ASME B30.27-2009
(Revision of ASME B30.27-2005)

Material Placement Systems

Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

ASME
SETTING THE STANDARD

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Date of Issuance: May 15, 2009

The next edition of this Standard is scheduled for publication in 2014. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Interpretations are published on the ASME Web site under the Committee Pages at http://cstools.asme.org as they are issued, and will also be published within the next edition of the Standard.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

CONTENTS

FOREWORD

This American National Standard, Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings, has been developed under the procedures accredited by the American National Standards Institute (formerly the United States of America Standards Institute). This Standard had its beginning in December 1916 when an eight-page Code of Safety Standards for Cranes, prepared by an ASME Committee on the Protection of Industrial Workers, was presented to the annual meeting of ASME.

Meetings and discussions regarding safety on cranes, derricks, and hoists were held from 1920 to 1925, involving the ASME Safety Code Correlating Committee, the Association of Iron and Steel Electrical Engineers, the American Museum of Safety, the American Engineering Standards Committee (later changed to American Standards Association and subsequently to the USA Standards Institute), Department of Labor — State of New Jersey, Department of Labor and Industry — State of Pennsylvania, and the Locomotive Crane Manufacturers Association. On June 11, 1925, the American Engineering Standards Committee approved the ASME Safety Code Correlating Committee's recommendation and authorized the project with the U.S. Department of the Navy, Bureau of Yards and Docks, and ASME as sponsors.

In March 1926, invitations were issued to 50 organizations to appoint representatives to a Sectional Committee. The call for organization of this Sectional Committee was sent out October 2, 1926, and the committee organized November 4, 1926, with 57 members representing 29 national organizations. The Safety Code for Cranes, Derricks, and Hoists, ASA B30.2-1943, was created from the eight-page document referred to in the first paragraph. This document was reaffirmed in 1952 and widely accepted as a safety standard.

Due to changes in design, advancement in techniques, and general interest of labor and industry in safety, the Sectional Committee, under the joint sponsorship of ASME and the Naval Facilities Engineering Command, U.S. Department of the Navy, was reorganized as an American National Standards Committee on January 31, 1962, with 39 members representing 27 national organizations.

The format of the previous code was changed so that separate volumes (each complete as to construction and installation; inspection, testing, and maintenance; and operation) would cover the different types of equipment included in the scope of B30.

In 1982, the Committee was reorganized as an Accredited Organization Committee, operating under procedures developed by ASME and accredited by the American National Standards Institute.

In 2007, the committee undertook this current revision to consolidate the requirements of two standards (CPMA 27-2000 and B30.27-2005) into the current revision of B30.27.

This Standard presents a coordinated set of rules that may serve as a guide to government and other regulatory bodies and municipal authorities responsible for the guarding and inspection of the equipment falling within its scope. The suggestions leading to accident prevention are given both as mandatory and advisory provisions; compliance with both types may be required by employers of their employees.

In case of practical difficulties, new developments, or unnecessary hardship, the administrative or regulatory authority may grant variances from the literal requirements or permit the use of other devices or methods, but only when it is clearly evident that an equivalent degree of protection is thereby secured. To secure uniform application and interpretation of this Standard, administrative or regulatory authorities are urged to consult the B30 Committee, in accordance with the format described in Section IX, before rendering decisions on disputed points.

This volume of the Standard, which was approved by the B30 Committee and by ASME, was approved by ANSI and designated as an American National Standard on February 24, 2009.

Safety codes and standards are intended to enhance public safety. Revisions result from committee consideration of factors such as technological advances, new data, and changing environmental and industry needs. Revisions do not imply that previous editions were inadequate.

ASME B30 COMMITTEE
Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings

(The following is the roster of the Committee at the time of approval of this Standard.)

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SAFETY STANDARD FOR CABLEWAYS, CRANES, DERRICKS, HOISTS, HOOKS, JACKS, AND SLINGS

B30 STANDARD INTRODUCTION

(09)

SECTION I: SCOPE

The ASME B30 Standard contains provisions that apply to the construction, installation, operation, inspection, testing, maintenance, and use of cranes and other lifting and material-handling related equipment. For the convenience of the reader, the Standard has been divided into separate volumes. Each volume has been written under the direction of the ASME B30 Standards Committee and has successfully completed a consensus approval process under the general auspices of the American National Standards Institute (ANSI).

As of the date of issuance of this Volume, the B30 Standard comprises the following volumes:

B30.1 Jacks
B30.2 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
B30.3 Construction Tower Cranes
B30.4 Portal, Tower, and Pedestal Cranes
B30.5 Mobile and Locomotive Cranes
B30.6 Derricks
B30.7 Base-Mounted Drum Hoists
B30.8 Floating Cranes and Floating Derricks
B30.9 Slings
B30.10 Hooks
B30.11 Monorails and Underhung Cranes
B30.12 Handling Loads Suspended From Rotorcraft
B30.13 Storage/Retrieval (S/R) Machines and Associated Equipment
B30.14 Side Boom Tractors
B30.15 Mobile Hydraulic Cranes (withdrawn 1982—requirements found in latest revision of B30.5)
B30.16 Overhead Hoists (Underhung)
B30.17 Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)
B30.18 Stacker Cranes (Top or Under Running Bridge, Multiple Girder With Top or Under Running Trolley Hoist)
B30.19 Cableways
B30.20 Below-the-Hook Lifting Devices
B30.21 Manually Lever-Operated Hoists
B30.22 Articulating Boom Cranes
B30.23 Personnel Lifting Systems
B30.24 Container Cranes
B30.25 Scrap and Material Handlers
B30.26 Rigging Hardware
B30.27 Material Placement Systems
B30.28 Balance Lifting Units[1]
B30.29 Self-Erect Tower Cranes[1]

SECTION II: SCOPE EXCLUSIONS

The B30 Standard does not apply to track and automotive jacks, railway or automobile wrecking cranes, shipboard cranes, shipboard cargo-handling equipment, well-drilling derricks, skip hoists, mine hoists, truck body hoists, car or barge pullers, conveyors, excavating equipment, or equipment covered under the scope of the following standards: A10, A17, A90, A92, A120, B20, B56, and B77.

SECTION III: PURPOSE

The B30 Standard is intended to

(a) prevent or minimize injury to workers, and otherwise provide for the protection of life, limb, and property by prescribing safety requirements

(b) provide direction to manufacturers, owners, employers, users, and others concerned with, or responsible for, its application

(c) guide governments and other regulatory bodies in the development, promulgation, and enforcement of appropriate safety directives

SECTION IV: USE BY REGULATORY AGENCIES

These Volumes may be adopted in whole or in part for governmental or regulatory use. If adopted for governmental use, the references to other national codes and standards in the specific volumes may be changed to refer to the corresponding regulations of the governmental authorities.

SECTION V: EFFECTIVE DATE

(a) Effective Date. The effective date of this Volume of the B30 Standard shall be 1 year after its date of issuance. Construction, installation, inspection, testing, maintenance, and operation of equipment manufactured and

[1] These volumes are currently in the development process.

facilities constructed after the effective date of this Volume shall conform to the mandatory requirements of this Volume.

(b) Existing Installations. Equipment manufactured and facilities constructed prior to the effective date of this Volume of the B30 Standard shall be subject to the inspection, testing, maintenance, and operation requirements of this Standard after the effective date.

It is not the intent of this Volume of the B30 Standard to require retrofitting of existing equipment. However, when an item is being modified, its performance requirements shall be reviewed relative to the requirements within the current volume. The need to meet the current requirements shall be evaluated by a qualified person selected by the owner (user). Recommended changes shall be made by the owner (user) within 1 year.

SECTION VI: REQUIREMENTS AND RECOMMENDATIONS

Requirements of this Standard are characterized by use of the word *shall*. Recommendations of this Standard are characterized by the word *should*.

SECTION VII: USE OF MEASUREMENT UNITS

This Standard contains SI (metric) units as well as U.S. Customary units. The values stated in U.S. Customary units are to be regarded as the standard. The SI units are a direct (soft) conversion from the U.S Customary units.

SECTION VIII: REQUESTS FOR REVISION

The B30 Standards Committee will consider requests for revision of any of the volumes within the B30 Standard. Such requests should be directed to

Secretary, B30 Standards Committee
ASME Codes and Standards
Three Park Avenue
New York, NY 10016-5990

Requests should be in the following format:

Volume: Cite the designation and title of the volume.
Edition: Cite the applicable edition of the volume.
Subject: Cite the applicable paragraph number(s) and the relevant heading(s).
Request: Indicate the suggested revision.
Rationale: State the rationale for the suggested revision.

Upon receipt by the Secretary, the request will be forwarded to the relevant B30 Subcommittee for consideration and action. Correspondence will be provided to the requester defining the actions undertaken by the B30 Standards Committee.

SECTION IX: REQUESTS FOR INTERPRETATION

The B30 Standards Committee will render an interpretation of the provisions of the B30 Standard. Such requests should be directed to

Secretary, B30 Standards Committee
ASME Codes and Standards
Three Park Avenue
New York, NY 10016-5990

Requests should be in the following format:

Volume: Cite the designation and title of the volume.
Edition: Cite the applicable edition of the volume.
Subject: Cite the applicable paragraph number(s) and the relevant heading(s).
Question: Phrase the question as a request for an interpretation of a specific provision suitable for general understanding and use, not as a request for approval of a proprietary design or situation. Plans or drawings that explain the question may be submitted to clarify the question. However, they should not contain any proprietary names or information.

Upon receipt by the Secretary, the request will be forwarded to the relevant B30 Subcommittee for a draft response, which will then be subject to approval by the B30 Standards Committee prior to its formal issuance.

Interpretations to the B30 Standard will be published in the subsequent edition of the respective volume, and will be available online at http://cstools.asme.org.

SECTION X: ADDITIONAL GUIDANCE

The equipment covered by the B30 Standard is subject to hazards that cannot be abated by mechanical means, but only by the exercise of intelligence, care, and common sense. It is therefore essential to have personnel involved in the use and operation of equipment who are competent, careful, physically and mentally qualified, and trained in the proper operation of the equipment and the handling of loads. Serious hazards include, but are not limited to, improper or inadequate maintenance, overloading, dropping or slipping of the load, obstructing the free passage of the load, and using equipment for a purpose for which it was not intended or designed.

The B30 Standards Committee fully realizes the importance of proper design factors, minimum or maximum dimensions, and other limiting criteria of wire

rope or chain and their fastenings, sheaves, sprockets, drums, and similar equipment covered by the standard, all of which are closely connected with safety. Sizes, strengths, and similar criteria are dependent on many different factors, often varying with the installation and uses. These factors depend on

(a) the condition of the equipment or material

(b) the loads

(c) the acceleration or speed of the ropes, chains, sheaves, sprockets, or drums

(d) the type of attachments

(e) the number, size, and arrangement of sheaves or other parts

(f) environmental conditions causing corrosion or wear

(g) many variables that must be considered in each individual case

The requirements and recommendations provided in the volumes must be interpreted accordingly, and judgment used in determining their application.

ASME B30.27-2009
SUMMARY OF CHANGES

Following approval by the ASME B30 Committee and ASME, and after public review, ASME B30.27-2009 was approved by the American National Standards Institute on February 24, 2009.

ASME B30.27-2009 includes editorial changes, revisions, and corrections, as well as the following changes identified by a margin note, **(09).**

Page	*Location*	*Change*
vii	B30 Standard Introduction	Revised in its entirety
1	Section 27-0.1	Revised
	Section 27-0.2	Definitions of *durably marked, fixed guard, grooved connection, hopper, metric connection, raised-end connection,* and *waterbox* added
4–9	Section 27-0.3	Revised
	27-1.1.2	Subparagraphs (a), (b), (c), and (d) added and subsequent paragraphs redesignated
	27-1.1.6	Revised
	27-1.1.8	Added
	27-1.1.9	Added
	27-1.2.3(c)	Added
	Figure 5	Added
	27-1.7.5	Added
	Section 27-1.8(f)	Added
	Section 27-1.10	Revised in its entirety
	Figure 6	Added
	Section 27-1.15	Added
	Section 27-1.16	Added
11	27-2.1.3.4(k)	Added
16–18	Figure 7	Formerly Fig. 5, renumbered, and revised in its entirety
	Figure 8	Formerly Fig. 6, renumbered
	Figure 9	Formerly Fig. 7, renumbered

MATERIAL PLACEMENT SYSTEMS

Chapter 27-0
Scope, Definitions, and References

(09) SECTION 27-0.1: SCOPE

Volume B30.27, Material Placement Systems, includes provisions that apply to the construction, installation, operation, inspection, testing, and maintenance of trailer and truck-mounted material placement systems. Included in this are mechanical and hydraulic pea gravel systems, mobile telescoping boom conveyors, separate placing booms, and material placement accessories (see Figs. 1 through 4). Truck-mounted material placement systems can be either with or without an integral placing boom.

This Volume does not apply to the conveyor parts of mobile telescoping boom conveyors, mortar conveying and spraying machines, or dry mix shotcreting machines. The conveyor section of these machines is covered by ASME B20.1

(09) SECTION 27-0.2: DEFINITIONS

concrete delivery hose: a flexible delivery hose having a coupling on each end.

control panel: controls mounted on the material placement system.

delivery systems: delivery lines, pipes, hoses, attachment components, and transfer valves, through which material is transported (see Fig. 4).

designated person: a person selected or assigned by the employer or the employer's representative as being competent to perform specific duties.

durably marked: a method of attaching information to a part, assembly, or machine that will satisfy the need for the marking. For example, in the case of pipe or hose components, a marking that would last until the component is installed on a machine or put into use would be considered durably marked. For all other items required to be durably marked, the marking would last for the expected life of the part or machine under reasonably foreseeable circumstances.

end hose: a flexible concrete delivery hose that only has one coupling.

fixed guard: a component used to shield the user from machine interaction and attached by mechanical means. On material placement systems, temporary or removable guards do exist, such as a hopper grate that rotates up for cleaning but is covered by a separate safety switch.

grooved connection: a type of pipe connection where a groove is machined or rolled directly into the outside of the pipe wall, creating a flange height of less than 0.15 in. (3.8 mm).

hopper: a receptacle for the material to be transported, which can include an agitator, a mixer, or both.

manual valve override: a mechanical valve actuator used to operate an electrically controlled valve in emergency or breakdown situations.

manual valves: a valve whose manual actuator is the only means of valve actuation.

maximum support force: the maximum force exerted on the supporting surface at any one outrigger.

metric connection: a type of pipe connection where the raised flange diameter, shape, and thickness are manufactured to metric specifications.

normal operating conditions: conditions during which a material placement system is performing functions within the scope of the original design. Under these conditions, no one other than the operator is on the material placement system.

outrigger: extendable or fixed members attached to the mounting base, which rest on supports at the outer ends used to support the machine.

placing booms: manual or power driven, slewable working devices, consisting of one or more extendable or foldable parts supporting the material delivery system, and directing the discharge into the desired location.

priority switching: transferring control of one or more functions from a control location to a different control location.

qualified person: a person who, by possession of a recognized degree in an applicable field, or certificate of pro-

Fig. 1 Material Placement System: Truck-Mounted Concrete Pump With Integrated Placing Boom

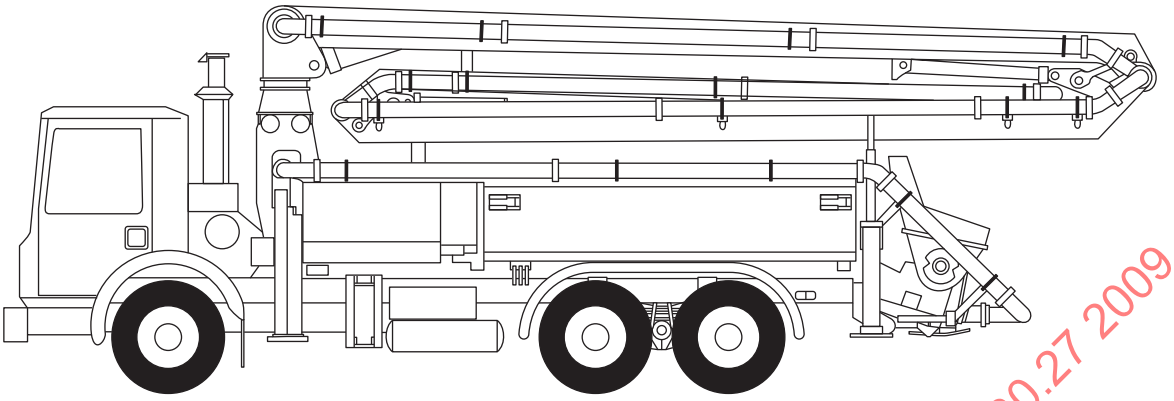


Fig. 2 Material Placement System: Separate Placing Boom

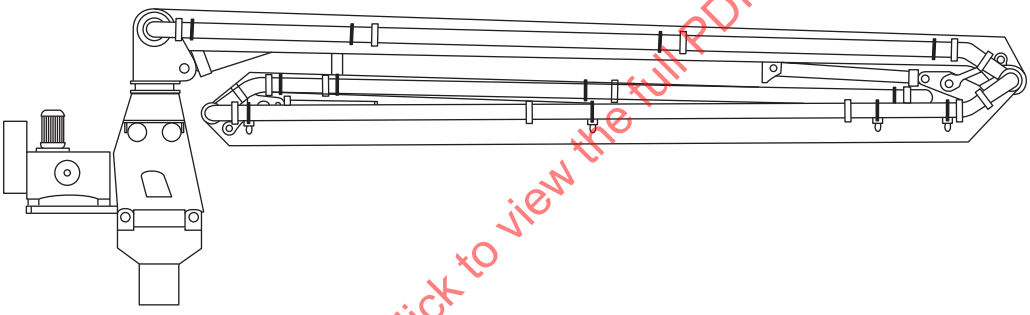


Fig. 3 Material Placement System: Truck-Mounted Telescopic Conveyor System

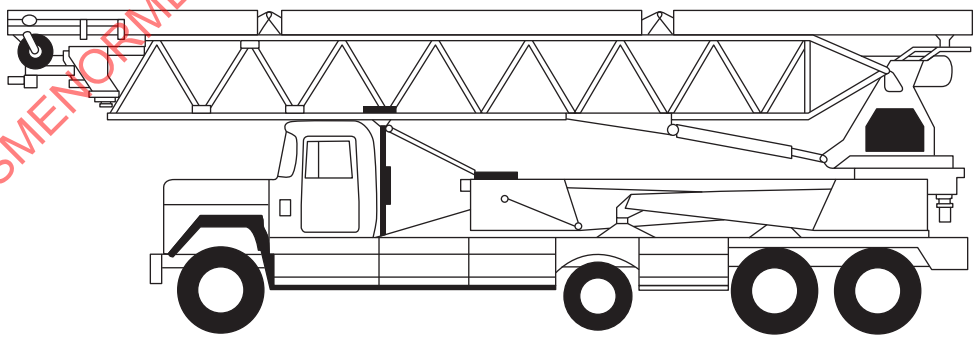
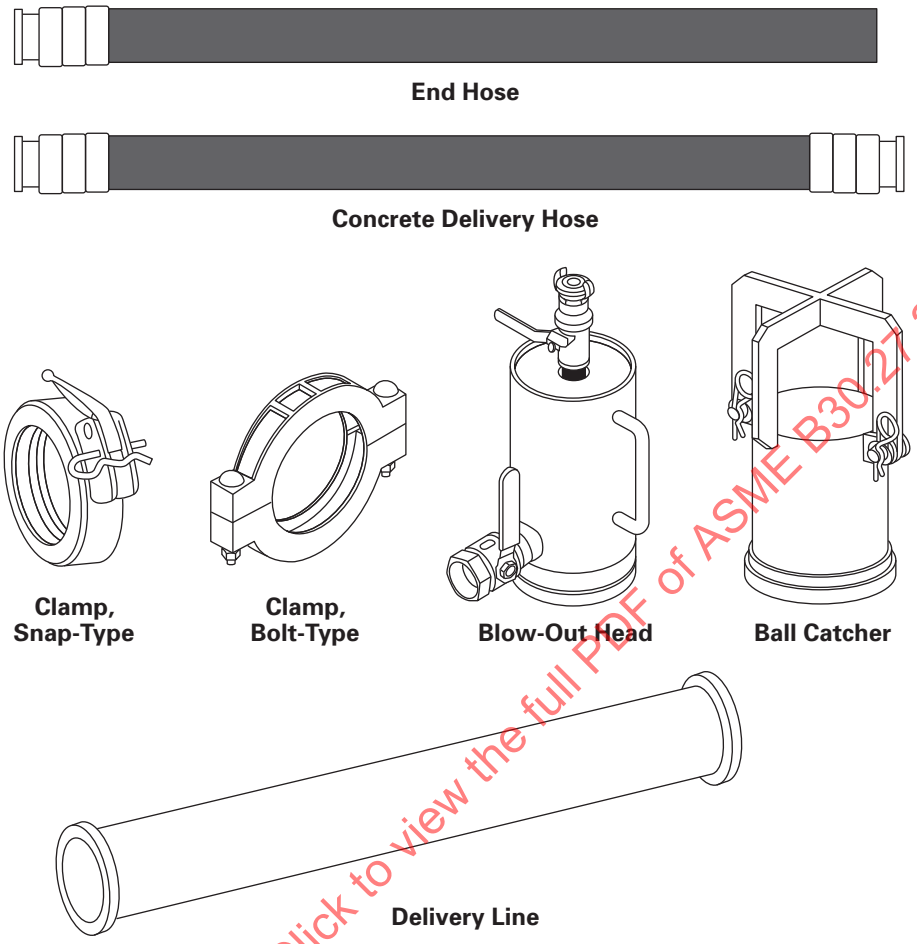


Fig. 4 Material Placement System: Examples of Delivery System Components



fessional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

raised-end connection: a type of pipe connection where the raised flange is tapered and self aligning.

rated load: maximum allowable working load designated by the manufacturer.

remote control: a portable control device connected to the machine by a wire cable or linked by radio or other means.

safety device: a means placed in use for the specific purpose of preventing an unsafe condition.

sheave: a grooved wheel or pulley used with a rope to change the direction and point of application of a pulling force.

shortrigging: one or more outriggers not fully extended on the side away from the boom operational area.

signalperson: see *spotter*.

specific type (of material placement system): a model, style, or size classification of material placement system (e.g., three section boom, four section boom, 50 meter class, conveyor).

spotter: a signalperson/spotter is a person positioned at a vantage point where both the point of discharge and the operator of the material placement system can be seen and relays information to the operator.

waterbox: the structural member holding the differential hydraulic cylinders in alignment with the material cylinders, which contains the flushing water.

(09) SECTION 27-0.3: REFERENCE TO OTHER CODES AND STANDARDS

The following is a list of publications referenced in this Volume:

ANSI Z-244.1, Lock-out, Tag-out of Energy Sources—Minimum Safety Requirements
ANSI Z-535, Product Safety Signs and Labels
Publisher: American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036

ASME B30.5, Mobile and Locomotive Cranes
ASME B30.22, Articulating Boom Cranes
Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

ISO 3411, Earth-Moving Machinery—Human Physical Dimensions of Operators and Minimum Operator Space Envelope
ISO 13850, Safety of Machinery—Emergency Stop—Principles for Design
Publisher: International Organization for Standardization (ISO), 1 rue de Varembé, Case Postale 56, CH-1211, Genève 20, Switzerland/Suisse

SAE J185, Access Systems for Off-Road Machines
Publisher: Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001

Chapter 27-1
Construction and Installation

SECTION 27-1.1: MARKINGS

27-1.1.1 Placing Boom Rating and Identification Markings

(a) The following information shall be legibly marked on a durable identification plate on the placing boom:

(1) manufacturer, supplier, or importer
(2) year of manufacture
(3) fabrication (serial) number
(4) type or model
(5) maximum design working pressure in the hydraulic system
(6) rated load

(a) for placing booms, maximum weight per foot of delivery system when filled with material based on 150 lb/ft^3 (2 400 kg/m^3)

(b) for conveyor, maximum weight of material per foot of belt

(b) Power rating for electrical equipment above 24 V (voltage, frequency, power, amperage draw).

(c) Placing booms shall be clearly marked with a label affixed near the tip elbow warning about the use of improper diameter delivery system.

(d) A durable plate showing the maximum weight of the hanging system components shall be attached to the boom tip.

(e) Placing booms shall not be used to move freely suspended loads. A safety sign shall be placed on the machine to this effect.

(09) 27-1.1.2 Material Placement System Rating and Identification Markings

The following information shall be legibly marked on a durable identification plate on the lower support structure of the material placement system:

(a) manufacturer, assembler, supplier, or importer
(b) year of manufacture
(c) fabrication (serial) number
(d) type or model
(e) maximum working pressure of material placement system hydraulic circuit(s)
(f) maximum material pressure, if applicable
(g) maximum working pressure supplied to the boom hydraulic system

27-1.1.3 Straight Delivery Pipes Rating and Identification Markings

The following information shall be legibly and durably marked on straight delivery pipes longer than 12 in. (305 mm):

(a) manufacturer or supplier (name or code)
(b) nominal diameter
(c) maximum working pressure, when new
(d) weight of pipe per foot when filled with material based on 150 lb/ft^3 (2 400 kg/m^3)

27-1.1.4 Delivery System Elbow Rating and Identification Marking

The following information shall be legibly and durably marked on delivery system elbows:

(a) manufacturer or supplier (name or code)
(b) nominal diameter
(c) maximum working pressure, when new
(d) weight of elbow when filled with material based on 150 lb/ft^3 (2 400 kg/m^3)

27-1.1.5 Delivery System Hose Rating and Identification Marking

The following information shall be legibly marked on the delivery hose:

(a) manufacturer
(b) nominal diameter
(c) working pressure when new
(d) weight

(1) for delivery hose, pounds per foot when filled with material based on 150 lb/ft^3 (2 400 kg/m^3)

(2) for end hose, total weight [when filled with material based on 150 lb/ft^3 (2 400 kg/m^3)] of component

27-1.1.6 Safety Signs (09)

Safety signs shall meet the requirements of ANSI Z-535, parts 1, 3, and 4.

27-1.1.7 Hand Signals

Hand signals in accordance with para. 27-3.3.2 shall be posted conspicuously on the material placement system or placing boom.

(09) 27-1.1.8 Delivery System Accessory Identification Marking

The following information shall be legibly and durably marked on shut-off valves, clamps, and reducers:

(a) manufacturer or supplier (name or code)

(b) maximum working pressure, when new

(c) weight of the component, with concrete at 150 lb/ft^3 (2 400 kg/m^3)

(09) 27-1.1.9 Air Compressor Rating Markings

If the machine is equipped with an air compressor, the following information shall be legibly marked on a durable identification plate:

(a) at the compressor

(1) volume stream

(2) maximum working pressure

(3) highest working speed per minute

(4) installed engine performance in kW or HP

(5) power rating for high voltage (above 24 V) electrical equipment (voltage, frequency, power, amperage draw)

(b) at the air chamber

(1) permissible working pressure of the pressure vessel

(2) volume of the pressure vessel (e.g., in gallons)

(3) the construction identification for pressure vessels

NOTE: This requirement does not apply to any part of the air system installed by the chassis manufacturer.

SECTION 27-1.2: MOBILE MATERIAL PLACING BOOM CONSTRUCTION

27-1.2.1 Structural

The material placement system shall be designed and constructed so when operated in accordance with manufacturer's intended use, stresses in load-bearing components shall not exceed structural limits.

27-1.2.2 Stability

The material placement system shall be designed and constructed so three outriggers of the machine support structure remain in contact with the support surface under the following conditions:

(a) The unit is set up within 3 deg of level.

(b) 125% of the rated static load is applied to the boom.

Stability of a representative model of the truck-mounted material placement system with integral placing boom shall be verified by performing the test described in para. 27-2.2.2.

27-1.2.3 Lifting Attachments

(a) Machines or their parts designed to be lifted by cranes or other lifting devices shall be equipped with suitable attachment points.

(b) Attachment points shall be clearly marked for identification purposes.

(c) Any component weighing more than 500 lb (227 kg) and having identified lifting attachment points shall have the component weight legibly and durably marked on the component. (09)

SECTION 27-1.3: WORK PLATFORMS, ACCESS WALKWAYS, AND GANGWAYS

(a) Work platforms, access walkways, and gangways shall be a skid-resistant type.

(b) Access for maintenance, assembly, dismantling, and testing should be provided.

(c) The machine designer should consider weather conditions in the design phase to minimize adverse effects, such as pooling of water and accumulation of ice and mud.

(d) Access provisions for getting on and off the material placement system shall be in accordance with SAE J185.

SECTION 27-1.4: ELECTRICAL INSTALLATIONS

(a) Each electrically powered placing boom shall have a power disconnect switch mounted at or near the base of the placing boom. This switch shall have provisions to apply lockout/tagout procedures in accordance with ANSI Z244.1.

(b) Electrical equipment shall be located or guarded so that live parts are not exposed to inadvertent contact under normal operating conditions.

(c) Electrical equipment shall be protected from concrete, dirt, grease, oil, and moisture infiltration. Fixtures, wiring, and connections exposed to the weather shall be of weather-resistant type.

(d) Overload protection shall be provided for each individual motor.

SECTION 27-1.5: ERGONOMICS

Control panels, manual override levers, access doors, and covers shall be located to provide access to accommodate human physical dimensions as outlined in ISO 3411.

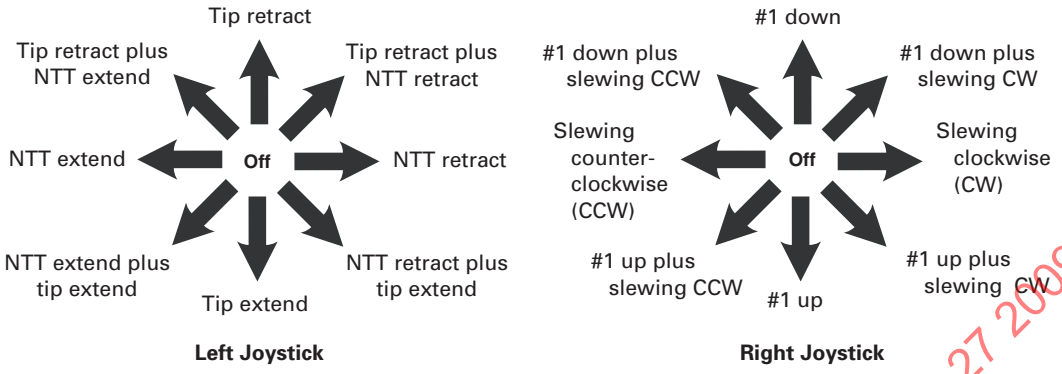
SECTION 27-1.6: OUTRIGGERS

(a) The machine shall be constructed so that the operator can see the area of outrigger movement from the outrigger control station.

(b) Means shall be provided to hold all outriggers in the retracted position while traveling and in the extended position when set for operating.

(c) If equipped with detachable outrigger floats (feet), they shall be securable to the outrigger jack.

Fig. 5 Standardized Joystick Movement (09)



GENERAL NOTE: NTT = Next To Tip. It means the section of boom attached to the tip section. For example, on a 4-section boom, NTT would be number 3. On a 3-section boom, NTT would be number 2. Each remote box will show the configuration correctly for the unit it will run. There is no standard for any sections not listed, meaning that extra sections may have pushbuttons, additional joysticks, or some other configuration.

(d) The maximum downward force imposed by the outrigger shall be marked at each outrigger.

(e) Power-actuated jacks, where used, shall be provided with the means (such as integral load hold check valves on hydraulic cylinders, mechanical locks, etc.) to prevent loss of support under load.

SECTION 27-1.7: CONTROLS AND INDICATORS

27-1.7.1 Emergency Stops

(a) Each machine shall be equipped with an emergency stop system.

(b) The emergency stop system actuator(s) shall be visible, accessible, and easy to operate.

(c) The machine shall be equipped with an emergency stop actuator at control panel(s) and at the remote control device(s). The machine may be fitted with additional emergency stop actuators.

(d) Emergency stops shall

(1) cause the machinery to stop instantaneously, taking into account stored energy.

(2) prevent the automatic restart of the machine. The machine will have to be started intentionally.

(3) be constructed according to ISO 13850.

27-1.7.2 Outriggers

(a) Control devices for slewable, telescopic, or adjustable outriggers shall return to the neutral position when released.

(b) Control devices for outriggers shall be situated outside of the area of outrigger movement, or access to the area of outrigger movement shall be otherwise restricted.

(c) Control circuits for the outriggers shall be independent of each other.

(d) Outrigger control systems shall be designed so they are nonfunctional when the machine is locked out in accordance with ANSI Z244.1.

27-1.7.3 General Control Requirements

(a) If there are multiple control locations, the same operation (e.g., start, close, open) shall only be possible from one location at a time. Priority switching (either manual or automatic) shall be used to transfer the control between the control locations.

(b) Control devices shall be designed to prevent unintentional operation.

(c) Control systems shall be designed so that they are nonfunctional when the equipment is locked out in accordance with ANSI Z244.1.

(d) All control devices shall be constructed, arranged, and marked so their function is indicated.

(e) Control devices that activate boom movements shall return to the neutral position when released.

27-1.7.4 Hour Meters

Hour meters shall be installed on any material placement system requiring maintenance based on hours.

27-1.7.5 Standardized Joystick Movements (09)

Joystick movements shall be consistent with the standardized movements shown in Fig. 5.

SECTION 27-1.8: GUARDS

(a) Any hazard that is inaccessible is considered guarded by location.

(b) A fixed guard shall be installed for rotating shafts. The underside of a mobile truck chassis-mounted

material placement system is considered guarded by location.

(c) A fixed guard shall be installed over V-belts, drive pulleys, chains, sprockets, gears, and other moving parts.

(d) All exhaust pipes shall be guarded or insulated to prevent contact with personnel when performing routine duties.

(e) Whenever guarding is impractical, prominent means such as safety signs or lights shall be provided at the point of hazard in lieu of guarding.

(09) *(f)* A fixed guard shall be installed to prevent unintentional access to the moving parts in the waterbox.

SECTION 27-1.9: MOBILE AND STATIONARY PLACING BOOMS

27-1.9.1 Placing Booms

(a) Mobile placing booms shall be equipped with a remote control with sufficient range to operate the material placement system from a distance equivalent to the boom length.

(b) The lifting and lowering speed at the end of the boom shall not exceed 3 ft/sec (1 m/s) when activating any one section.

(c) The lifting and lowering speed at the end of the boom shall not exceed 10 ft/sec (3 m/s) when activating any combination of boom functions.

(d) The horizontal slewing speed at the end of the boom shall not exceed 5 ft/sec (1.5 m/s).

(e) An integrally mounted holding device (such as a load hold check valve) shall be provided with each hydraulic cylinder on each boom section to prevent uncontrolled movement of the boom in the event of a hydraulic system failure (e.g., supply hose rupture).

27-1.9.2 Boom Tip Attachments

Provisions shall be made so that attachments suspended from the boom tip can be restrained.

(09) SECTION 27-1.10: DELIVERY SYSTEMS

27-1.10.1 Delivery Line

Delivery system components supplied with a machine shall have a working pressure rating at least equal to the maximum pressure of the machine configuration, as delivered.

27-1.10.2 Delivery System Components

(a) New delivery system components shall meet the following minimum ratios of burst pressure versus working pressure:

(1) end hoses—2:1

(2) boom pipes and boom couplings—2:1

(3) other concrete placing line and accessories, including concrete delivery hose, delivery line, valves, and couplings—2:1

(b) Delivery system components for boom units shall have a minimum of 85 bar (1 233 psi) working pressure, when new. Any boom unit capable of exceeding 85 bar material pressure shall have the delivery system's working pressure requirements clearly marked on the boom.

(c) Pipeline couplings shall be constructed to minimize the possibility of inadvertent opening.

(d) Delivery systems with grooved connections [a groove machined or rolled directly into the outside of the pipe wall, creating a flange height of less than 0.15 in. (3.8 mm)] shall not be used on placing booms or on lay-down delivery line or hoses.

(e) Air blow-out caps shall be equipped with a separate bleed-off valve to allow the operator to relieve pressure in the system.

SECTION 27-1.11: LOSS OF POWER

Interruption of power to the material placement system shall not cause a hazardous situation.

SECTION 27-1.12: REMOTE STARTING

A material placement system powered by the vehicle engine shall be designed so the engine cannot be started from a remote location unless the drive axles are disengaged.

SECTION 27-1.13: MANUALS

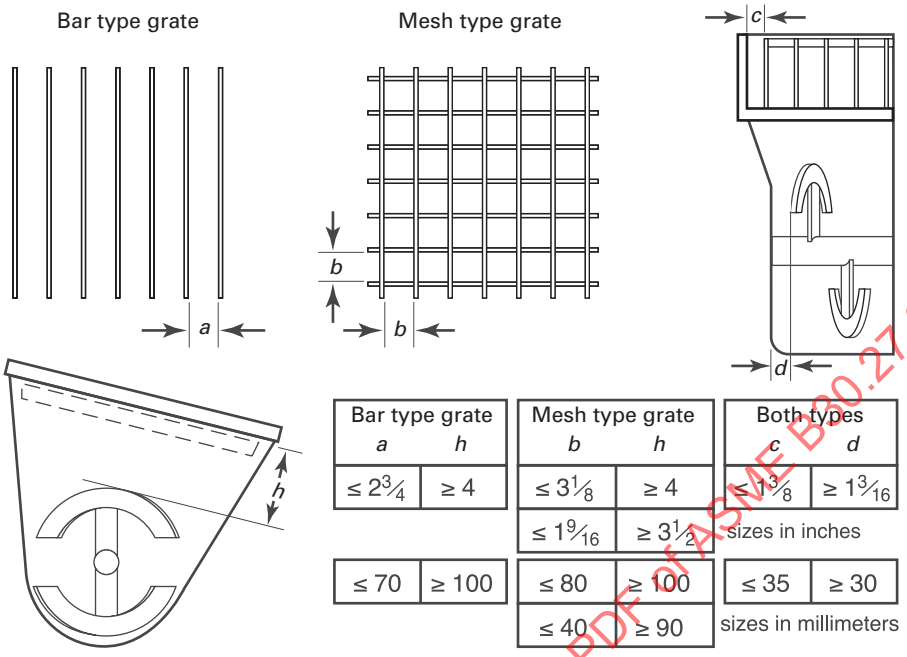
The manufacturer, supplier, or importer shall furnish with each material placement system information applicable to the following:

(a) installation
(b) hazards
(c) lockout/tagout procedures
(d) operation
(e) inspection
(f) testing
(g) lubrication
(h) maintenance
(i) parts
(j) wiring diagram (may be supplied separately)
(k) hydraulic diagram (may be supplied separately)
(l) safety sign ordering information and location guide (may be supplied separately)
(m) spare parts list containing relevant safety-related spare parts, such as relief valves, check valves, and guards, with part location

SECTION 27-1.14: FUEL AND EXHAUST SYSTEMS

(a) The material placement system's fuel system components shall be compatible with the fuel used.

Fig. 6 Grates on Hoppers (09)



Bar type grate		Mesh type grate		Both types	
a	*h*	*b*	*h*	*c*	*d*
≤ 2¾	≥ 4	≤ 3⅛	≥ 4	≤ 1⅜	≥ 1 3/16
		≤ 1 9/16	≥ 3½	sizes in inches	
≤ 70	≥ 100	≤ 80	≥ 100	≤ 35	≥ 30
		≤ 40	≥ 90	sizes in millimeters	

(b) The fuel system filling area shall be located away from potential fuel ignition sources on the machine.

(c) Engine exhaust gases shall be piped to the outside of the cab and discharged in a direction away from the operator and other locations where personnel would be performing routine duties.

(09) SECTION 27-1.15: HOPPERS

(a) Grates on hoppers of reversible pumps that can be opened without a tool or that have to be opened more than once a day shall be configured in such a way that when they are opened, operation of the concrete pump and agitator is stopped, and they shall be secured against restarting while the grate remains open.

(b) A valve mechanism capable of crushing, tearing, or cutting shall be guarded by a cover grate on the opening of the charging hopper within the dimensions shown in Fig. 6, or the machine shall be constructed in such a way that the crushing points are inaccessible.

(c) Agitators or screw conveyors located inside of hoppers shall be guarded with a cover grate constructed within the dimensions shown in Fig. 6.

(d) Power-operated hopper cover grates or hopper covers shall have a control device with self-acting reset. The location of the control levers shall be far enough away from the crushing points to prevent contact with the moving parts.

(e) A grate or cover that can be raised shall be securable in the open position or constructed in such a way that it will not close unintentionally.

SECTION 27-1.16: PUMP PRESSURE RELEASE (09)

27-1.16.1 Reversible Pumps

Reversible pumps shall be constructed so pressure caused by blockages in the delivery system can be removed by reversing pumping.

27-1.16.2 Nonreversible Pumps

Nonreversible pumps shall be constructed so personnel are not endangered by the forceful ejection of concrete when removing the pressure caused by blockages. This can be accomplished by

(a) a restraining device allowing the pump manifold to be opened safely

(b) a pressure release gate in the manifold

(c) any other pressure release mechanism that will not endanger personnel when used

Chapter 27-2
Inspection, Testing, and Maintenance

SECTION 27-2.1: INSPECTION

27-2.1.1 Inspection Classifications

(a) Initial Inspection. Prior to initial use, all new, repaired, or altered material placement systems shall be inspected by a qualified person to verify compliance with the provisions of this Volume.

(b) Frequent and Periodic Inspections. The inspection procedure for material placement systems in regular service is divided into two general classifications based upon the intervals at which the inspections are to be performed. The inspection intervals are dependent upon the nature of the components and degree of safety, exposure to wear, malfunction, or deterioration. The two general classifications of regular inspection are designated as "frequent" and "periodic."

27-2.1.2 Frequent Inspection

27-2.1.2.1 Frequent inspection shall be performed by a designated person at daily to monthly intervals and shall include observations prior to and during operation.

27-2.1.2.2 A designated person shall determine whether conditions found during the inspection constitute a hazard and whether a more detailed inspection is required.

27-2.1.2.3 Frequent inspection of the material placing boom and structural support system shall include, as applicable

(a) safety devices, such as holding valves, guards, and interlocks, for proper operation

(b) boom controls for proper operation and engagement

(c) boom and outrigger hooks, straps, and latches for proper operation and engagement

(d) hydraulic hoses for wear, rubbing, and cracking

(e) hydraulic oil level

(f) hydraulic oil leaks

(g) remote control boxes and cables for proper operation, exposed wires, broken controls, missing control guards, or broken plugs

(h) boom and outrigger structures for visible deformations, cracks, and damage

(i) boom and outrigger pins for visible wear, damage, and missing hardware

(j) tires for sufficient tread, proper inflation, cuts, and loose lug nuts

(k) proper loading of accessories to prevent loss while traveling

(l) proper lubrication of moving parts

27-2.1.2.4 Frequent inspection of the delivery system components shall include

(a) boom delivery system for

(1) minimum wall thickness to withstand the maximum material pressure, according to the manufacturer's instructions

(2) dents or cracks

(3) missing locking pins

(4) leaking gaskets

(b) delivery system hoses for

(1) internal wear, according to the manufacturer's instructions

(2) separation of the ferrule from the hose

(3) bulges, kinks, soft spots, cuts, or abraded areas, which may indicate broken or misplaced reinforcement

(4) presence of hardened concrete

(c) couplings for

(1) cracked, broken, distorted, or missing components

(2) proper operation of the adjusting nut, if so equipped

(3) concrete preventing proper operation

(4) system compatibility

(d) separately laid pipeline components for

(1) sufficient wall thickness to withstand the maximum material pressure of the material placement system, according to the manufacturer's instructions

(2) dents, holes, or deformed ends

(3) the presence of old concrete inside the pipeline

(e) cables or slings used to secure hanging system components

(f) missing or damaged safety signs and operational labels

27-2.1.2.5 Frequent inspection of conveyor system components shall include

(a) conveyor belts for proper tension, proper alignment (i.e., in center of pulleys and rollers), and unusual wear (e.g., grooves or holes in belt)

(b) telescope drive cable or chain for excessive wear, damage, and proper tension

(c) sheaves for excessive wear or damage

(d) chains for excessive wear or damage

(e) chain sprockets for excessive wear or damage

(*f*) rollers, pulleys for proper adjustment, concrete buildup, excessive wear, or damage
(*g*) tie rods for proper adjustment or damage
(*h*) scraper blade assemblies for excessive wear, damage, concrete buildup, or improper adjustment
(*i*) hydraulic cylinder pins or anchors for excessive wear or damage
(*j*) missing or loose mounting bolts, guards, or hardware
(*k*) missing or damaged safety signs and operational labels
(*l*) proper lubrication of moving parts

27-2.1.3 Periodic Inspections

27-2.1.3.1 Complete inspections of the material placing boom and structural support system shall be performed by a qualified person at the intervals listed below
(*a*) first 5 years — every 2,000 working hours, or at least once per year, whichever occurs first
(*b*) 5 to 10 years — every 1,000 working hours, or at least once per year, whichever occurs first
(*c*) 10 years and older — every 500 working hours, or at least once per year, whichever occurs first

27-2.1.3.2 A qualified person shall inspect
(*a*) the placing boom for corrosion, cracking, deformation, or damage
(*b*) the structural support system for corrosion, cracking, deformation, or damage
(*c*) measured boom pin wear

27-2.1.3.3 If the inspection of para. 27-2.1.3.2 reveals a condition determined as hazardous, the machine shall be taken out of service until repairs are made.

27-2.1.3.4 The periodic inspection shall include the requirements of frequent inspections (paras. 27-2.1.2.3 and 27-2.1.2.4) and in addition, the following items, as applicable, which can be inspected by a designated person:
(*a*) measured gear lash and bearing clearances
(*b*) loose or missing fasteners, including pins or pin retainers
(*c*) slewing and telescope bearings, gear drives, and gears for mounting and wear
(*d*) hydraulic component mounting(s)
(*e*) missing or loose mounting bolts to the carrier chassis
(*f*) truck mounting for cracks, deformation, or damage
(*g*) hydraulic and pneumatic pumps and motors
(*1*) loose bolts or fasteners
(*2*) leaks at joints between sections
(*3*) shaft seal leaks
(*4*) unusual noises or vibration
(*5*) loss of operating speed
(*6*) excessive heating of the fluid
(*7*) loss of pressure
(*h*) hydraulic and pneumatic valves
(*1*) cracks in valve housing
(*2*) improper return of spool to neutral position
(*3*) leaks at spools or joints
(*4*) sticking spools
(*5*) failure of relief valves to attain correct pressure setting
(*6*) relief valve pressures shall be checked as specified by the manufacturer
(*i*) hydraulic and pneumatic cylinders
(*1*) drifting caused by fluid leaking across the piston
(*2*) rod seals leakage
(*3*) leaks at welded joints
(*4*) scored, nicked, or dented cylinder rods
(*5*) dented case (barrel)
(*6*) loose or deformed rod eyes or connecting joints
(*j*) operational labels and safety signs are present, attached in the appropriate place, and legible
(*k*) concrete pump components (as recommended by the manufacturer) **(09)**

27-2.1.3.5 A designated person shall determine whether conditions found during the inspection of para. 27-2.1.3.4 constitute a hazard and whether a more detailed inspection is required.

27-2.1.4 Material Placement Systems Not in Regular Use

A material placement system that has been idle for a period of 1 month or more shall be given a frequent inspection before being placed in service.

27-2.1.5 Inspection Records

Dated periodic inspection records shall be maintained by a designated person.

SECTION 27-2.2: TESTING

27-2.2.1 Operational Testing

All new production material placement systems shall be tested by the manufacturer after final assembly to verify
(*a*) proper operation of all safety devices
(*b*) proper operation of all controls
(*c*) proper positioning of all boom sections in all intended operational positions
(*d*) proper positioning of outriggers in all intended operational positions
(*e*) proper setting of hydraulic pressures and relief settings
(*f*) no unusual vibrations or noise
(*g*) the boom will support the intended load without seeping down in excess of the manufacturer's specification
(*h*) proper operation and engaging of latching and locking devices
(*i*) compliance with the requirements of this Volume

27-2.2.2 Manufacturer's Stability Test

A representative unit of each model and chassis in each intended operation configuration shall be tested for stability. A written test report shall be kept on file. The stability test shall comply with the following minimum guidelines:

(a) The margin of stability shall be determined by calculation of the static load imposed by the boom and its systems and mountings, plus the maximum allowable load imposed on the boom by the material in the delivery system, including end hose, and the boom rotated to the least stable position. The calculation of the material load shall be based on material with a bulk density of 150 lb/ft^3 (2 400 kg/m^3).

(b) If having the outriggers, extendable axles, or other means in use are part of the normal configuration to meet the stability requirements, they shall be set per manufacturer's instructions.

(c) The test load equivalent to 125% of the rated load (1.25 times) shall be applied to the boom to verify its stability. The manufacturer shall determine the most critical configuration(s) of the unit for this test. Ballast may be applied to the unit that is equivalent to the weight of material in the hopper (filled to the top of delivery cylinder opening), one delivery cylinder (filled 75%), and the deck delivery line.

(d) None of the stability testing shall cause permanent deformation to any component. While being tested, three outriggers shall remain in contact with the support surface. During the stability test, the lifting of one outrigger on the opposite side of the load does not necessarily indicate a condition of instability.

27-2.2.3 Postmaintenance Test

Before being returned to service after maintenance is performed, any altered, replaced, or repaired components shall be tested for proper operation per the manufacturer's recommendations.

SECTION 27-2.3: MAINTENANCE

(a) The manufacturer shall provide a recommended preventive maintenance schedule to minimize the possibility of mechanical failures and excessive and unnecessary wear.

(b) A preventive maintenance program based on the machine and truck manufacturer's recommendations should be established for material placement systems. Dated records of maintenance performed should be maintained.

(c) Under severe conditions, or if excessive wear is noted, scheduled intervals should be adjusted to prevent breakdowns and excessive wear.

(d) Maintenance shall be performed by a designated person.

(e) Maintenance should be performed in accordance with the manufacturer's recommended procedures.

(f) All guards shall be reinstalled, all safety devices reactivated, and maintenance equipment removed after maintenance is completed.

(g) Welding on the boom, outrigger, or structural member shall be performed in accordance with the recommendations of the manufacturer. In the absence of a manufacturer's recommendation, the welding can be performed per the recommendations of a qualified person.

(h) Replacement parts shall meet or exceed the manufacturer's specifications.

(i) Missing or illegible operational labels and safety signs shall be replaced.

(j) Lubrication should be performed according to the manufacturer's recommendations and procedures.

(k) Delivery of lubricant to intended points should be verified.

(l) Machinery shall not be in operation while lubricants are being applied, unless equipped for automatic or remote lubrication or the lubrication point specifically requires movement for the lubricating procedure.

Chapter 27-3
Operation

SECTION 27-3.1: QUALIFICATIONS FOR AND CONDUCT OF OPERATORS AND OPERATING PRACTICES

27-3.1.1 Operators

(a) Material placement systems shall be operated only by the following personnel:

(1) persons who have met the requirements of paras. 27-3.1.2(a), (b), and (c).

(2) persons who have met the requirements of para. 27-3.1.2(d) and are training for the type of material placement system being operated. While operating, the trainee shall be under the direct supervision of a designated, qualified operator.

(3) maintenance personnel who have completed all operator trainee qualification requirements and demonstrated operational ability as defined in para. 27-3.1.2 (b)(4). Operation by these persons shall be limited to those material placement system functions necessary to perform maintenance on the machine or verify the performance of the material placement system after maintenance has been performed.

(4) inspectors who have completed all operator trainee qualification requirements and demonstrated operational ability as defined in para. 27-3.1.2(b)(4). Operation by these persons shall be limited to those material placement system functions necessary to accomplish the inspection.

(b) During material placement system operations, no one other than the personnel specified in para. 27-3.1.1(a) shall be within 5 ft (1.5 m) of the material placement system or climb up on the machine, with the exception of supervisors, those specified persons authorized by supervisors whose duties require them to do so in the performance of their duties, or concrete truck drivers having the knowledge and permission of the material placement system operator.

27-3.1.2 Qualifications for Operators

Operators shall be required to successfully meet the qualifications for the specific type of material placement system they are operating.

(a) Operator and operator trainees shall meet the following physical qualifications unless it can be shown that failure to meet the qualifications will not affect the operation of the material placement system. In such cases, specialized clinical or medical judgements and tests may be required.

(1) vision of at least 20/30 Snellen in one eye, with or without corrective lenses.

(2) ability to distinguish colors, regardless of position, if color differentiation is required.

(3) adequate hearing, to meet operational demands, with or without a hearing aid.

(4) sufficient strength, endurance, agility, coordination, and speed of reaction to meet the operational demands.

(5) shall have normal depth perception, field of vision, reaction time, manual dexterity, coordination, and no tendencies to dizziness or similar undesirable characteristics.

(6) should successfully pass with a negative result a substance abuse test. The level of testing will be determined by the standard practice for the industry where the material placement system is employed, and this test shall be confirmed by a recognized laboratory service.

(7) no evidence of physical defects or emotional instability that could render a hazard to the operator or others or that in the opinion of the examiner could interfere with the operator's performance. If evidence of this nature is found, it may be sufficient cause for disqualification.

(8) evidence that an operator is subject to seizures or loss of physical control shall be sufficient reason for disqualification. Specialized medical tests may be required to determine these conditions.

(b) Operator requirements shall include, but not be limited to, the following:

(1) evidence of successfully passing a physical examination as defined in para. 27-3.1.2(a).

(2) satisfactory completion of a written examination covering operational characteristics, controls, power line avoidance, stability requirements, and emergency control skills, such as response to fire, power line contact, loss of stability, or control malfunction, as well as characteristic and performance questions appropriate to the material placement system type for which qualification is sought.

(3) operators shall demonstrate their ability to read and comprehend the material placement system manufacturer's operation and maintenance instruction materials.

(4) completing an operation test demonstrating proficiency in handling the specific type material place-