysis is completed.
 - The CG and total weight of load are known and documented
 - If 2-way radios are to be used, all units are fully charged, functioning properly, and do not produce radio interference with other equipment in the vicinity.
 - Ensure that all Team members are wearing appropriate PPE.
 - Check weather forecast and/or storm code panel (if applicable) for adverse conditions that could potentially affect the Lift.
- Check LDE for valid certification.
- Check LDE Log Book to ensure that there are no outstanding deficiencies.
- Verify that the LDE operator's certification is valid.

Signed by:

Date

NOTE:

This is an example only. Developing custom checklists for lifts is encouraged because checklists aid in the planning process, they document that individual steps are taken, and they eliminate the possibility of omitting steps by mistake.

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APPENDIX C
PROCESS
FOR LIFTING CATEGORY DETERMINATION (See Note 1)

PIC:
Date:
Project:
Organization:
Description of Lift:

For the Lift in Question	YES**
1. Will LDE failure/loss of control result in serious personnel injury or loss of life?	
2. Will LDE failure/loss of control result in damage or loss of program-critical flight hardware?	
3. Will LDE failure/loss of control result in damage or loss of one-of-a-kind articles?	
4. Will LDE failure/loss of control result in damage or loss of major facility components which will have serious institutional or programmatic impact?	
5. Will LDE failure/loss of control result in damage or loss of any article that could have serious programmatic or institutional impact?	
6. Are personnel being lifted with a crane? (see NASA-STD-8719.9, App. C & ASME B30.23)	
7. Are personnel required to work under a suspended load? (see NASA-STD-8719.9, App. A)	
8. Does the load contain explosives or EEDs ? (see 2.1.4 for exceptions)	
9. Does the load contain pressurized containers? (see 2.1.5 for exceptions)	
10. Does the load contain hazardous materials? (see 2.1.6 for exceptions)	
11. Is the lift an OLOC? (see 2.6 for explanation) – See Note 2.	
12. Are there any other personnel or equipment safety concerns that could be considered out of the ordinary?	

** If the answer to any of the questions listed above is “YES”, the Lifting Operation must be declared a Critical Lift.

Concurrence: Program/Project Manager

 Safety/Facilities Manager

Notes:

1. A signed copy of Appendix C shall be sent to the RECERT Manager.
2. A signed copy of the OLOC Risk Assessment shall be sent to the RECERT Manager.

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CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	8/8/2006	Initial Release
A	2/4/2008	Added new requirements for off-load operations with constraints, NASA document designation updates, variance processing, and other changes throughout for clarification. In P.2, clarified Applicability for contractors.
B	9/29/2009	Added Appendix C – Process for Lifting Category Determination, modified OLOC definition (P.10) and requirements (2.6), and other changes throughout for clarification.

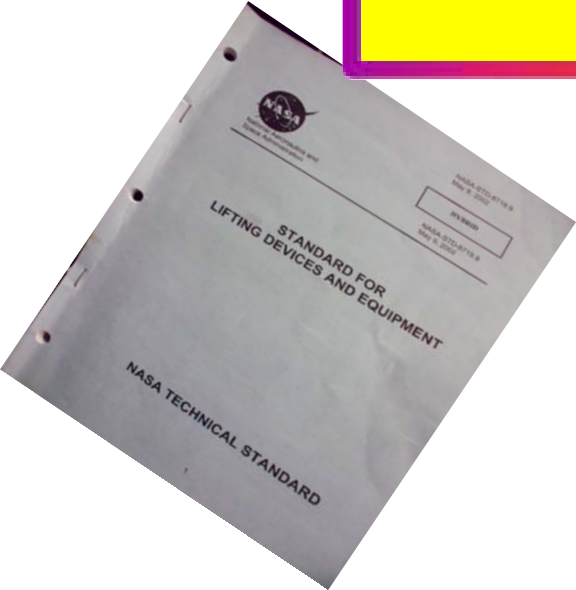


Occupational Safety
and Health Administration



Reference OSHA Standard 29CFR 1910.178

Pre-Operational Inspection



Reference: ANSI/ITSDF B56.1-2009



Pre-Operational Inspection

- Must comply with the manufacturers recommendations
- Reference Goddard Directive Management System For Work Instruction



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540-WI-8719.1.3A

Appendix C – Sample Lifting Device Daily Inspection Forms

Operator's Daily Inspection of Powered Industrial Trucks (PITs)		Month	Year
Vehicle Type	Recert Number:	RECERT Certification Expiration:	
ITEMS TO BE CHECKED DAILY (Operator's Signature Required on Opposite Side)		Operator's Printed Name and Signature Signifies Accomplishment Of Checks On The Date of the Month Indicated	
1. Damage (exterior and interior, missing parts)		1	11 21
2. Tires, Wheels, Lug Nuts		2	12 22
3. Fluids (Oil, Antifreeze, Hydraulic Fluid, Fuel)		3	13 23
4. Safety Devices (Seatbelt, Overhead Guard, Safety Decals)		4	14 24
5. Battery (Fluid level if applicable, Restraint, Connections)		5	15 25
6. Lights (Headlights, Floodlights, Brake Lights)		6	16 26
7. Gauges (Inspect for functionality and legibility)		7	17 27
8. Forks (Check for damage and movement)		8	18 28
9. Engine (Starting, Stopping, Unusual Noises)		9	19 29
10. Steering		10	20 30
11. Brakes (Clutch, Creep & Parking)			31
12. Audible Alarms (Horn, Back-Up Alarm)		Indicate any deficiencies found on reverse and report them to your supervisor and RECERT (x6-5181 in Greenbelt, x1714 at Wallops Island) immediately	
13. Hydraulic System (Functionality, Leaks, Damaged Hoses)		Reference: ASME B56.1, B56.6, B56.10, 540-WI-8719.1.3	
14. Belts (Water Pump, Generator, Compressor)			
15. Lift/Lower Mechanism (Functionality, Free Movement)			
16. Attachments (Forks, Extensions, Buckets, etc.)			
17. Air Compressor (Functionality)			
18. Windows (Damage that obscures the operator's vision)			
19. Windshield Wiper/Washer (if applicable)			
20. Controls (Free Movement)			

Pre-Operational Inspection

You Must Perform A Pre-Shift Truck Inspection

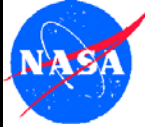


It Is **Required** By OSHA To Perform A Pre-Shift Inspection

Pre-Operational Inspection

What To Look For During A Pre-Shift Inspection !!!

- Seat Belt
- Tires/Lug Nuts
- Fork Condition
- Fluid Leaks
- Any Damage
- Lights
- Horn
- Brakes
- Directional Control
- Steering
- Hydraulics Operation
- Battery Water/Cables
- Guards Secure
- Gauges
- Overhead Guard
- Unusual Noises
- Proper Fluid Levels
- Warning Alarms



NASA Standard 8719.9



12.4.4 Daily Inspections.

These inspections shall be performed by the operator prior to each shift the truck is used.

- a. Warning and safety devices for malfunction (to include the horn).



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (c) (d)

Reference: ANSI/ITSDF B56.6-2005 6.5.1 (c)

Reference OSHA Standard 29CFR 1910.178(q)(7)



NASA Standard 8719.9



- b. Condition of tires (if pneumatic tires, check inflation pressures).



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (a) (b)

Reference: ANSI/ITSDF B56.6-2005 6.5.1 (a)

Reference OSHA Standard 29CFR 1910.178(q)(7)



NASA Standard 8719.9



c. Lights.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (d)

Reference: ANSI/ITSDF B56.6-2005 6.5.1 (c)

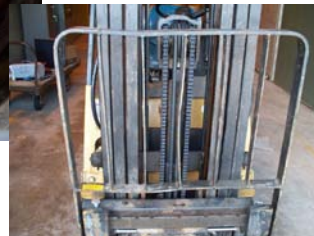
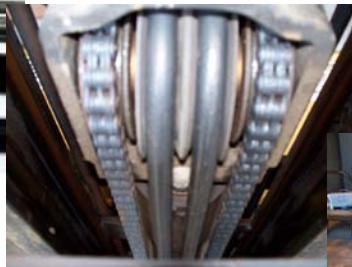
Reference OSHA Standard 29CFR 1910.178(q)(7)



NASA Standard 8719.9



d. Hydraulic system for observable deterioration or leakage and check for proper oil level if suspect.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (g)

Reference: ANSI/ITSDF B56.6-2005 6.5.1 (d)

Reference OSHA Standard 29CFR 1910.178(q)(7)



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e. Electrical equipment for signs of malfunction, signs of deterioration, and dust and moisture accumulation.

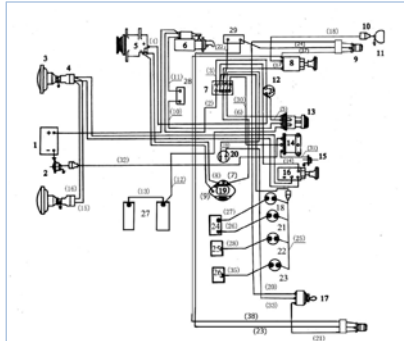
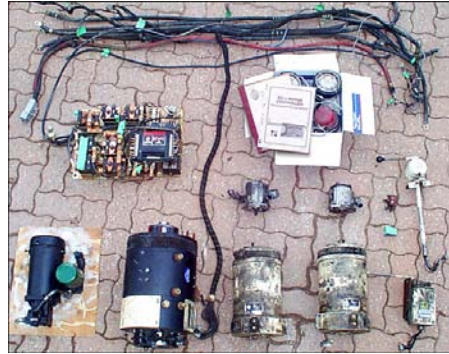


Fig. 4-1 Wiring diagram of the electrical system
1. Battery 6-QEAI-40 2. Electric horn EL28-12 3. Fuse load lamp 4. Double plug socket 5. Silicon rectifying element 6. Switcher 7. Fuse box RT 302 8. On - position switch 9. Turning signal light 10. On - plug socket 11. Rear work light 12. Ammeter 307A 13. Starting switch 200A/250W 14. Horn relay 15. Horn buzzer 16. On - position switch 17. Direction indicating light switch 18. Oil pressure gauge 19. Regulator 20. Thermal switch 21. Charging meter 22. Motor temperature gauge 23. Fuel gauge 24. Oil pressure plug 25. Motor temperature gauge 26. Fuel Plug 27. Indicator 28. Switch 29. Brake switch



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (e) (f)

Reference: ANSI/ITSDF B56..6-2005 6.5.1 (b) (c) (d)

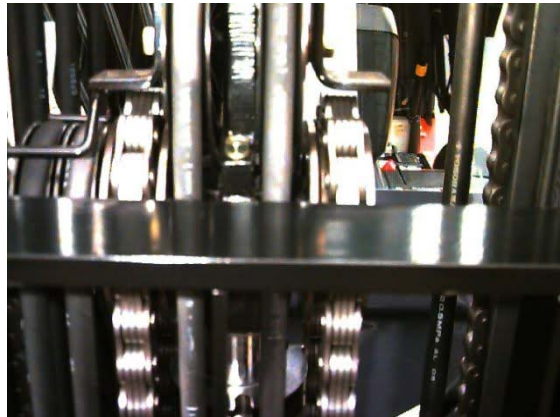
Reference OSHA Standard 29CFR 1910.178(q)(7)



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f. Chains and cables for wear or distortion.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (g)

Reference: ANSI/ITSDF B56..6-2005 6.5.1 (d)

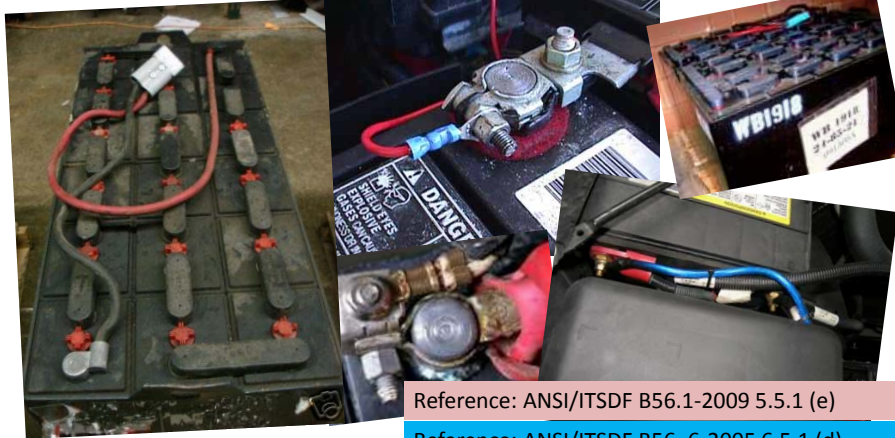
Reference OSHA Standard 29CFR 1910.178(q)(7)



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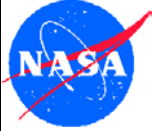
g. Battery, connections, and load test.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (e)

Reference: ANSI/ITSDF B56..6-2005 6.5.1 (d)

Reference OSHA Standard 29CFR 1910.178(q)(7)



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h. Control mechanisms.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (f)

Reference: ANSI/ITSDF B56..6-2005 6.5.1 (d)

Reference OSHA Standard 29CFR 1910.178(q)(7)



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i. Lift and tilt systems.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (g)

Reference: ANSI/ITSDF B56..6-2005 6.5.1 (d)

Reference OSHA Standard 29CFR 1910.178(q)(7)



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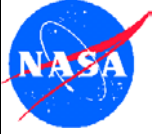
j. Load engaging means.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (h)

Reference: ANSI/ITSDF B56..6-2005 6.5.1 (d)

Reference OSHA Standard 29CFR 1910.178(q)(7)



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k. Brakes.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (i)

Reference: ANSI/ITSDF B56..6-2005 6.5.1 (e)

Reference OSHA Standard 29CFR 1910.178(q)(7)



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l. Steering mechanism.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (j)

Reference: ANSI/ITSDF B56..6-2005 6.5.1 (f)

Reference OSHA Standard 29CFR 1910.178(q)(7)



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m. Fuel systems.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (k)

Reference: ANSI/ITSDF B56..6-2005 6.5.1 (g)

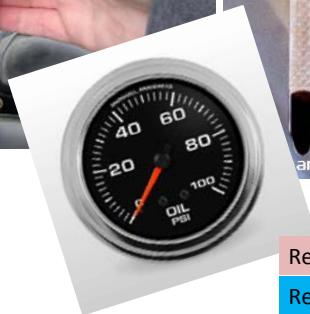
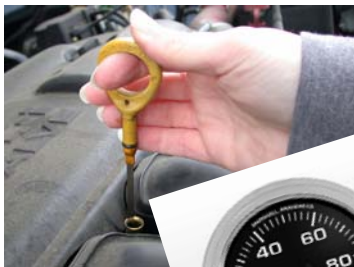
Reference OSHA Standard 29CFR 1910.178(q)(7)



NASA Standard 8719.9



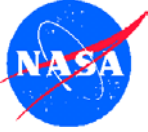
n. Engine oil and pressure.



Reference: ANSI/ITSDF B56.1-2009 5.5.1 (l)

Reference: ANSI/ITSDF B56..6-2005 6.5.1

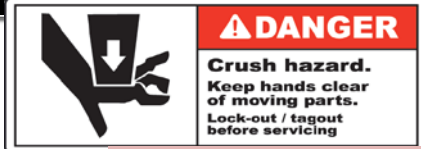
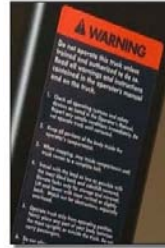
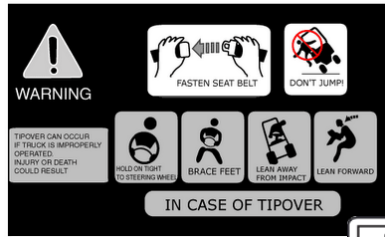
Reference OSHA Standard 29CFR 1910.178(q)(7)



NASA Standard 8719.9



o. Manufacturing plates, tags, or decals in legible condition.



- Reference: ANSI/ITSDF B56.1-2009 4.2.4
- Reference: ANSI/ITSDF B56.6-2005 8.5.2
- Reference OSHA Standard 29CFR 1910.178(q)(7)

Forklift Fatalities

Summaries of Selected Forklift Fatalities Investigated by OSHA

Selected Fatalities Investigated in 1998

- **EMPLOYEE STRUCK BY FORKLIFT:** Employee #1, a clerk assigned to the marine terminal, was walking on the wharf alongside a container top lift machine. A forklift truck, with a squeeze attachment carrying two rolls of paper, was traveling in the same direction as employee #1. The forklift truck continued forward and apparently the load (which was approximately 11 inches higher than the steering wheel) obstructed the driver's forward view. He struck and crushed employee #1 beneath the load.
- **FORKLIFT TIPOVER:** While an employee was operating a forklift, the forklift tipped over while the operator was apparently making a sharp turn at excessive speed. No seat belt was installed and when employee fell from the seat he was crushed by the rollover bar.
- **FALL FROM PLATFORM ON FORKLIFT:** The victim (employee #1) was found pinned between the mast and the frame of the forklift. Prior to the accident, employee #1 was raised approximately 6 feet high by the forklift operator while the employee was standing on a pallet that was not secured to the frame of the forklift. The operator left the forklift unattended while the employee was on the pallet pouring spice into a mixing tank.
- **CRUSHED BY FORKLIFT:** Victim was driving a stand up forklift into a tractor trailer to start unloading when the truck driver pulled away from the dock. The forklift fell back onto the forklift driver, striking his head, and apparently breaking his neck.
- **STRUCK BY FORKLIFT:** The employee was given instructions to take the forklift to unload a truck. The employee picked up the forklift located on the premises less than one half mile from where the accident occurred. Traveling down an incline, the employee attempted to make a left turn into a parking lot, struck a pothole in the road, and the forklift began to tip over to the right. The employee attempted to jump clear of the forklift, but was struck and killed as the forklift fell.
- **STRUCK BY FORKLIFT:** The victim was assigned as the scrap dumpster forklift operator and was in route to a dumpster located in the remote southeast section of the outside material storage area. The victim was utilizing a forklift rated at 4500 pounds. A metal dump hopper, equipped with a manual dump release handle, was attached to the forks of the forklift. The hopper was filled with scrap shingles. The victim positioned the load above the north side of the dumpster. He dismounted from the right side of the forklift, closest to the north wall of the dumpster, and tripped the dump handle of the hopper. As he dismounted, he failed to set the parking brake. As the load suddenly dropped, apparently the forklift jerked, causing the transmission, low on fluid, to slip into drive, and the right rear side of the forklift to travel toward the dumpster, pinning the victim against north wall of the dumpster. A crushing chest injury resulted. The primary cause of the accident was that the employee failed to set the parking brake prior to dismounting the powered forklift.

- **STRUCK BY LOAD TOPPLING FROM FORKLIFT:** A longshoreman was crushed when he was struck by a toppling load of fiber-board. This cargo had just been off-loaded from a ship and was on the dock awaiting transfer by forklift to an adjacent warehouse. The forklift intended to pick up a stack of three crates. The width of the crates had changed from previous loads to more narrow gauge. The forklift operator did not realize he was dealing with a more narrow cargo which allowed his forks to extend beyond the intended cargo's base. The forks extended some 10 inches under the base of an adjacent stack of three crates which was some 31 inches wide. When the operator raised his forks he not only picked up his intended load, but caused the adjacent stack of crates to topple onto the nearby longshoreman.
- **FALL FROM FORKS:** Two employees were riding the load which was tied onto the forks of a forklift. The load was being lifted additionally with the aid of a crane. The men were standing on the load as it was lifted about 23 feet in the air, above packed dirt. The load shifted and slipped off the forks, propelling the two men off the load. One man was seriously injured and the other died of his injuries.
- **STRUCK BY FORKLIFT:** Operator was driving a forklift forward with a load on the forks which obstructed his view. The operator did not see the employee walking by and struck her.
- **FORKLIFT TIPOVER:** An employee was driving an unloaded forklift down a ramp with a 13% slope when the forklift started to tip over. The operator attempted to jump clear and the ROP of the forklift landed on him and killed him. The employee was not wearing the supplied seatbelt.
- **STRUCK BY:** The operator of a sit-down forklift (Forklift #1) was in the process of delivering a pump to the drum/bleach line, unaware he was being followed by the operator of a stand-up forklift (Forklift #2). The operator of Forklift #1 received a page to turn off a valve, in route to deliver the pump. Parking his forklift next to three pallets of materials without lowering the forks, he went to answer the page. The distance between Forklift #1 and Forklift #2 was less than the required three truck lengths. In addition, there was insufficient passage in the aisle way and the presence of water leaking from a steam pipe in the area. Having nowhere to maneuver and little traction because of the wet floor, Forklift #2 collided with the parked Forklift #1. The right fork of Forklift #1 stabbed into the left leg of the operator of Forklift #2. The operator of the Forklift #2 was pronounced dead upon arrival at the hospital.

Selected Forklift Fatalities Investigated in 1997

- **FORKLIFT TIPPED OVER WHILE BEING TOWED:** An employee was behind the wheel of a forklift being towed by a pick-up truck operated by another company employee when the operator lost control of the forklift. The forklift veered from the roadway into a ditch, pinning the operator underneath. Prior to the accident the forklift was operational and was being driven with the forks forward, on a newly paved two lane roadway. The employee in the truck caught up with the forklift, and the two employees decided that they could get the forklift back to town faster and get the operator out of the cold weather by towing the forklift. Together they attached a tow strap to the counterweight of the forklift and began to tow the forklift down the road at approximately 15 to 18 miles per hour, with the steering wheel to the front and the forks to the rear. At

some point thereafter, the operator lost control of the forklift and it veered from the roadway into a ditch along side of the road and flipped, eventually landing on its side with the operator pinned underneath. The forklift was not equipped with seatbelts.

- **FALL FROM FORKLIFT PLATFORM:** The victim fell approximately 17 feet from an improper work platform while raised on a 3-stage industrial truck (forklift). The work platform used was a wooden appliance pallet placed on the top edge of the squeeze clamps used to move appliances by vertically squeezing them. The victim fell from the pallet head first, landing on the concrete below when the lift operator started to lower the platform.
- **FORKLIFT TIPOVER:** The victim/operator drove a forklift down a ramp rapidly and appeared to be attempting to make a sharp left turn. The forklift overturned. Apparently, the employee was unaccustomed to the quickness and sharp turning radius of the new forklift. The victim was not wearing the provided seatbelt. The driver/victim was dislodged from the seat and his head was caught under the overhead protective cage.
- **FALL FROM FORKLIFT PLATFORM (PALLET):** The employee was in the process of pulling orders from the top shelf of the storage racks in the warehouse area of the grocery store. He was on the raised forks of the forklift on a wooden pallet. Neither he nor the pallet was secured to the forks. The forklift operator was moving along the aisle next to the racks when he hit something with the tire next to the shelf and the forklift stopped suddenly. The employee on the pallet was standing on the front edge of the pallet facing towards the back of the lift. The sudden stop threw him and he fell to the concrete floor hitting his head. The pallet and most of the products remained on the forklift. The victim died the following day from head injuries.
- **FALL FROM LADDER STRUCK BY FORKLIFT:** Employee #1, an inventory control person, was standing on a step of a portable stairway stand placed against and parallel to a rack containing rolls of carpeting. Another employee (Employee #2) was operating a forklift with a pole attached to the front on which had been placed a roll of carpeting. When the forklift operator (Employee #2) turned a corner from one aisle to another, the roll caught the rear leg of the stairway stand. This jostled Employee #1 and he fell three feet to the concrete floor, landing on his back and then his head struck the floor. He received head injuries and died twenty days later.

A Primer on Keeping Forklifts Upright

Operating a forklift may seem simple at first, but one wrong maneuver could send both you and the machine tumbling

As common as forklifts are, operating one is nothing like driving a car. It is essentially a balancing act that requires utmost skill, training and attention. According to the Occupational Safety and Health Administration, 85 fatal forklift-related accidents occur each year. Another 34,900 operators suffer serious injuries. Forty-two percent of those deaths are a result of operators crushed by the forklift after an unintended tip over.

Without training, operators adopt bad habits from each other, says Jeff Stachowiak, director of safety training at Sunbelt Rentals. This leads to maneuvers, lifts and other operating actions that appear safe, but may result in a catastrophic forklift failure.

Know what you're lifting

One important skill that operators should have is to be able to estimate the weight of each load. In heavy construction, loads often have a known weight, which is listed on the load itself. An eight-inch concrete block, for instance, weighs around 35 pounds. Operators

pick up cubes containing 90 concrete blocks, adding up to approximately 3,000 pounds. If the blocks are wet, they may weigh another 100 or 200 pounds.

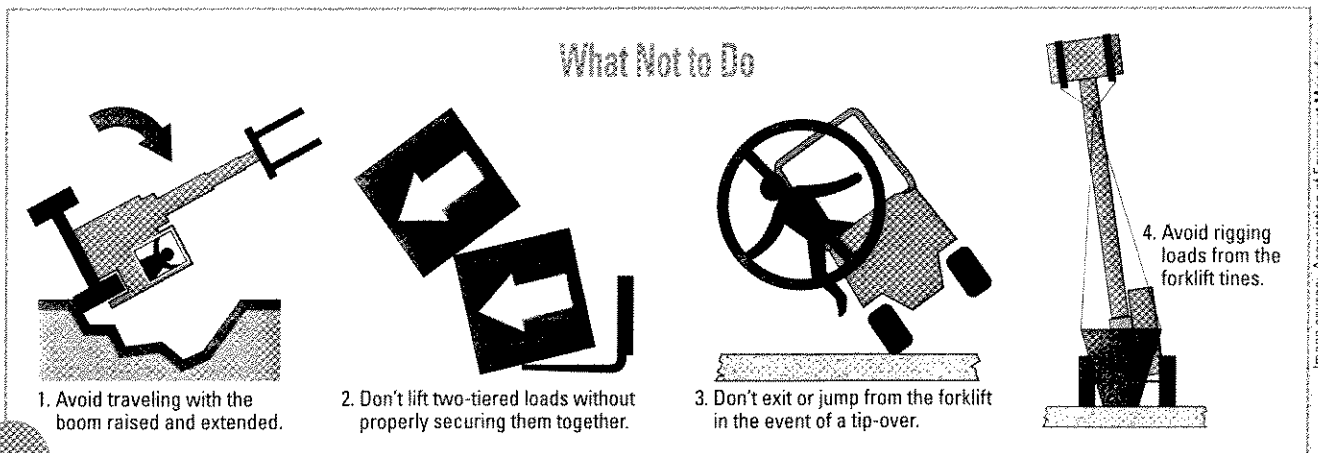
"Every forklift is made to the same ANSI/ASME standard," Stachowiak says. "All forklifts are designed to pick up a 48-inch by 48-inch by 48-inch cube with the load laterally centered 24 inches out and up."

"Anytime you're picking up a load outside that 24-inch load center, unless it's indicated on the I.D. plate or the load chart, it's really an unknown capacity," he says.

If operators don't know the weight of a load, they should ask their supervisor for it.

"The load must be split or a machine of sufficient capacity should be used," says Mike Pankonin, senior director of technical and safety services for the Association of Equipment Manufacturers. "If there is any question about the weight of the load or the capacity of the machine, the load should not be moved."

"You have to look at the load chart and you have to look at where you're going to place the load," Stachowiak says. "You have



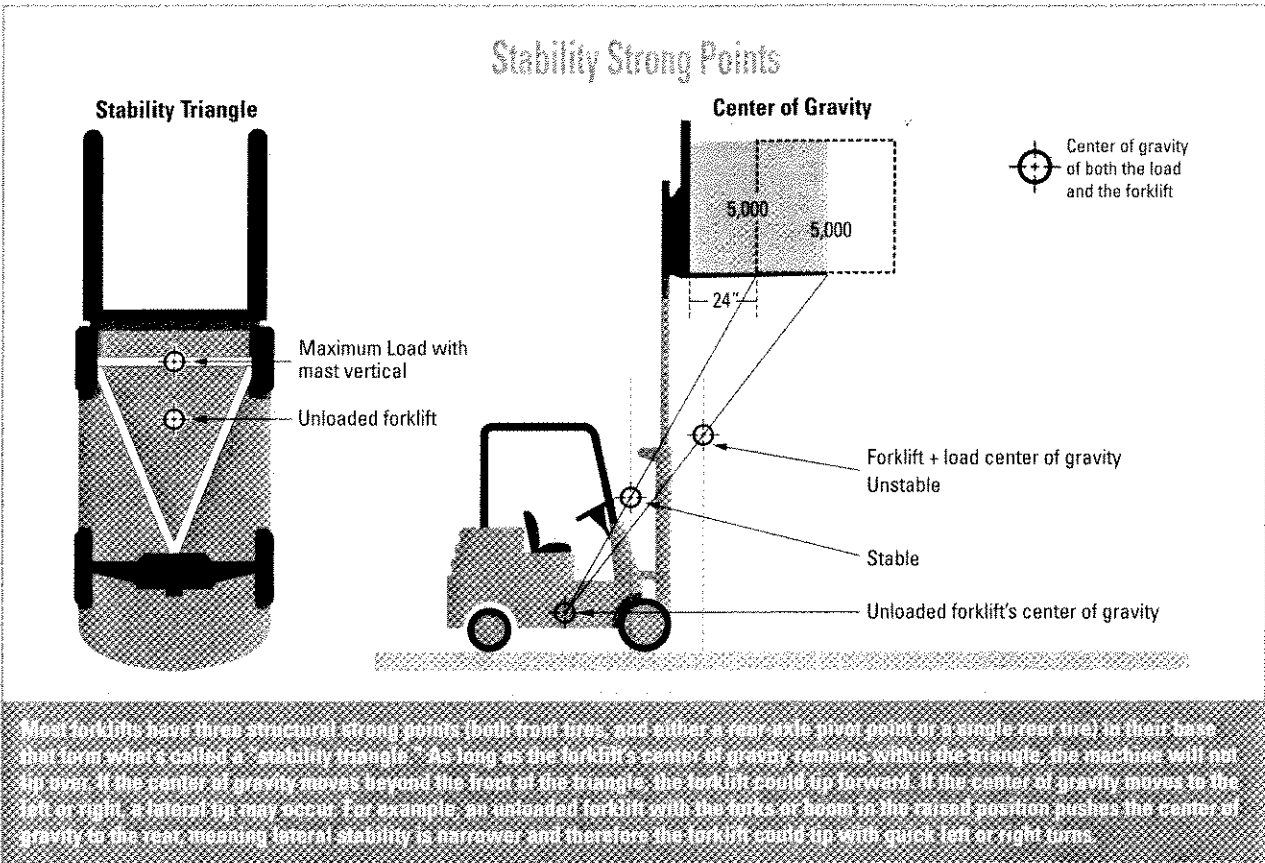


Image source: Washington Department of Labor and Industries

to figure out whether you're within capacity on the load chart."

Many operators, however, use "the seat of their pants" to determine the weight of the load and whether the forklift can handle it.

Operators, for example, commonly do not pull up close enough to a building to place or lift a load using an extended boom. They end up tipping the forklift because they decline to use the load chart.

Anytime the rear wheels come off the ground, the limitations of the forklift have been exceeded and therefore an accident has occurred, Stachowiak says, even if the machine doesn't tip over. The forklift may appear intact, but the rear axle could have been damaged after hitting the ground.

Other times, forklifts tip when not loaded.

"Driving without out a load, that's when the machine is least stable," Stachowiak says. "All of the center of gravity is closer to the rear of the machine, and putting a load on the forks actually stabilizes the forklift."

Tipping an unloaded forklift often happens when an operator has just placed a load on scaffolding using an extended boom.

How to Brace Yourself in a Tip-Over

- 1 **HOLD ON TIGHT TO STEERING WHEEL**
- 2 **LEAN AWAY FROM IMPACT**
- 3 **BRACE FEET**
- 4 **LEAN FORWARD**

Image source: Occupational Safety and Health Administration

Rather than using the joysticks to retract and lower the fork, the operator puts the entire machine in reverse and turns abruptly while bringing the boom down, which pushes the center of gravity to the edges of the forklift.

"At that point, it's not hard to tip the forklift over," he says.



A Sunbelt customer in Jacksonville, Fla., recently lifted a 4,500-pound tree by suspending with a rope tow from a forklift's tines. The work-site crew attempted to lift the tree by its root ball and then place it in a hole next to a pool at a residence under construction. Both the tree and ground were level, but the operator frame-tipped the forklift to get around some obstructions. When they lifted the tree off the ground, it began to swing in the direction of the tilted frame. That swing caused enough force to tip the forklift over. Stachowiak says the operator essentially side-loaded the forklift, which is a no-no in the forklift business. Yet many operators make similar maneuvers each day. It's only a matter of time before an accident catches up with them, Stachowiak says.

Sunbelt Customer Sideloads and Tips Forklift

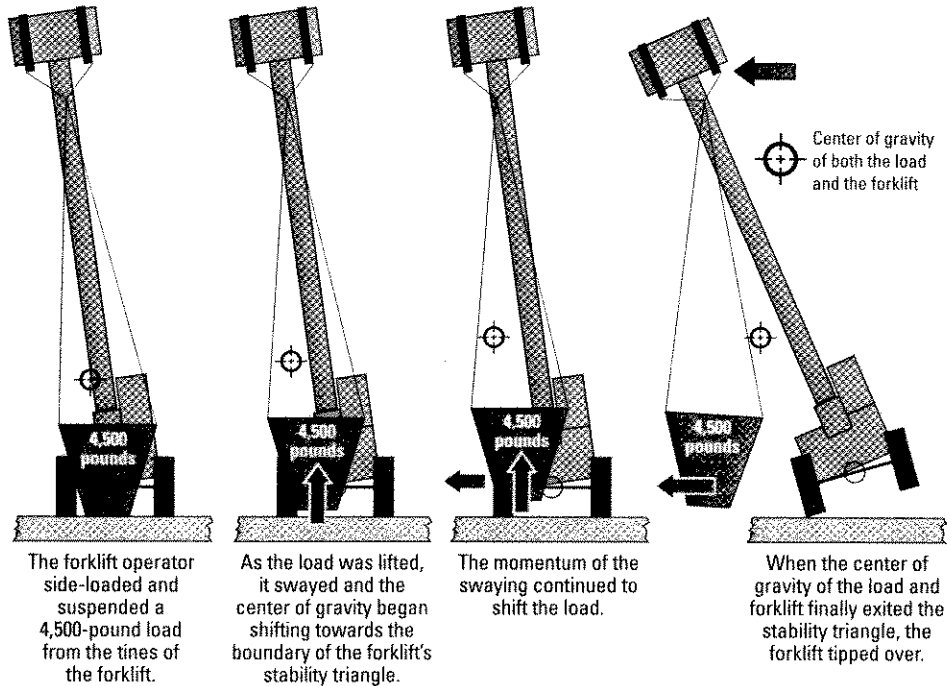
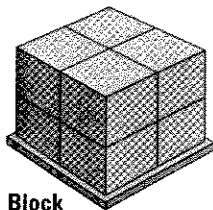
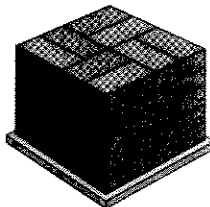


Image source: Sunbelt Rentals

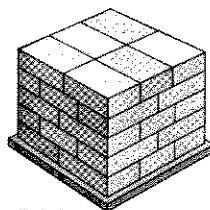
Proper Load Stacking Means More Stability



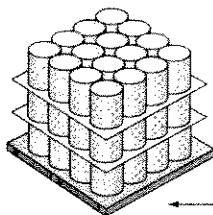
Block
Block stacks are the most common on a job site. The upper level may be unstable if not secured with wire or strapping.



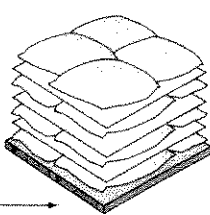
Pinwheel
Each pair of blocks is turned 90 degrees from adjacent blocks.



Brick
Containers are interlocked by turning each level 90 degrees.



Irregular
Wood strips, plywood or heavy cardboard between layers can help stabilize castings, bags, and other irregular shapes.



Regular maintenance

As for maintenance, fleets often overlook forklift brakes. Part of an operator's pre-start check must include simple brakes testing to determine whether they work both forward and backward. Emergency brakes should be checked regularly as well. Just like with a car, if the brakes feel mushy or lack stopping power, the operator needs to alert the service department.

"There's a huge amount of forklifts out there that don't have working brakes on them," Stachowiak says. "The way operators stop without brakes is by shifting between forward and neutral, or they drive into the load and it stops when it hits the pallet."

Forklifts engage in rigorous work requiring heavy loads to be raised and lowered several times each day. Combined with tight work schedules that contractors must stick to, operators push forklifts to their limits.

Get to know the limits of each forklift you use by reading the operators manual and becoming familiar with its load chart.

Image source: Washington Department of Labor and Industries