



HARVARD UNIVERSITY • UNIVERSITY OPERATIONS SERVICES

Environmental Health & Safety

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Aerial Lifts

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AERIAL LIFTS

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AERIAL LIFTS TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	SCOPE AND APPLICATION	1
3.0	ROLES AND RESPONSIBILITIES	1
3.1	<i>General Responsibilities</i>	2
3.1.1	Supervisor	2
3.1.2	Operator	2
3.1.3	Department Of Environmental Health & Safety.....	3
3.2	<i>Standard Specific Responsibilities</i>	3
4.0	GENERAL REQUIREMENTS	3
4.1	<i>Personal Protective Equipment Requirements</i>	3
4.2	<i>Operating Requirements</i>	4
4.2.1	Care And Use	4
4.2.2	Street Travel.....	4
4.2.3	Fall Protection.....	4
4.2.4	Working Surfaces	6
4.2.5	Load Limits	6
4.2.6	Vehicle Positioning	6
4.2.7	Outriggers.....	7
4.2.8	Brakes	7
4.2.9	<i>Wheel Chocks</i>	7
4.2.1.0	Power Lines.....	7
4.2.1.1	Dangerous Obstacles.....	8
4.2.1.2	Tip-Overs.....	8
4.2.1.3	Pedestrian Traffic	9
4.2.1.4	Signs, Caution Tape And Barriers.....	9
4.2.1.5	Types Of Lifts	10
4.3	<i>Maintenance Requirements</i>	12
4.3.1	Fossil Fuels	12
4.3.2	Charging Batteries.....	12
5.0	INSPECTIONS	13
5.1	<i>Operational Inspections</i>	13
5.1.1	Work Area Inspection	13
5.1.2	Personal Fall Arrest System.....	14
5.1.3	Power Source Inspection	14
5.2	<i>Physical Inspections</i>	15
5.2.1	Aerial Lift Inspection	15
6.0	STANDARD DOCUMENTATION	15
7.0	TRAINING	15



1.0 INTRODUCTION

Aerial lifts are commonly used in construction, inspection and repair services to lift University employees to an elevated work position. Proper operation and use of aerial lifts can make completion of tasks at elevation, safer and more efficient. However, unsafe use, operation and aerial lift work practices can result in serious injury. This standard has been developed due to the high consequence of improper use. In addition, this standard outlines general, operating, maintenance, inspection and training requirements governing safe aerial lift use at the University.

2.0 SCOPE AND APPLICATION

This standard is applicable to all University employees who own aerial lifts, employees whose duties require them to operate, service, repair or maintain aerial lifts and supervisors of employees who use aerial lifts.

OSHA has established specialized safety requirements for employees conducting hot work activities.

This standard incorporates the requirements of OSHA 29CFR1910 Subpart F: “Powered Platforms, Man lifts, and Vehicle-Mounted Work Platforms and 29CFR1926 Subpart L: “Scaffolds”

The major provisions of the regulations are:

- Personal fall protection
- Specific requirements
- General requirements
- Operating rules
- Mechanical requirements
- Periodic inspection

3.0 ROLES AND RESPONSIBILITIES

Supervisors and operators are required to follow the procedures described in this Aerial Lift Safety Standard. Specific responsibilities are further described below.



3.1 GENERAL RESPONSIBILITIES

In order for the Aerial Lift Standard to be effective all Harvard University employees must clearly understand and take an active role in meeting their responsibilities. Due to the potential hazards associated with various types of work activities, the specific responsibilities outlined below must be followed.

In addition to the duties and responsibilities of employees and supervisors outlined in the following sections, other groups at Harvard University will play an important role in supporting the successful implementation and maintenance of this standard.

The Environmental Health and Safety Department will provide expert technical guidance to support the implementation of the Aerial Lift Standard, and will participate in the annual standard review process.

Supervisors will provide management commitment and operational support for successful implementation and maintenance of this standard.

3.1.1 SUPERVISOR

The following are the responsibilities of the Supervisor under the provisions of the Harvard University Aerial Lift Standard:

- Understand and adhere to requirements of Harvard Aerial Lift Standard
- Understand hazards specific to aerial lift type
- Ensure modifications are not made to aerial lifts without manufacturer's prior approval
- Ensure signs, caution tape, barriers/fences and other means of diverting pedestrian traffic are in place prior to operating lift
- Ensure that employees attend and complete Aerial Lift training
- Attend and complete Aerial Lift training must ensure that no modifications or additions are made to an aerial lift without the manufacturer's written approval
- Supervisors must retain completed Aerial Lift checklists and Aerial Lift Work Area Inspection checklists

3.1.2 OPERATOR

The following are the responsibilities of the Employee under the provisions of the Harvard University Personal Protective Equipment Standard:



- Understand and adhere to requirements of Harvard Aerial Lift Standard
- Understand hazards specific to aerial lift type
- Ensure modifications are not made to aerial lifts without manufacturer's prior approval
- Perform aerial lift pre-use safety check prior to each use (see *Aerial Lift Pre-Use Inspection Checklist Form*) and submit to supervisor
- Perform lift work area inspection prior to aerial lift use (see *Aerial Lift Work Area Inspection Checklist Form*) and submit to supervisor
- Immediately report damage or irregularities of lift operation to supervisor
- Immediately report worn personal fall arrest system components to supervisor
- Conduct a work area inspection prior to using the aerial lift
- Attend Aerial Lift training, pass a written examination and demonstrate proficiency during a practical exercise with the lift in operation

3.1.3 DEPARTMENT OF ENVIRONMENTAL HEALTH & SAFETY

The following are the responsibilities of the Department of Environmental Health and Safety under the provisions of the Harvard University Personal Protective Equipment Standard:

- Provide regulatory guidance to Harvard University regarding Occupational Safety and Health Administration standards.
- Evaluate and update the written Aerial Lift Standard on an annual basis.
- Coordinate Aerial Lift Training for supervisors and employees.

3.2 STANDARD SPECIFIC RESPONSIBILITIES

4.0 GENERAL REQUIREMENTS

4.1 PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

Employees in a lift are required to wear a personal fall arrest system consisting of a full body harness and a lanyard properly attached to the lift basket.

In addition, protective insulated gloves, goggles, and long sleeves shall be worn when checking or charging LPG tanks. PPE is necessary since LPG gas will freeze skin.



4.2 OPERATING REQUIREMENTS

4.2.1 CARE AND USE

Aerial lifts must be operated and used in accordance with OSHA regulations and American National Standard Institute (ANSI) standards.

Aerial lifts must be cared for according to manufacturer's requirements. Aerial lifts may be "field modified" for uses other than those intended by the manufacturer, provided the modification has been certified in writing by the manufacturer or by any other equivalent entity, such as a nationally recognized testing laboratory. Aerial lifts shall also conform to all applicable provisions of ANSI A92.2-1969 for Vehicle-Mounted Elevating and Rotating Platforms and 1910.68 to be at least as safe as the equipment was before modification. Approved equipment must bear a label or some other identifying mark indicating approval by the testing authority and/or laboratory.

4.2.2 STREET TRAVEL

Before traveling on open roadways, operators must secure necessary traffic permits from local police department. Prior to travel aerial ladders, booms and towers must be secured in the lower traveling positions by the locking devices provided or by other equally effective means. Locking pins must be in place as directed by the manufacturer.

4.2.3 FALL PROTECTION

Employees that perform work in an aerial lift must adhere to all safety rules and regulations provided in the Aerial Lift Safety Standard. Employees are prohibited from extending their upper body outside of the basket. Operators must also insure that their weight and the weight of any equipment and tools they are using do not exceed the load limit of the aerial lift.

The following section applies to the mandatory fall protection requirements for operators and employees conducting aerial lift work. Mandatory and non-mandatory fall protection guidance is available on the OSHA website or in the *Resources Section* of our website.

Employees working in a man lift, bucket truck, boom lift or aerial lift other than a scissor lift must wear a full body harness and a lanyard (2-foot in length for restraint) connected to an appropriate attachment point on the bucket or boom. Employees that work in a scissor lift where the guard rails are not in place are required to wear a harness and a lanyard attached to the basket.



Employees shall remain tied-off until the work is finished and the basket has been safely lowered to the ground. Employees working from an aerial lift may only tie off to the basket or boom of the aerial lift. Tying off to an adjacent pole, structure or other equipment is prohibited.

In some cases, the stopping force of a fall can cause the lift to tip-over. Operators should review the aerial lift manufacturer's recommendations for fall arrest systems before using the lift.

Personal Fall Arrest Systems

Employees that are working in an aerial lift are required to wear a personal fall arrest system. It is critical that the appropriate fall protection equipment is selected and that employees understand how to utilize the equipment. The manufacturer's instructions included with fall arrest systems and positioning devices must be read prior to each use to ensure that it is appropriate for the particular situation or environment.

When stopping a fall, personal fall arrest systems shall:

1. Limit maximum arresting force on an employee to 1,800 pounds when used with a body harness
2. Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet
3. Shall have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of six feet, or the free fall distance permitted by the system, whichever is less.

Personal fall arrest systems shall be rigged such that an employee can not free fall more than six feet or contact a lower level.

Personal fall arrest systems or components subjected to impact loading shall be immediately removed from service and shall not be used again for employee protection unless inspected and determined by a competent person to be undamaged and suitable for reuse.

Personal fall arrest systems or components shall be used only for employee fall protection.

Emergency Rescue

Harvard University provides immediate rescue service for employees in the event of a fall or other emergency. In the event of a fall or other emergency, immediately call the **University Operations Center** at **617-495-5560** or **911**.

Emergency Planning

Employees should review building emergency escape routes, procedures and alarm systems before operating a platform. Upon initial assignment and whenever the plan is changed the supervisor should review with each employee those parts of the plan which the employee must know to evacuate safely in the event of an emergency.

4.2.4 WORKING SURFACES

Employees shall always stand firmly on the floor of the basket and shall not sit or climb on the edge of the basket. Employees should **NEVER** attempt to climb outside of the basket or over extend the upper body beyond the railing of the basket.

Employees may only perform work in areas which can be reached from inside the basket of the lifting device. Aerial lifts may not be used in combination with other devices such as ladders, planks or scaffolding.

4.2.5 LOAD LIMITS

Load limits for the boom and basket shall not be exceeded. Load limits for boom and basket must be posted in a visible location on the aerial lift. Boom and basket load limits must be specified by the manufacturer or by any other equivalent entity, such as a nationally recognized testing laboratory.

4.2.6 VEHICLE POSITIONING

Prior to executing a lift, the vehicle in which the lift is mounted needs to be positioned in such a way as to allow the boom and basket a full range of motion inside the work area. With some types of lifts, once the vehicle is in the desired position, special stabilizing tools such as “outriggers” and “wheel chocks” need to be installed in order to safely operate the lift. Other types of lifts allow vehicle movement while the boom is extended and do not require stabilizing equipment. Unless the vehicle is designed to do so an aerial lift vehicle should never be moved when the boom is elevated.





4.2.7 OUTRIGGERS

Outriggers are one type of stabilizing tool. If outriggers are used, they should be positioned on “cribbing” pads or a solid surface.

Setting up and positioning the outriggers is extremely important, if done incorrectly the aerial lift could tip over.

When setting outriggers, remember:

- When possible, position outriggers on solid surface such as concrete or asphalt
- Position outriggers on level ground
- If outriggers are positioned on soil, check the soil density to ensure that the surface is stable and not recently backfilled
- Always use cribbing when positioning outriggers on soil
- Always bring the outrigger straight down, **NEVER** at an angle
- Never stand behind an outrigger or between an outrigger and another object when it is being retracted because the center of gravity might have shifted during lifting activities and the sudden release of the outrigger could cause the vehicle to lunge.

4.2.8 BRAKES

Brakes provide protection against accidental movement. Prior to operating the lift, the operator should ensure that the brakes are set.

4.2.9 WHEEL CHOCKS

Wheel chocks provide additional protection against accidental vehicle movement. Chocks prevent accidental movement or slippage of vehicles by bracing the wheels on either side. This is important during boom and basket movement when shifting weight can affect wheel placement. Chocks must be utilized before operating an aerial lift that is positioned on an incline.

4.2.1.0 POWER LINES

Only aerial lifts with insulated buckets may be used for work on overhead power lines. The bucket's insulation should be inspected periodically for decay and damage that could reduce its level of protection. Lifts that are not insulated must maintain at least a 10 foot distance between the boom and energized electrical lines. Always treat power



lines, wires and other conductors as being energized, even if they are inactive or appear to be insulated. Workers that are not electrical workers must remain at least ten feet from power lines.

4.2.1.1 DANGEROUS OBSTACLES

Operators should never position themselves between overhead hazards; such as joists and beams, or the rails of the basket. Accidental movement of the lift could result in a crushing hazard.

Operators should also be aware of other obstacles. Operators must keep a minimum distance of 10 feet from all dangerous obstacles. Dangerous obstacles include:

- Other vehicles
- Tools & equipment
- Other aerial lifts
- Trenches & pits
- Mechanical devices
- Pot holes
- Cranes
- Power lines

4.2.1.2 TIP-OVERS

Tip-overs can occur when aerial lifts are operated on soft or uneven ground, if the rated load limit is exceeded or if the lift is struck by another vehicle. To avoid a tip-over:

- Do not exceed the manufacturer's rated load capacity limits
- Avoid unnecessary travel with lift in the elevated position
- Establish a work area perimeter
- Do not drive near leading edges or holes
- Do not raise the platform on a slope or drive onto a slope when elevated
- Do not drive onto uneven or soft surfaces when elevated.
- Complete the Work Area Inspection Checklist Form found on our website
- Do not use the platform in windy conditions
- Avoid excessive horizontal forces when working from an elevated scissor lif

4.2.1.3 PEDESTRIAN TRAFFIC

Operators must be constantly aware of their surroundings. Aerial lift operators are a vital part of the University’s construction and maintenance services. Operators are responsible for the safety of people in the vicinity of the lifting equipment. In the event that aerial lift work needs to be conducted in the vicinity of pedestrian traffic, operators must take special precautions to ensure that the work is isolated from pedestrian traffic.

4.2.1.4 SIGNS, CAUTION TAPE AND BARRIERS

The aerial lift boom and basket should never be positioned above pedestrians and other workers. If an aerial lift is going to be used in an area near pedestrian traffic, operators are required to isolate the work area by establishing a perimeter and safely diverting the pedestrian traffic. Danger signs, caution tape and barriers should be used to create the perimeter of the work area.

The perimeter must be delineated in such a way that the boom and basket remain in the work area during all work positions (*Figure 1*). If the work area is limited, operators may only position the boom as far as the established perimeter. If the work area is located in a pedestrian thoroughway such as a sidewalk, pedestrian traffic must be safely diverted. If pedestrian traffic is to be diverted onto a street, a police detail must be hired to direct traffic (*Figure 2 and 3*).

When pedestrian traffic is diverted, signs must be posted to direct people in the appropriate direction. Additional signs must be posted at all entrances and around the perimeter of the work area to warn pedestrians that dangerous work is being conducted.

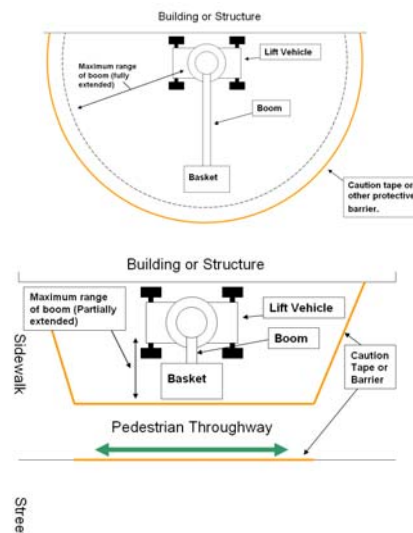


Figure 1

Figure 2

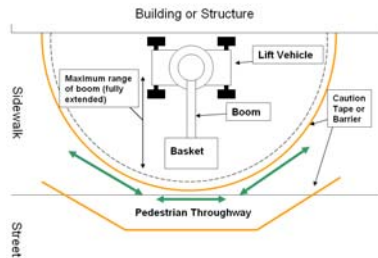


Figure 3

4.2.1.5 TYPES OF LIFTS

Bucket Trucks

Cherry pickers and bucket trucks are types of aerial lifts that contain a bucket-like platform attached to a long arm (boom). As the arm unfolds, the platform rises. These types of lifts are commonly used by utility workers and landscapers.



Special Hazards:

- Insulating integrity
- Fall from above
- Tip over
- Collision
- Electrocution

Scissor Lifts

Scissor lifts use criss-cross braces that extend and stretch upward. As the criss-cross braces rise, the platform attached to the top of the braces also rises.



Special Hazards:

- Collision



- Fall from above
- Tip-over
- Electrocution

Articulated Boom Lift

Articulating boom lifts (knuckle booms) are able to extend up and over machinery and other obstacles and are able to reach elevated positions not easily approached by a straight (telescopic) boom lift. Typically, the turntable is capable of rotating 360 degrees in either direction. The boom can be raised or lowered from vertical to below horizontal and extended (telescoped) while the work platform remains horizontal and stable. It can be maneuvered forward or backward and steered in any direction by the operator from the work platform, in some cases while the basket is elevated. Most articulating models can be driven with the boom extended to its full elevation. Operators should insure that the articulating boom is designed for this before attempting to drive the lift with the boom extended.



Special Hazards:

- Insulating integrity
- Fall from above
- Tip over
- Collision
- Electrocution

Telescoping Boom Lift

Telescopic (straight or stick boom) boom lifts are used for applications that require high reach capability. The lift's turntable can be rotated 360 degrees in either direction for easier positioning. The boom can be raised or lowered from vertical to below horizontal and extended while the work platform remains straight and stable. The operator in the platform can maneuver and steer in any direction, in some cases while the boom is extended. Operators should insure that the articulating boom is designed for this before attempting to drive the lift with the boom extended.



Special Hazards:



- Insulating integrity
- Fall from above
- Tip-over
- Collision
- Electrocution

4.3 MAINTENANCE REQUIREMENTS

4.3.1 FOSSIL FUELS

Storage and handling of liquid fuels must be in accordance with NFPA Flammable and Combustible Liquids Code (NFPA No. 30-1969), and Massachusetts 527 CMR 15 Flammable and Combustible Liquids, Flammable Solids or Flammable Gases.

Storage and handling of liquefied petroleum gas must be in accordance with NFPA Storage and Handling of Liquefied Petroleum Gases (NFPA No. 58-1969) and Massachusetts 527 CMR 6 Liquefied Petroleum Gas Containers and Systems.

Unless otherwise exempt by CMR 527, a permit is required by any owner, tenant, lessee, or business to store and use flammable liquids and gases. The maximum storage limits with a permit for Boston and Cambridge are:

Gasoline	Liquefied Petroleum Gas
793 gallons	3000 cu/ft

Table 2

4.3.2 CHARGING BATTERIES

Locate battery-charge stations in areas capable of flushing and neutralizing of spilled electrolyte, equipped with appropriate fire protection, charging apparatus protection, and adequate ventilation for dispersal of battery off-gassing. Battery handling equipment and a carboy tilter or siphon for handling electrolyte should be provided. Smoking and other potential ignition sources are prohibited in the designated area.

Follow MSDS recommendations for sulfuric acid. When charging batteries, pour acid into water; not water into acid. Pouring water into acid can result in a violent reaction

and is a potential explosion hazard. Properly position the aerial lift and secure the brake before attempting to change or charge batteries. Properly position, and secure

reinstalled batteries in the aerial lift. Ensure vent caps are functioning and the battery (or compartment) cover(s) are open to dissipate heat. Prevent open flames, sparks, or electric arcs in battery charging areas. Keep tools and other metallic objects away from the top of uncovered batteries. Make sure the keys are not in aerial lift ignition when disconnecting the battery leads from the charging device. A spark from the ignition switch could generate an electrical shock.

Smoking is prohibited during fueling, battery charging of a lift, and operation. Working around batteries can be dangerous because they contain sulfuric acid and generate potentially explosive gases (hydrogen) during the charging cycle. Do not smoke or let anyone else smoke in a battery charging area. Never use an open flame to check the electrolyte level in batteries or the gasoline level in fuel tanks. The following conditions pertain to battery charging and fuel handling and storage:

- Battery charging must be accomplished in well ventilated areas
- Fuel tanks must not be filled while the engine is running
- Trucks shall not be operated with a recognized leak in the fuel system
- Spillage of oil or fuel must be carefully cleaned up and the fuel tank cap replaced before restarting the engine
- When checking fluid levels in batteries, PPE (face and hand protection) must be worn
- In areas where electrolyte is added to batteries, an eyewash station must be readily accessible

5.0 INSPECTIONS

5.1 OPERATIONAL INSPECTIONS

5.1.1 WORK AREA INSPECTION

Prior to operating an aerial lift, the work area shall be inspected to ensure that conditions are safe to operate the aerial lift. Operators must ensure that pedestrian traffic has been diverted in accordance with section 4.2.1.3 of this standard. Ground density and positioning of the aerial lift must be in accordance with the Work Area Inspection form located in the *Forms Section* of this standard. Operators must also observe any additional hazards such as power lines, cranes, structures, driving surfaces and other aerial lifts being used in the area before operating the aerial lift. Operators must document area inspections by using the “Work Area Inspection” document located online in the *Forms Section* of the standard. Submit completed forms to supervisor.



5.1.2 PERSONAL FALL ARREST SYSTEM

Personal fall arrest systems shall be inspected prior to each use for mildew, wear, damage and other deterioration. Defective components shall be removed from service if their strength or function may be adversely affected. Damaged equipment must be reported to the operator's supervisor.

5.1.3 POWER SOURCE INSPECTION

The aerial lift power source must also be inspected prior to use. Battery, liquid propane and diesel are used as power sources for aerial lifts. Each power source has specific inspection criteria.

Battery Power

Protective acid resistant gloves, goggles, and long sleeves shall be worn when checking battery fluid levels and/or replacing battery electrolytes. PPE is necessary to protect against irritation to the airways and skin. Inspect batteries for:

- Proper electrolyte fluid levels
- No cracks or holes
- No cells that are unsecured or leaking
- No frayed electrical cables
- No broken or cracked insulation material
- Tight connections
- No clogged vent caps

Liquid Petroleum Gas (LPG) Tanks/Cylinders

Protective insulated gloves, goggles, and long sleeves shall be worn when checking or charging LPG tanks. PPE is necessary since LPG gas will freeze skin. Inspect tank(s) for:

- Rust
- Cracks
- Broken weld points
- Expired hydrostatic test date
- Leaking valves



- Frayed fuel gas lines and other damage

All valves, nozzles, and hoses should be secure and must not leak. If damage is found, the equipment should not be operated until the damage has been corrected.

Diesel Power

Fuel lines should be visually inspected for cracks and other signs of deterioration or damage. Petroleum odors are also an indication that the lift may be leaking fuel.

5.2 PHYSICAL INSPECTIONS

5.2.1 AERIAL LIFT INSPECTION

Prior to operating an aerial lift, vehicle and lift components must be inspected. Operators must document area inspections using the “Pre-Use Inspection” form located online in the *Forms Section* of the standard. Submit completed forms to supervisor.

6.0 STANDARD DOCUMENTATION

7.0 TRAINING

One of the most important elements of any aerial lift safety standard is operator training. All aerial lift operators are required to successfully complete an Aerial Lift Operator Training Program prior to operating an aerial lift. All operators must re-qualify for their Operator Permit annually through successful completion of the Aerial Lift Operator Refresher Program.

The Aerial Lift Operator Training Program includes a written test and a proficiency demonstration with the student driving and positioning an aerial lift through a predetermined course.

Before using a personal fall arrest system and after any component or system is changed, employees shall be trained in accordance with the requirements of 1910.66 in the safe use of the system. These are:

- Recognition of, and preventive measures for, the safety hazards associated with their individual work tasks
- General recognition and prevention of safety hazards associated with the use of working platforms, including the provisions relating to the particular working platform to be operated



- Emergency action plan procedures as described in the Aerial Lift Safety Standard
- Written work procedures for the operation, safe use and inspection of working platforms shall be provided for employee training
- Personal fall arrest system inspection, care, use and system performance

For additional information, assistance and inquiries on Aerial Lift Training visit the EH&S Website http://www.uos.harvard.edu/ehsapps/training/classroom_courses.jsp