

ANSI/SIA A92.9 – 2011

AMERICAN NATIONAL STANDARD

for

Mast-Climbing Work Platforms



American National Standards
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The design and manufacturing requirements of this standard apply to all mast-climbing work platforms manufactured on or after the effective date. All other provisions of this standard apply to both new and existing units delivered by sale, lease, rental or for any form of beneficial use on or after the effective date.

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ANSI/SIA
A92.9-2011

AMERICAN NATIONAL STANDARD
for MAST-CLIMBING WORK PLATFORMS

Secretariat
Scaffold Industry Association, Inc.

Approved February 25, 2011
American National Standards Institute, Inc

AMERICAN NATIONAL STANDARD

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FOREWORD

This foreword is not part of American National Standard for Mast-Climbing Work Platforms, ANSI/SIA A92.9-2011.

This standard is one of a series on aerial platforms developed under the committee procedures of the American National Standards Institute. The A92 standards committee was organized by the Institute in 1948. The Scaffold Industry Association, Inc. serves as Secretariat.

The primary objective of this standard is to prevent accidents associated with the use of Mast-Climbing Work Platforms by establishing requirements for design manufacture, installation, maintenance, performance, use and training.

Interpretations and Suggestions for Improvement

All inquiries requesting interpretation of the Committee's approved American National Standards must be in writing and directed to the Secretariat. The A92 Committee shall approve the interpretation before submission to the inquirer. No one but the A92 Committee is authorized to provide any interpretation of this standard.

The A92 Committee solicits comments on and criticism of the requirements of the standards. The standards will be revised from time to time where necessary or desirable, as demonstrated by the experience gained from the application of the standards. Proposals for improvement of this standard will be welcome. Proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed rationale for the proposal including any pertinent documentation.

All requests for interpretation and all suggestions for improvement shall be forwarded in writing to the ASC A92 Committee, c/o Secretariat ~ Scaffold Industry Association, 400 Admiral Boulevard, Kansas City, MO 64106

This Standard was processed and approved for submittal to ANSI by Accredited Standards Committee Aerial Platforms, A92 Aerial Work Platforms. The ASC A92 committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time the ASC A92 committee approved this standard, the A92 Aerial Work Platforms Committee had the following members:

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1 Scope This standard applies to Mast Climbing Work Platforms that are primarily used to position personnel, along with their necessary tools and materials, to perform their work. (See Figures 1 and 2 on the following pages for typical examples of equipment covered.) Platforms may be adjustable by manual or powered means.

1.1

This standard is applicable to work platforms which are elevated by a drive system and guided by and move along their supporting masts, where the mast may or may not require lateral restraint from separate supporting structures.

1.2

This standard is applicable to any combination of the following alternatives:

- a) one or more masts.
- b) mast tied or untied.
- c) mast of fixed or variable length.
- d) masts vertical or inclined between 0° and 30° to the vertical.
- e) masts which are standing or hanging.
- f) movable or static base (chassis, or base frame).
- g) manually or power operated elevation.
- h) towed or self powered ground travel on site, excluding road traffic regulation requirements.
- i) driven using electric, pneumatic, hydraulic motors or internal combustion engines.

1.3

This standard identifies the hazards arising during the various phases in the life of such equipment and describes methods for the elimination or reduction of these hazards and for the use of safe working practices.

1.4 Effective Dates

The design and manufacturing requirements of this standard apply to all mast-climbing work platforms manufactured on or after the effective date of this standard. All other provisions of this standard apply to both new and existing units delivered by sale, lease, rental or for any form of beneficial use on or after the effective date.

1.4.1 Design, manufacture and remanufacture requirements

The design and manufacturing requirements of this Standard will apply to all Mast Climbing Work Platforms (MCWPs) manufactured on or after the effective date. MCWPs remanufactured on or

after the effective date of this Standard shall comply with the requirements of this Standard.

1.4.2 Rebuild / recondition requirements

Rebuilt / reconditioned MCWPs shall comply with the Standard in effect as of the date of their original manufacture.

1.4.3 Installation requirements

The installation requirements of this Standard apply to all MCWP's installed on or after the effective date.

1.4.4 Responsibilities for dealers, owners, users, operators, lessors, lessees and brokers

All provisions detailed for dealers, owners, users, operators, lessors, lessees and brokers apply to both new and existing units delivered by sale, lease, rental or any form of beneficial use on or after the effective date.

1.5

This standard does not specify the requirements for dealing with the hazards involved in the maneuvering, erection or dismantling, fixing or removing of any materials or equipment, which are not part of the Mast Climbing Work Platform (MCWP). Neither does it deal with the handling of specific hazardous materials.

1.6

This standard does not specify the requirements for delivering persons and materials to fixed landing levels. Such equipment is referred to as lifts, hoists, or transport platforms and are dealt with by other standards.

1.7 Equipment Not Covered

This standard does not apply to equipment listed below:

- a) Ladder and ladder stands such as those covered in American National Standards for Ladder and Ladder Stands. ANSI A14 series.
- b) Scaffolding such as those covered in American National Standard for Construction and Demolition Operations Scaffolding Safety Requirements, ANSI A10.8.
- c) Vehicle mounted elevating and rotating aerial platforms such as those covered in American National Standard for Vehicle Mounted Elevating and Rotating Aerial Devices, ANSI/SIA A92.2.
- d) Non self-propelled elevating aerial platforms such as those covered in American National

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

e) Self propelled elevating aerial platforms such as those covered in American National Standards for Boom Supported Elevating Work Platforms, ANSI/SIA A92.5.

f) Self propelled elevating aerial platforms such as those covered in American National Standard for Self Propelled Elevating Work Platforms, ANSI/SIA A92.6.

g) Safety requirements for airline ground support vehicle mounted vertical lift devices, American National Standard for Airline Ground Support Vehicle Mounted Vertical Lift Devices, ANSI/SIA A92.7.

h) Vehicle Mounted Bridge Inspection and Maintenance Devices, ANSI/SIA A92.8.

i) Transport Platforms such as those covered in American National Standard for Transport Platforms, ANSI/SIA A92.10

j) Suspended Powered Platforms for Exterior Building Maintenance, ANSI A120.1.

k) Vertically adjustable equipment used primarily to raise and lower materials and equipment from one elevation to another such as American National Standards in the A17 and B56 series.

l) Firefighting equipment such as that covered in American National Standard for Automotive Fire Apparatus, ANSI/NFPA 1901.

m) Construction and demolition operation digger / derricks such as those covered in American National Standard for Construction and Demolition Digger Derricks Safety Requirements, Definitions and Specifications, ANSI A10.31.

2 References & Related Standards

2.1 Referenced Standards

This standard is intended to be used in conjunction with the following Standards. When these referenced standards are superseded by a revision approved by the appropriate authority, the revision shall apply to Mast Climbing Work Platforms manufactured on or after the effective date of the revision.

ANSI Z535.1, Z535.2, Z535.3 and Z535.4 Safety Signs and Colors

ANSI/AGMA 2001-C95 Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth

ANSI/ASME B15.1 Safety Standard for Mechanical Power Transmission Apparatus

ANSI/AWS D1.1 Structural Welding Code Steel

ANSI/AWS D1.2 Structural Welding Code Aluminum.

ANSI/NFPA 70 National Electrical Code

ANSI/NFPA 505 Powered Industrial Trucks, Including Type Designations, Areas of Use, Maintenance, and Operation

AISC-ASD Manual of Steel Construction - Allowable Stress Design.

AISC-LRFD Load and Resistance Factor Design Specification for Structural Steel Buildings

ANSI/ASCE 7-02 Minimum Design Loads for Buildings and Other Structures.

ANSI/NFPA 1901 Automotive Fire Apparatus

ANSI/AFBMA 9 Ball Bearings, Load Ratings and fatigue Life for.

ASTM A535 Standard Specifications for Special-Quality Ball and Roller Bearings Steel

ASTM A295 Standard Specifications for High-Carbon Anti-Friction Bearing Steel

SAE J514 Hydraulic Tube Fittings

SAE J516 Hydraulic Hose Fittings

SAE J517 Hydraulic Hoses

IEC 60065 Audio, Video and Similar Electronic Apparatus – Safety Requirements

IEC 60947-5-1 Low Voltage Switchgears and Control Gear

ISO 76 Rolling Bearings-Static Load Ratings

ISO 281 Rolling Bearings-Dynamic load ratings and rating life

ASTM SI 10-02 Metric Practice Guide

OSHA-CFR Subpart L Scaffolds 1926.450

2.2 Related Standards

The standards listed here are for information only and are not essential for the completion of the requirements of this standard:

ANSI/SIA A92.2-2009, Vehicle Mounted Elevating and Rotating Aerial Devices

ANSI/SIA A92.3-2006, Manually Propelled Elevating Aerial Platforms

ANSI/SIA A92.5-2006, Boom Supported Elevating Work Platforms

ANSI/SIA A92.6-2006, Self Propelled Elevating Work Platforms

ANSI/SIA A92.7-1998, Airline Ground Support Vehicle Mounted Vertical Lift Devices

ANSI/SIA A92.8-2006, Vehicle Mounted Bridge Inspection and Maintenance Devices

ANSI/SIA A92.10-2009, Transport Platforms

ANSI A10.8-2001, Construction and Demolition Operations Scaffolding Safety Requirements

2.3 Referenced Scaffold Industry Association Publication(s)

The standard is intended to be used in conjunction with the following SIA publication(s): ANSI/SIA A92.9 Manual of Responsibilities for Dealers, Owners, Users, Operators, Lessors, Lessees and Brokers of Mast Climbing Work Platforms.

3 Definitions

For the purposes of this standard the following terms and definitions apply:

Note: The terms, which are used in this standard, with reference to the definitions below, are indicated in figures 1 and 2.

3.1 Authorized personnel (authorized person): Personnel approved or assigned to perform a specific type of duty or duties at a specific location or locations at a work site.

3.2 Available platform area: Area of the work platform measured at the work platform floor level.

3.3 Base frame: That part of the MCWP, which provides support for the mast and elevating assembly.

3.4 Broker: An independent business entity or person that arranges a lease or transfer of ownership of a MCWP, but does not own the MCWP. If the entity or person is an employee of the buyer, seller, lessor or lessee of the MCWP, he shall not be considered a broker.

3.5 Buffer: A device designed to stop the vertical movement of the platform beyond its normal limit of travel by storing or by absorbing and dissipating the kinetic energy of the platform.

3.6 Chassis: That part of the MCWP which provides mobility and support for the mast and elevating assembly.

3.7 Competent person: One who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous or dangerous to employees and who has the authority to take prompt corrective measures to eliminate such hazards.

3.8 Counter roller: A roller used to counteract the gear meshing separation forces between a rack and pinion.

3.9 Dealer: A person or entity who buys, rents or leases from a manufacturer or distributor and who generally sells, rents, erects, and services MCWPs.

3.10 Delivery: Transfer of care, control and custody of the MCWP from one person or entity to another person or entity.

3.11 Elevating assembly: The platform, drive mechanisms and all other components that travel vertically on the mast.

3.12 Equivalent entity: An organization, agency, or individual who, by possession of an appropriate technical degree, certificate, professional standing, or skill, and who, by knowledge, training, and experience, has equivalent ability to deal with the problems relating to the subject matter, the work or the project of the entity referenced.

3.13 Exposed side: A side of the platform that is a greater distance from a building wall or structure than that allowed by Local, State and Federal codes and ordinances for guardrail requirements.

3.14 Familiarization: Providing information regarding the control functions and safety devices for the MCWP to a competent person or the operator who will control the movement of the MCWP being delivered.

3.15 Guardrail system: A vertical barrier intended to protect personnel and objects from falling to lower levels.

3.16 Guides: The parts of the mast which provide guiding for the work platform.

3.17 Hazardous location: Any location that contains, or has the potential to contain, an explosive or flammable atmosphere as defined in ANSI/NFPA 505 Powered Industrial Trucks.

3.18 Instability: A condition in which the sum of the moments which tend to overturn the MCWP is equal to or exceeds the sum of the moments tending to resist overturning.

3.19 Interlock: A control or mechanism that, under specified conditions, automatically allows or prevents the operation of another control or mechanism.

3.20 Lessee: A person(s) or entity to whom a MCWP is provided by lease, rental, loan, or other arrangement. A lessee may also be a user or operator.

3.21 Lessor: A person(s) or entity who leases, rents, loans, or otherwise provides a MCWP to another party for the beneficial use of that party (the user). A lessor may also be a dealer, owner, lessee, user or operator.

3.22 Load diagram: A notice displayed on the work platform showing the permitted number of persons and the weight and distribution of materials for the particular configuration.

3.23 Main platform: That part of the work platform which is built up using primary structural elements.

3.24 Manual of Responsibilities: A document containing the definitions (Section 3) and the requirements mandated in this Standard for the following entities: Dealers (Section 7.3); Owners (Section 7.4); Users (Section 7.5); Operators (Section 7.6); Lessors (Section 7.7); Lessees (Section 7.8); and Brokers (Section 7.9).

3.25 Manufacturer: A person or entity who makes, builds or produces a MCWP.

3.26 Mast: A structure that supports and guides the platform.

3.27 Mast, fixed length: A mast whose length is fixed and cannot be varied, even by the attachment of further mast sections.

3.28 Mast, variable length: A mast whose length can be varied by the attachment of successive lengths of prepared sections.

3.29 Mast tie: Anchorage system used to provide lateral restraint to the mast from the building or other structure.

3.30 Modification, modified: To make a change(s) to a MCWP which affects the operation, stability, safety factors, or rated load of the MCWP in any way.

3.31 Multilevel work platforms: Two or more work platforms travelling on the same mast or an additional working level attached to and totally supported by a work platform. (For illustration see annex B)

3.32 Operator: An authorized person qualified to control the movement of a MCWP.

3.33 Outrigger: Support at the base frame level used to maintain or increase the stability of the MCWP within specified conditions. An outrigger may also be used for leveling.

3.34 Outrigger beam: That part of an outrigger assembly which moves in a substantially horizontal plane and may be powered or operated manually.

3.35 Overspeed: Any speed above rated speed.

3.36 Overspeed detector: A device which, when the work platform attains a predetermined speed

above rated speed, causes the overspeed safety device to be applied.

3.37 Overspeed safety device: A mechanical device for stopping and maintaining the work platform stationary on the mast in the event of overspeed

3.38 Owner: A person or entity who has possession of a MCWP by virtue of proof of purchase or legal possession of a MCWP.

3.39 Planking (decking): A work surface used on platform extensions.

3.40 Platform extensions: Those additional parts of the work platform which are built up using secondary structural elements, whose support and location is dependent upon the main platform. They are used to extend the main work platform, usually along its longitudinal working edge. They may form irregular shapes, which conform, to the work site. They may also extend at a level just above or below the main platform level.

3.41 Platform height: The vertical distance measured from the floor of the platform to the surface upon which the MCWP is being supported.

3.42 Qualified person: One who, by possession of a recognized degree, certificate or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.

3.43 Rack & pinion drive system: A drive system using a gearing arrangement consisting of a cylindrical gear (pinion) which engages a linear gear (rack) attached to the mast.

3.44 Rail mounted chassis: A chassis designed to transmit horizontal as well as vertical forces to the ground via rails.

3.45 Ratchet drive system: A drive system that operates by attaching a ratcheting device to the rungs or other element of the mast in an alternating manner and elevates or lowers the platform a predefined distance. The platform may be supported by a pawl or similar device when the drive mechanism is not engaged.

3.46 Rated load: The loads for which the MCWP has been designed for in normal operation as stated in the load diagram.

3.47 Rated speed: The vertical or horizontal speed for which the MCWP has been designed.

3.48 Remanufacture: The modification of a MCWP, either by the original manufacturer or an entity authorized by the manufacturer, so that the MCWP will comply with the ANSI Standard in effect on the date the modification is completed.

3.49 Re-rent: A transaction in which an entity not owning the MCWP benefits in some manner by arranging its utilization by a user.

3.50 Screw drive system: A drive system which consists of a mast mounted rack which meshes with a powered drive screw attached to the platform. Rotation of the powered drive screw elevates or lowers the platform.

3.51 Shall: The word shall is to be understood as mandatory.

3.52 Stability: A condition in which the sum of the moments which tend to overturn the MCWP is less than the sum of the moments tending to resist overturning.

3.53 Transfer: Any horizontal movement of the MCWP from one position to another on the same working site.

3.54 Transfer condition: The configuration of the MCWP in which it is moved from one position to another on the same working site.

3.55 Transfer and transport interlocks: Any design features on the MCWP which prevent unsafe transfer or transportation.

3.56 Transfer and transport loads and forces: Inertia forces plus any loads permitted by the manufacturer on the MCWP shall be taken into account when the MCWP is subject to transfer conditions. Including any limitation on the weather and the load or persons on the MCWP.

3.57 Transport: Any movement of the MCWP outside the boundaries of the working site.

3.58 Transport condition: The configuration of the MCWP in which it is moved outside the boundaries of the working site (for example road transport).

3.59 User: A person or entity that has care, custody and control of the MCWP. This person or entity may also be the employee of the operator, a dealer, owner, lessor, lessee, broker or the operator.

3.60 Upper & lower limit devices: Means to limit the maximum and minimum platform height, usually by mechanical or electrical means, or

both.

3.61 Work platform: The vertical traveling part of the installation upon which the persons, equipment and materials are carried and from which work is carried out. This is as opposed to the MCWP, which refers to the whole of the

installation, including the work platform, mast, mast ties, base and chassis. The work platform includes the main platform and any platform extension.

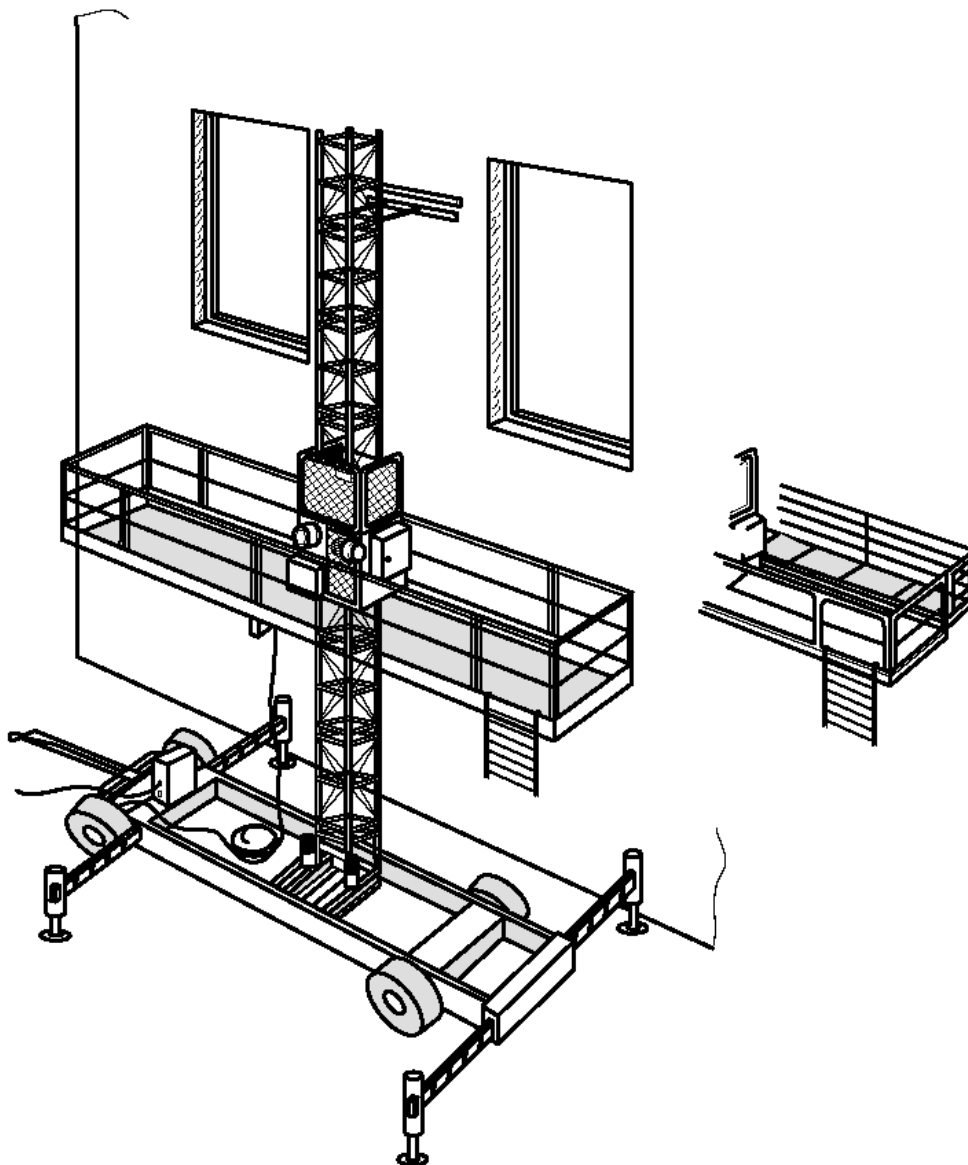


Figure 1: TYPICAL SINGLE MAST MCWP



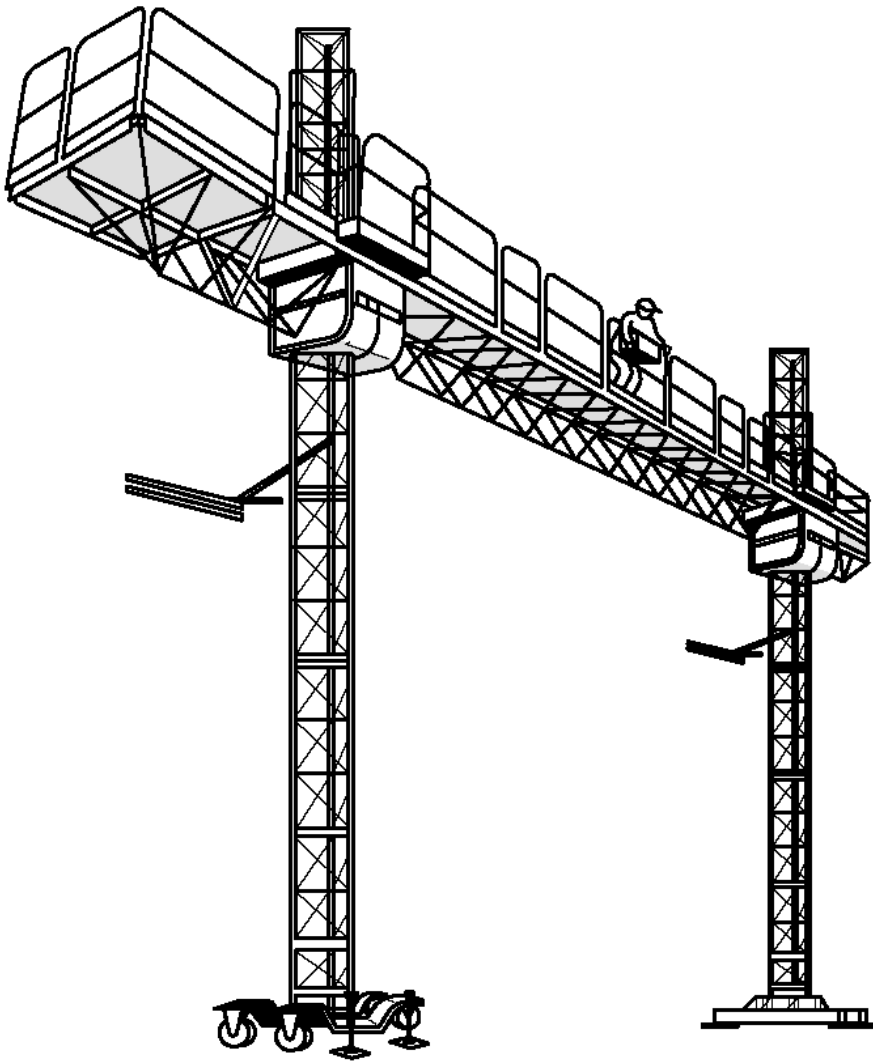


Figure 2: TYPICAL TWIN MAST MCWP

SECTION 4 - LIST OF HAZARDS

The following table shows the hazards which have been identified and where the corresponding requirements have been formulated in this standard in order to limit the risk or reduce these hazards in each situation.

A hazard which is not applicable or is not significant and for which, therefore, no requirements are formulated is shown in the relevant clause column as NA (not applicable).

Table 1

Hazards	Description	Relevant clauses in this Standard
1	Mechanical Hazards	
1.1	Crushing	5.2.1.3; 5.3.2; 5.4.1
1.2	Shearing	5.2.1.3; 5.3.2; 5.4.1
1.3	Cutting or severing	5.3.2; 5.4.1
1.4	Entanglement	5.4.1
1.5	Drawing in or trapping	5.2.1.3; 5.3.2; 5.4.1
1.6	Impact	5.4
1.7	Stabbing or puncture	NA
1.8	Friction or abrasion	NA
1.9	High pressure fluid ejection	5.10
1.10	Ejection of parts	5.2.1.4; 5.2.1.5
1.11	Loss of stability	5.1.5; 5.2; 5.2.5
1.12	Slip, trip and fall	5.3.1.3
2	Electrical Hazards	
2.1	Electrical contact	5.8; 7.1.2.7
2.2	Electrostatic phenomena	NA
2.3	Thermal radiation	NA
3	Hazards generated by materials and substances processed, used or exhausted by machinery	
3.1	Contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	5.9; 5.10
3.2	Fire or explosion	5.9; 5.10
3.3	Biological and microbiological	5.9; 5.10
4	Hazards generated by neglecting ergonomic principles in machine design	
4.1	Unhealthy postures or excessive effort	5.2.1.6; 5.2.5.2; 5.6.2; 5.12
4.2	Inadequate consideration of human hand/arm or foot/leg anatomy	NA
4.3	Neglected use of personal protection equipment related measures/means	7.1.2.7; 7.1.2.12
4.4	Inadequate area lighting	7.1.2.6
4.5	Mental overload or underload, stress	NA
4.6	Human error	5.2.2.1; 5.12
5	Hazard combinations	5.1.1.1; 5.1.1.2; 5.1.3; 5.2.1.3; 5.7.1.7;

			5.1.2.9; 7.1.2.12; 7.5.9; 7.6.7; 7.6.8
6		Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders	
	6.1	Failure of energy supply	5.4.1.7; 5.4.4.2.1; 5.5; 5.7.1.6; 5.8; 5.10.1
	6.2	Unexpected ejection of machine parts or fluids	5.4.1.2; 5.9.1; 5.9.5; 5.10
	6.3	Failure or malfunction of control system	5.4.4.2.1; 5.4.5.1.1; 5.5.1.1; 5.5.2.2.1; 5.5.3; 5.6.1; 5.7; 5.8; 5.11; 5.12; 5.13.5; 6.1.2.2.2
	6.4	Errors of lifting	5.1.2.11; 5.1.5.1.5; 5.2.4; 5.4
	6.5	Overturn, unexpected loss of machine stability	5.1.1.2; 5.1.2.3; 5.1.2.5; 5.1.2.11; 5.1.3; 5.1.5; 5.2.1.4; 5.2.2.2; 5.2.2.3; 5.2.5.1; 5.4.1.6; 5.2.1.6
7		Hazards caused by missing and/or incorrectly positioned safety related measures and means	
	7.1	Guards	5.2.1.3; 5.3.2; 5.4.1.2; 7.1.2.6; 7.1.2.9; 7.2.2
	7.2	Safety related (protection) devices	5.2.1.2; 5.2.1.4; 5.2.1.5; 5.4.4.2; 5.6
8		Inadequate lighting of moving / working area	7.1.2.6
9		Hazards due to sudden movement instability etc. during handling	5.1.5; 5.2.2
10		Inadequate / non ergonomic design of operating position	
	10.1	Hazards due to dangerous environments (contact with moving parts, exhaust, gases, etc.)	5.2.2; 5.9; 5.3.1.3; 5.3.2; 5.3.3
	10.2	Inadequate visibility from operators position	5.12.2; 5.12.5
	10.3	Inadequate seat/seating	NA
	10.4	Inadequate/non ergonomic design/positioning of controls	5.12
	10.5	Start/moving of self propelled machinery	5.12; 5.13
	10.6	Road traffic of self propelled machinery	7.1.2.6; 7.1.2.12
	10.7	Movement of pedestrian controlled machinery	7.1.2.6; 7.1.2.12
11		Mechanical hazards	
	11.1	Hazards to exposed persons due to uncontrolled movement	5.2.2.1; 5.2.4; 5.4.1; 7.1.2.7
	11.2	Hazards due to breakup and/or ejection of parts	5.2.1.4; 5.2.1.5; 5.2.2.3
	11.3	Hazards due to rolling over (ROPS)	5.1.5
	11.4	Hazards due to falling objects (FOPS)	7.1.2.7
	11.5	Inadequate means of access	5.3.3; 5.3.3.4
	11.6	Hazards due to towing, coupling, connecting,	5.4.1; 7.1.2.7; 5.2.2.4

		transmissions, etc.	
	11.7	Hazards due to batteries, fire, emissions, etc.	5.9.1; 5.9.2; 5.9.3; 5.9.4; 5.9.5; 5.9.6
12		Hazards due to lifting operations	
	12.1	Lack of stability	5.1.5; 5.1.1.2; 5.2.2.3; 5.2.2.2; 5.2.5.1; 5.4.1.6
	12.2	Derailment of machinery	7.2.2.4; 7.4.1.5; 5.4.2; 5.4.1.5; 5.12.2
	12.3	Loss of mechanical strength of machinery and lifting accessories	5.1; 5.2.1.7; 5.2.1.8; 5.2.2.2; 5.2.2.3; 5.2.3.3; 5.2.5.3; 5.3.1.4; 5.4.2; 5.4
	12.4	Hazards caused by uncontrolled movement	5.2.2.3; 5.2.4; 5.4.1; 5.11; 5.2.5; 5.10.12.3
13		Inadequate view of trajectories of moving parts	5.13.4
14		Hazards caused by lightning	7.1.2.6 g)
15		Hazards due to loading/overloading	5.5.2.2
16		Overloading or overcrowding of the platform	5.1.2; 5.5.2.2; 5.5.3
17		Unexpected movement of the platform in response to external controls	5.12.2; 5.8
18		Excess speed	5.5; 5.6.3; 5.4.4.1; 3.5.3
19		Persons falling from the platforms	5.3.2
20		The platform falling or overturning	5.2.2.3; 5.5; 5.10; 5.2.3; 5.2.5
21		Excess acceleration or braking of the platform	5.5; 6.4.4.4.2.2; 5.4.5
22		Due to imprecise markings	5.2.2.5

SECTION 5 - SAFETY REQUIREMENTS AND/OR MEASURES

5.1 Structural and stability calculations

5.1.1 General

Sound engineering principles consistent with all data available regarding the parameters of intended use and expected environment shall be applied in the design, testing and manufacture of MCWP's, with due consideration of the knowledge that the unit will be carrying personnel.

5.1.1.1

All loads and forces which can occur in any allowed configuration during erection, operation, out-of-service, dismantling and transfer shall be considered. This shall also include inclined or hanging masts.

5.1.1.2

The manufacturer shall be responsible for:

- a) stability calculations, in order to identify the various configurations of the MCWP and the combinations of loads and deflections, which together create conditions of instability
- b) structural calculations, in order to evaluate the individual forces and to make allowance for deflections. All combinations of forces shall be considered including those which produce the most unfavorable stresses in the components.

5.1.2 Loads and Forces

The following loads and forces shall be taken into account.

5.1.2.1 Structural loads

The masses of the components of the MCWP when they are not moving are considered to be static structural loads.

The masses of the components of the MCWP when they are moving are considered to be dynamic structural loads.

5.1.2.2 Rated load

5.1.2.2.1 The rated load for design purposes is:

$$m = (n \times m_p) + m_t + (2 \times m_e)$$

where m = rated load (lbs)

m_p =	175 lbs (80 kg); mass of each person
m_e =	90 lbs (40kg); mass of personal equipment (for the first two persons only)
m_t =	mass (lbs.) of material and equipment on the work platform (excluding personal equipment)
n =	number of persons on the work platform

The mass of persons and the mass of equipment and material shall act simultaneously.

The minimum number of persons shall be: Two (2) for single mast platforms and four (4) for multiple mast platforms.

The mass of the personal equipment (m_e) shall be assumed to act on the point coincident with each of the two persons which give the highest stresses.

5.1.2.2.2

The mass of each person is assumed to act as a point load on the MCWP at a horizontal distance 4 in (0.1 m) from the upper inside edge of the top guard rail. The distance between the point loads shall be 20 in (0.51 m) (see figure 3 as an example).

5.1.2.2.3

The mass m_t shall be evenly distributed over the entire area of the main platform giving a specific load per length t .

The center of gravity of the mass m_t shall be assumed to act on a point 0.15 B (where B is the width of the main platform) away from the longitudinal center line of the main platform, on the side giving the highest stresses. See figure 4.

Calculations shall allow for the possibility that a reduced load giving an unbalanced load case may result in higher stresses in some parts of the MCWP than a balanced rated load case would give.

For single mast machines the bending moment, M , on masts and platforms shall be calculated according to Formula 1, where $L_{\max}$ is the greater of the distances L_1 and L_2 in figure 5.

For multiple mast machines the bending moment M , on masts and platforms shall be

calculated according to Formulas 2, 3, 4 and Figure 6. The factors 1.15 and 1.2 are used in the Formulas 1, 2, 3, 4 in order to cover the situations in use where, instead of a uniformly distributed load, a concentration of the same load is placed elsewhere within that individual length.

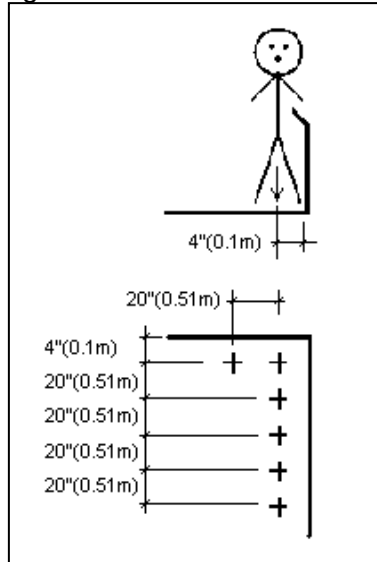


Figure 3: Example of the distribution of persons on the main platform or platform extensions.

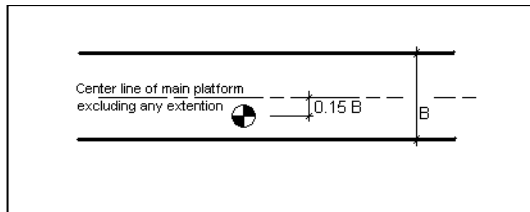
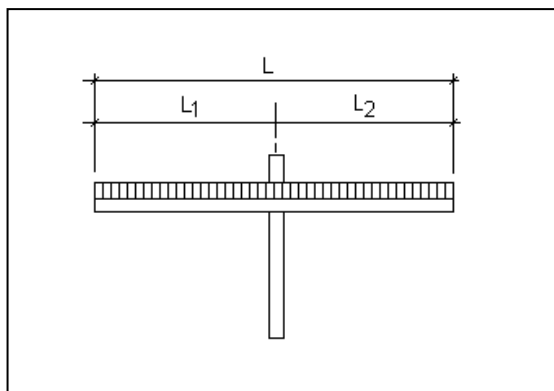


Figure 4: Eccentric loading normal to the centerline.



Formula (1)
$$M_{\max} = \frac{t \times L_{\max}^2 \times 1.15}{2}$$

Figure 5: Loading in the longitudinal direction. Single mast machines.

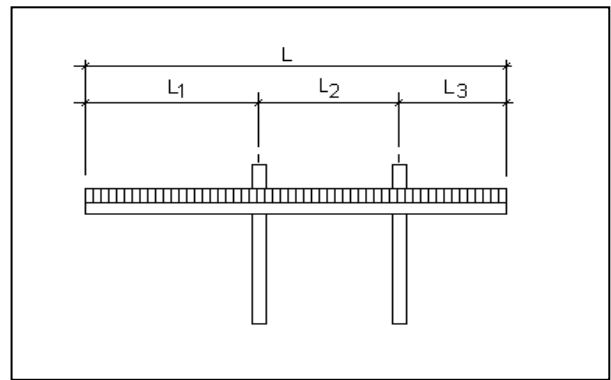


Figure 6: Loading in the longitudinal direction. Multiple mast machines.

Formulas: (2):
$$M_1 = \frac{t \times L_1^2 \times 1.15}{2}$$

(3):
$$M_2 = \frac{t \times L_2^2 \times 1.2}{2}$$

(4):
$$M_3 = \frac{t \times L_3^2 \times 1.15}{2}$$

5.1.2.2.4

If the area of the main platform, or part of it, is increased by means of extensions, usually to the longitudinal edge of the platform, the mass of the number of persons allowed on the platform, according to 5.1.2.2.1, shall be assumed to act on these longitudinal edges according to 5.1.2.2.2.

5.1.2.2.5

In order to provide long cantilever extensions to reach more distant work points an exception to 5.1.2.2.4 may be made, but shall be clearly explained on a sign easily visible on that particular extension to the main platform. In no case shall the load on the extension be calculated for less than two persons (m_p) carrying their personal equipment (m_e). In order to restrict the available platform extension area, such extensions shall not be more than 24 in (0.6 m) wide. See Figure 7.

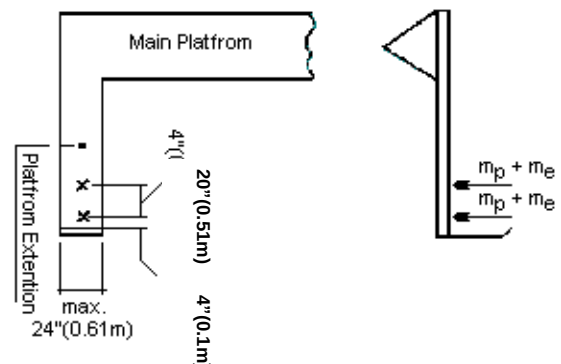


Figure 7: Long cantilever extensions.

5.1.2.2.6

When a handling crane is installed on the platform the mass of the crane and the cranes rated load shall together be treated as part of the rated load of the MCWP. The location of the force resulting from the use of the crane shall be dictated by the manufacturers chosen mounting positions for the crane supports.

5.1.2.3 Horizontal forces

5.1.2.3.1 Manual forces

The minimum value for the manual force is assumed to be 45 lbf (200 N) for each of the first two persons on the platform and 22.5 lbf (100 N) for each additional person permitted on the work platform.

It is assumed that the force is applied at a height of 42-in (1.1 m) above the floor of the work platform and acts in a horizontal direction.

5.1.2.3.2 Forces from the use of power tools

Where the manufacturer of the MCWP permits the use of power tools which impose horizontal reaction forces on the work platform which are in excess of those given in 5.1.2.3.1 then the manufacturer shall specify the maximum force permitted. It is to be assumed that the force is applied at a minimum height of 42 in (1.1 m) above the floor of the work platform.

Such forces may be caused by the use of, for example:

- water jetting equipment
- sand or grit blasting equipment
- mechanically assisted drilling machine
- hammer assisted drill
- electrically driven hammer/breaker

5.1.2.3.3 Forces from the use of weather protection screens on the Work Platform

If the Work Platform is designed to permit the use of weather protection, in the form of a roof over part of, or the whole of the platform, then the resulting wind forces shall be considered to act on walls which reach the full height from the work platform floor to the top of the roof. Wind forces shall be calculated according to 5.1.2.5 and 5.1.2.8. For platform regions protected by such weather screens, the wind forces on persons, equipment and material coming under the protection of these weather screens may be neglected.

The mass of the weather protection screens shall be treated as part of the rated load.

5.1.2.4 Dynamic forces

Dynamic forces shall be taken into account by multiplying all moving masses by a dynamic factor of 1.15.

The term, moving, includes raising and lowering of the work platform and also transfer of the MCWP in its transfer condition.

5.1.2.5 In service wind loads

5.1.2.5.1

All MCWP used out-of-doors or otherwise exposed to wind, while in service, shall be regarded as being affected by a minimum wind pressure in accordance with table 2.

5.1.2.5.2

Wind forces are assumed to act horizontally at the center of the windward area of the exposed structural parts of the MCWP.

5.1.2.5.3

The wind-force coefficients applied to areas exposed to the wind and calculation of wind

Table 2: Minimum design wind data for in-service conditions

Installation	Wind velocity Mph [m/s]	Wind pressure Psi [N/m ²]
Freestanding or MCWP during erection and dismantling.	28 [12.7]	0.0145 [100]
Tied MCWP	35 [15.5]	0.0218 [150]

Note: The wind values given in Table 2 are minimum values for the central United States area and at low altitudes. In special cases, e.g. coastal areas or at higher altitudes, information set out in the ANSI A92.7-2011 national standard shall be used.