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SUPERSEDED

ANSI A92.2-1969

American National Standard



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**for vehicle-mounted
elevating and rotating
work platforms**



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ANSI
A92.2-1969

American National Standard
for Vehicle-Mounted Elevating and Rotating
Work Platforms

Sponsors

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Approved November 3, 1969
American National Standards Institute, Inc

American National Standard

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Foreword

(This Foreword is not a part of American National Standard for Vehicle-Mounted Elevating and Rotating Work Platforms, A92.2-1969.)

This standard is one of a series developed under the committee procedures of the American National Standards Institute. The A92 project was approved as a project by the American Standards Association in 1948. In 1959, the National Safety Council withdrew as primary sponsor, and sponsorship was assumed by the American Society of Safety Engineers. In October, 1960, the American Mutual Insurance Alliance became a cosponsor of the project.

At the inception of this project, the A92 Committee was concerned only with manually-propelled mobile scaffolds and platforms. In 1961, the committee extended its scope to include a second project on vehicle-mounted elevating and rotating work platforms. The development and increasing use of such equipment had reached a stage where minimum specifications governing design and manufacture of such devices were necessary. This standard sets forth minimum requirements that must be considered and built into the devices to provide for proper and safe operation.

The use of aerial devices is subject to certain hazards that cannot be protected against by mechanical means, but only by the exercise of intelligence, care, and common sense. It is, therefore, essential to have competent and careful operators, physically and mentally fit, and thoroughly trained in the safe operation of aerial devices.

Suggestions for improvement gained in the use of the standard will be welcome. They should be sent to the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

At the time it approved this standard, the A92 Committee had the following members:

Robert L. Moore, *Chairman*

Wayne C. Christensen, *Secretary*

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Name of Representative

| | |
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| American Insurance Association | John Fahy |
| American Ladder Institute | Ralph J. Pazar (<i>Alt</i>) |
| American Mutual Insurance Alliance | Robert G. Howland |
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| American Society of Safety Engineers | I. G. Kennedy |
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| Hunt-Pierce Corporation | Norman J. Glomski |
| Institute of Electrical and Electronics Engineers, Inc. | Donald E. Anderson (<i>Alt</i>) |
| International Association of Governmental Labor Officials | A. C. Tayman |
| International Brotherhood of Electrical Workers | C. K. Poarch (<i>Alt</i>) |
| Metal Ladder Manufacturers Association | James L. Eucker |
| Mobile Aerial Towers, Inc. | John Lane (<i>Alt</i>) |
| National Automatic Sprinkler and Fire Control Association | Wayne Pierce |
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American National Standard for Vehicle-Mounted Elevating and Rotating Work Platforms

1. Scope and Purpose

1.1 Scope

1.1.1 Equipment Covered. This standard relates to the following types of vehicle-mounted aerial devices used to elevate personnel to job sites above ground:

- (1) Extensible boom platforms.
- (2) Aerial ladders.
- (3) Articulating boom platforms.
- (4) Vertical towers.
- (5) A combination of any of the above.

These devices are made of metal, wood, fiber-glass reinforced plastic (FRP), or other material and are powered or manually operated; whether or not they are capable of rotating about a substantially vertical axis.

1.1.2 Equipment Not Covered. The scope of this standard does not include any matter relating to fire fighting equipment or any matter relating to the vehicles upon which aerial devices are mounted, except in respect to a vehicle being a stable support for the aerial device.

1.2 Purpose. The purpose of this standard is to serve as a guide for manufacturers and dealers of aerial devices to achieve the following objectives:

- (1) Uniformity in ratings.
- (2) Standards of design and manufacture.
- (3) Standards for testing and inspections.
- (4) Understanding by manufacturers and dealers of their respective responsibilities.
- (5) Prevention of personal injuries to users and the public.

1.3 Minimum Requirements. The standards herein are to be considered as minimum requirements.

1.4 Exceptions. In cases of practical difficulty or unnecessary hardship, administrative authorities may grant exceptions to the literal requirements of this standard, or permit the use of other methods or materials; but only when it is clearly evident that equivalent protection is thereby secured.

2. Definitions

aerial device. Any vehicle-mounted device, telescoping or articulating or both, which is used to position personnel.

aerial ladder. An aerial device consisting of a single or multiple-section extensible ladder.

articulating boom platform. An aerial device with two or more hinged boom sections.

extensible boom platform. An aerial device (except ladders) with a telescopic or extensible boom. Telescopic derricks with personnel platform attachments shall be considered to be extensible boom platforms when used with a personnel platform.

instability. A condition of a mobile unit in which the sum of the moments tending to overturn the unit is equal to or exceeds the sum of the moments tending to resist overturning.

insulated aerial device. An aerial device designed for work on energized lines and apparatus.

line voltage. The nominal phase-to-phase voltage.

mobile unit. A combination of an aerial device, its vehicle, and related equipment.

override. The transfer or take-away of all movement control functions of the other station(s).

platform. Any personnel-carrying device (basket or bucket) which is a component of an aerial device.

rated line voltage. The manufacturer's recommended safe working-line voltage.

shall. The word *shall* is to be understood as mandatory.

should. The word *should* is to be understood as advisory.

vehicle. Any carrier that is not manually propelled.

vertical tower. An aerial device designed to elevate a platform in a substantially vertical axis.

3. Performance Ratings

3.1 Mechanical Ratings

3.1.1 Required Statement. Each manufacturer of an aerial device shall clearly state (in the manual and on the operating instruction plate(s) required by the standard) its rated capacity in pounds.

3.1.2 Vehicle Specifications. The manufacturer shall clearly state the minimum required vehicle specifications prerequisite to the vehicle's being an adequately stable carrier for the aerial device. The manufacturer may state part of these specifications in terms of the minimum weight of the completed mobile unit (or the weights on the front and the rear axle assemblies); in which case a counterweight and a body and other permanently attached vehicle accessories shall be included in the measurements; but tools, fuel, and other accessories not permanently attached to the aerial device or body, shall not be considered as part of the weight.

The manufacturer shall include in the minimum vehicle specifications, a minimum specification for each of the following: front axle, rear axle, vehicle frame material, and section modulus; and if frame reinforcement is required, a description of the recommended method of reinforcing the vehicle frame.

3.1.3 Alternative Configuration. If the aerial device is susceptible to several alternative configurations, then the manufacturer shall clearly describe these alternatives, including the rated capacity in each situation. Examples of alternative configurations requiring such a description by the manufacturer in his manual and on operating instruction plate(s) are as follows:

- (1) Without extending outriggers vs with outriggers extended to firm footing.
- (2) With spring lockouts engaged vs without spring lockouts engaged.
- (3) With only one platform attached vs with two platforms attached.
- (4) With digger attached to boom vs with digger removed from boom.
- (5) Used as a personnel-carrying device only vs used as a personnel-carrying and material-handling device.

If the rated capacity of the alternative configuration is related to an angle which a boom makes with the horizontal, then the manufacturer shall install a means by which the operator can determine whether the boom is at a safe

angle, using permanent and legible characters where marking is necessary.

3.1.4 Operating Instruction Plates. Manufacturers shall attach to all aerial devices a plate or plates located in a readily accessible area, clearly visible, stating the following:

- (1) Make, model and manufacturer's serial number.
- (2) Rated capacity.
- (3) Platform height.
- (4) Maximum recommended operating pressure of hydraulic or pneumatic system(s) or both.
- (5) Caution or restrictions of operation or both.
- (6) Operating instructions.
- (7) Manufacturer's rated line voltage.

Alternative configurations shall require in addition to the above:

- (a) Chart, schematic, or scale showing capacities of all combinations in their operating positions.
- (b) Caution or restrictions or both, of operation of all alternate or combinations of alternate configurations.

3.1.5 Stability on Level Ground. Each aerial device when properly mounted as a mobile unit meeting the minimum required vehicle specifications, and used in a specific configuration, shall be capable of sustaining a static load, one and one-half times its rated capacity, when the vehicle is on a firm and level surface.

3.1.5.1 Stability Test. The stability test as outlined in Crane Load Stability Test Code, SAE J765-1961[1]¹ shall apply as modified to platform loading.

3.1.6 Stability on Slopes. Each aerial device, when properly mounted upon a vehicle meeting the manufacturer's minimum vehicle specifications, and used in a specific configuration, shall comprise a unit capable of sustaining a static load, one and one-third times the rated capacity for that specific configuration, in every position in which the load can be placed within the definition of the specific configuration, when the vehicle is on a slope of five degrees downward in the direction most likely to cause overturning. If having the outriggers extended to a firm footing is part of the definition of the configura-

¹Numbers in brackets refer to corresponding numbers in Section 7, References to the Text.

tion, then outriggers shall be extended to provide maximum levelling for the purpose of determining whether the unit meets the stability standard. If other facilities, such as a means of turntable levelling, are provided to minimize the effect of sloping terrain, then those facilities shall be utilized for the purpose of determining whether the unit meets the stability standard.

3.1.7 Effects of Stability Test. None of the stability tests described above shall produce instability (as defined herein) of the unit or cause permanent deformation of any component.

3.1.8 Platform Ratings

3.1.8.1 Platform height shall be measured at its maximum elevation, from the floor of the platform to the ground, with the aerial device mounted on a vehicle having a chassis frame height of 36 inches.

3.1.8.2 Reach shall be measured from the center line of pedestal (rotation) to outer edge (rail) of platform.

3.1.8.3 Capacity may be of two distinct types:

- (1) The platform load.
- (2) Supplemental loads which may be affixed directly to the boom.

The capacity rating in either case shall be designated with boom or booms extended to the maximum horizontal reach attainable throughout full rotation of its pedestal. Capacities of the equipment in other positions must be specified separately.

3.2 Electrical Ratings

3.2.1 Required Statement. Each manufacturer of an aerial device shall clearly state in the manual or the operating instruction plates or both, required by this standard, whether the aerial device is insulated or non-insulated.

3.2.2 Rated Line Voltage. In the case of the insulated units, the manufacturer shall clearly state in the manual and on the operating instruction plates the rated line voltage for which the aerial device is designed and satisfactorily tested according to this standard (see 5.5).

3.2.3 Certification. Upon request, the manufacturer shall furnish the purchaser with a certified report of tests, signed by a registered professional engineer, or a qualified independent laboratory. The tests shall include those specified in Section 5.

4. Design and Manufacture

4.1 Basic Principles. Sound engineering principles and reasonable assumptions consistent with all data available regarding use and environment shall be applied in the design of aerial devices, with due respect for the unit's being personnel-carrying equipment.

4.2 Structural Safety Factor. The basic structural elements of the aerial device which support the platform shall be designed so that the yield point of the materials used for any such elements shall not be exceeded by three times the rated loads on the aerial device. The same structural safety factor shall apply to the platform.

4.3 Controls. Articulating boom and extensible boom platforms, primarily designed as personnel carriers, shall have both platform (upper) and lower controls. Upper controls shall be in or beside the platform within easy reach of the operator. Lower controls shall provide for overriding the upper controls. All controls shall be plainly marked as to their function.

4.4 System Protection. Where the elevation of the boom is accomplished by means of a hydraulic cylinder assembly, the system shall be equipped with pilot-operated check valves or other appropriate devices to prevent free fall of the boom in the event of hydraulic line failure.

4.4.1 Where the elevation of the boom is accomplished electrically, the system shall be designed to prevent free fall in the event of generator or power failure.

4.5 Platform Rail and Kickplate. Each platform shall be provided with a rail or other structure around its upper periphery that shall be at least 38 inches above the floor of the platform, and the kickplate shall be at least four inches high or its equivalent.

4.6 Welding Standards. All welding shall conform to the following standards recommended by the American Welding Society:

- (1) Standard Qualification Procedure, AWS B3.0-41[2].
- (2) Recommended Practices for Automotive Welding Design, AWS D8.4-61[3].
- (3) Standard Qualification of Welding Procedures and Welders for Piping and Tubing, AWS D10.9-69[4].

4.7 Axles. No load greater than double the truck axle's mobile rating shall be imposed when the aerial device is operated while the vehicle is stationary. No load greater than the truck axle's mobile rating shall be imposed when the aerial device is in its roading position.

4.8 Control Placard. The manufacturer shall install a placard or placards at each control station describing the motion or action which will be produced by each operation of a switch, valve handle, or other means of actuating a control.

4.9 Bursting Safety Factor. All components of hydraulic or pneumatic systems shall have a minimum bursting strength of at least four times the operating pressure for which the system is designed.

4.10 Insulated Boom and Platform Specifications. The insulated boom and platform shall be made of an insulating material of high dielectric strength which will not absorb moisture (usually fiberglass reinforced plastic or equivalent). All components bridging the insulated portions of the boom structure shall have an equivalent electrical insulating value.

4.11 Test Electrodes. Test electrodes (on units rated 69 kV and over) shall be permanently located on the inside and outside surfaces of the insulated portion of the boom. These electrodes should be two to six inches from the metal portion of the lower end of the insulated upper boom. All hydraulic and air lines bridging the insulated portion of the boom shall have metallic couplings adjacent to the test electrodes. Couplings shall be insulated from the metal portion of the boom and electrically connected to the test electrodes (see 5.5.3.2 and Fig. 1, Total Arm Current).

5. Testing and Inspection

5.1 Loading Test. The manufacturer shall perform a loading test (on a vehicle or test stand) on each aerial device manufactured. This test shall include the movement of the platform (with a static load at least one and one-half times the rated capacity imposed) through its entire range of motion (see 3.1.5).

5.1.1 Visual Inspection. Thereafter a final visual inspection of the finished article shall be made to determine whether the loading test has produced an adverse effect on any component.

5.2 Quality Control. The manufacturer shall use a uniform method of quality control to ensure compliance with this standard and with his own standards.

5.3 Installer's Responsibility. Whoever mounts an aerial device upon a vehicle (whether it be the manufacturer, dealer or purchaser) shall, before the unit is placed in operation, perform stability tests in accordance with the requirements of 3.1.5 and 3.1.6 of this standard. Thereafter, the installer shall make a visual inspection of all accessible components for evidence of defects such as loose connections, frayed wire rope, deformation of any component, hydraulic leaks, and other items specified in the manufacturer's operating manual.

5.4 Insulation Tests. Any aerial device or component thereof which is represented by the manufacturer or installer as being insulated shall meet the requirements of 5.5.3.

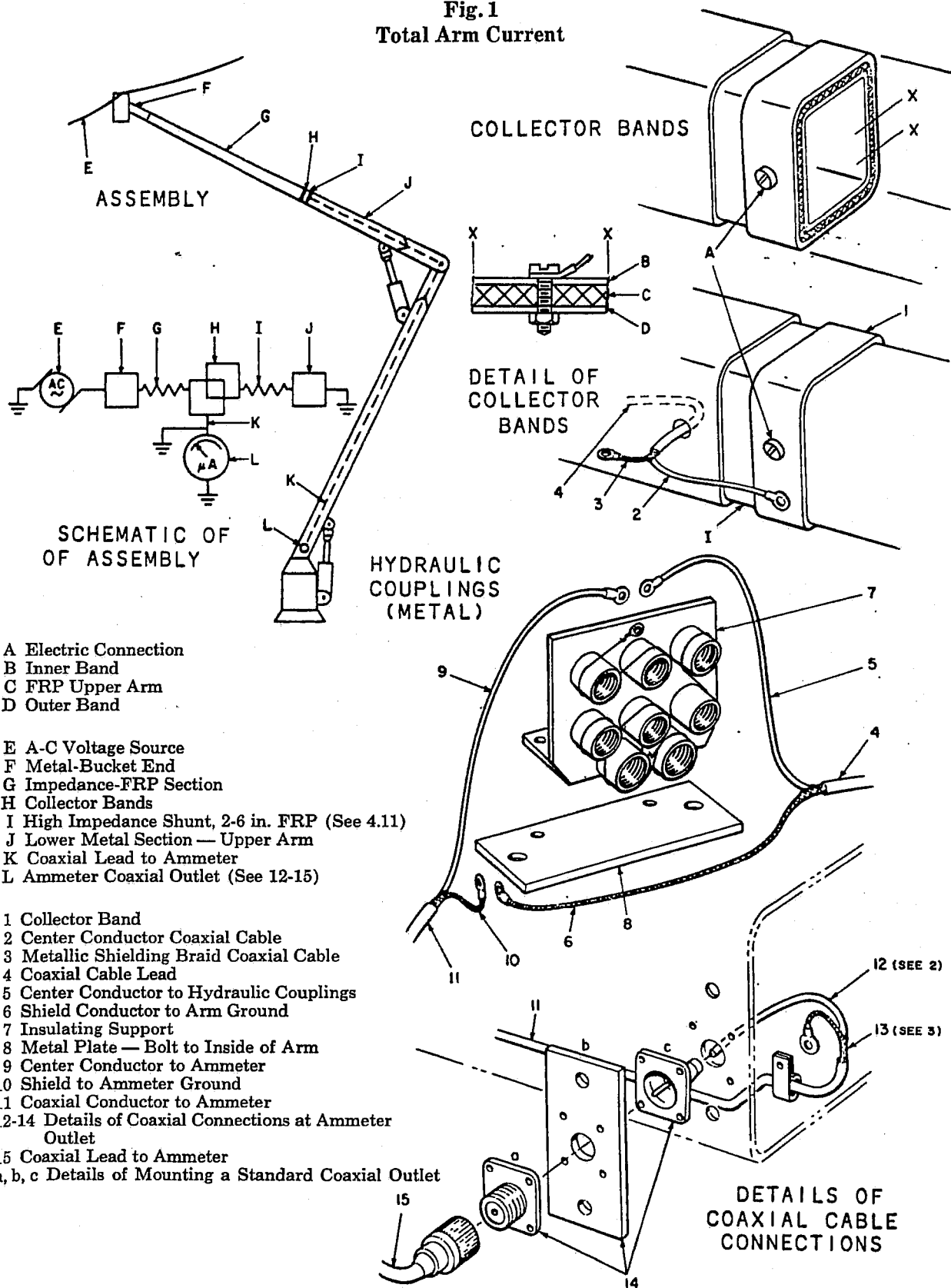
5.5 Manufacturer's Electrical Tests on Insulated Devices

5.5.1 Test equipment shall meet the requirements of American National Standard Techniques for Dielectric Tests, C68.1-1968, or the latest revision thereof. Suggestions as to voltage, source voltage, voltage control, protection, voltage measurement, and current measurement are set forth below.

5.5.1.1 Transformer. The prescribed test voltage can be most readily obtained from a step-up transformer energized from a variable low-voltage source. The transformer and its control equipment should be of such size and design that, with the test specimen in circuit, the crest factor (ratio of maximum to effective value of the test voltage) shall not differ more than ± 5 percent from that of a sinusoidal wave being 1.414. The crest factor may be checked by the reading of a crest-reading voltmeter connection in parallel with a regular AC voltmeter (which measures effective or rms values); or, if an electrostatic voltmeter or a voltmeter in connection with an instrument potential transformer is connected across the high voltage circuit, a standard sphere gap may be used for measurement of the crest value and compared with the reading of the AC voltmeter.

5.5.1.2 Circuit Breaker. The test transformer circuit should be protected by an automatic circuit-breaking device designed to open the

Fig. 1
Total Arm Current



circuit promptly by the high current due to breakdown or flashover.

5.5.1.3 Voltage Control. Control of voltage can be secured in one of several ways:

- (1) Induction regulator.
- (2) Variable-ratio autotransformer.
- (3) Generator field regulation.

Preference should be given to equipment producing no voltage distortion and having an approximately straight-line voltage time or voltage displacement curve over the operating range. Motor drive for the regulating equipment is convenient to use and tends to give uniform rate-of-rise to the test voltage.

5.5.1.4 Voltage Measurement. The voltage should be measured by a method which gives correct effective values of the voltage actually applied to the aerial device. Approved methods are:

- (1) A voltmeter used in conjunction with a calibrated instrument potential transformer connected directly across the high-voltage circuit.

- (2) A calibrated electrostatic voltmeter connected directly across the high-voltage circuit.

- (3) A voltmeter connected to a well designed tertiary coil in the test transformer, provided it has been demonstrated that the assigned ratio of transformation does not change appreciably with load.

- (4) A calibrated potential divider (resistive or capacitive).

5.5.1.5 Current Measurement. The current should be measured with an AC ammeter, or an equivalent non-inductive shunt and a voltmeter, connected in series with the specimen. The lead from the specimen to the ammeter shall be shielded.

5.5.2 Test Procedures

5.5.2.1 Test Voltage. Test voltage shall be applied to the upper electrode of the insulated boom at a low voltage and steadily raised until the prescribed test voltage is reached. This voltage shall be maintained for the prescribed test period. The current shall be recorded at the beginning and at the end of the test period.

5.5.3 Tests

5.5.3.1 Insulated Boom Assembly. The assembled aerial device in operable condition shall be tested on a grounded vehicle or a grounded test stand. The voltage shall be applied to the

upper electrode of the insulated boom, and the lower end of the insulated boom shall be connected to ground potential (see 4.11 and Fig. 1, Total Arm Current).

The location of the electrodes shall be permanently marked or recorded to facilitate repeating future tests of the apparatus. Appropriate test voltages shall be applied to the values in Table 1.

With electrodes as described in 4.11, tests shall consist of rated, double rated, and at the manufacturer's option, either momentary withstand or switching surge voltage (see footnote Table 1). The voltage is raised to rated voltage and the current recorded. The voltage is then raised to double-rated voltage and held for three minutes, recording the current at the start and end of the three-minute test period during which the current shall neither increase more than 10 percent nor exceed the values given in Table 1. The switching surge withstand test shall be in accordance with American National Standard Techniques for Dielectric Tests, C68.1-1968, or the latest revision thereof.

5.5.3.2 Manufacturer's Certification Test for Insulated Units Under 69 kV. Units for use under 69 kV do not require permanent electrodes. They shall be tested by insulating the vehicle and connecting it to ground through the current meter. They shall be tested at 100 kV 60 Hz (hertz), for three minutes and the current shall not exceed one milliamperere. This current will be largely capacitive, and, therefore, will not be consistent with values required where permanent electrodes are used. The test equipment and procedures shall conform with all applicable portions of 5.1 through 5.5.3.1.

6. Responsibilities of Manufacturers and Dealers

6.1. Responsibilities of Manufacturers

6.1.1 General Responsibilities. Each manufacturer shall perform all of the duties set forth in this and all other sections of this standard.

6.1.2 Manual. The manufacturer shall publish a manual or manuals and provide for the distribution of the manuals to his dealers and direct sale purchasers, so that purchasers and users will have access to manuals. The manuals shall contain:

- (1) Description, specifications, and capacities of the aerial device.

Table 1
Manufacturer's Certification Test*

| Rated Line Voltage rms kV | 60 Hertz Rated Voltage Test | | 60 Hertz Double- Rated Voltage Test | | 60 Hertz Momentary Withstand Voltage rms kV | Switching Surge Withstand Voltage Crest kV | Permanent Electrodes Required |
|--|--------------------------------|-------------------------------------|--|-------------------------------------|---|--|-------------------------------------|
| | Test Voltage | Boom Current rms Microamps | Test Voltage | Boom Current rms Microamps | | | |
| | rms kV | | rms kV | | | | |
| Below 69 | See 5.5.3.2 | | See 5.5.3.2 | | See 5.5.3.2 | | No |
| 69 | 40 | 40 | 80 | 80 | 120 | 170 | Yes |
| 115-138 | 80 | 80 | 160 | 160 | 240 | 340 | Yes |
| 230 | 133 | 133 | 265 | 265 | 400 | 565 | Yes |
| 345 | 200 | 200 | 400 | 400 | 600 | 850 | Yes |
| 500 | 288 | 288 | 575 | 575 | 720 | 1020 | Yes |

*Test voltages specified for the momentary or switching surge test are based upon a 3.0 per unit switching surge factor through 345 kV and a 2.5 per unit factor for 500 kV. When run the switching surge test shall consist of ten applications of both positive and negative polarity switching surge test waves, with the test waves having a front between 150 and 350 microseconds.

(2) Instructions for installing or mounting the aerial device.

(3) An expression of the operating pressure of any hydraulic or pneumatic system which is part of the aerial device.

(4) Instructions regarding operation and maintenance.

(5) Replacement part information.

6.2 Responsibilities of Dealers

6.2.1 Vehicle Specifications. Each dealer who sells an aerial device shall inform the purchaser of the manufacturer's minimum vehicle specifications.

6.2.2 Manuals. The dealer shall see that the purchaser is provided with copies of manuals required by this standard.

6.2.3 Installations. If the dealer mounts the aerial device, he shall comply with 5.3 of this standard, and he shall also follow the manual instructions relating to installations and truck frame reinforcement.

6.2.4 Assistance to Purchasers. If the dealer is unable to answer a purchaser's question relating to rated capacity, vehicle specifications,

maintenance, repair, inspection, or operation of the aerial device, the dealer shall obtain the proper information from the manufacturer and convey that information to the purchaser.

7. References to the Text

[1] *Crane Load Stability Test Code*. SAE J765-1961. New York: Society of Automotive Engineers, 1961.²

[2] *Standard Qualification Procedure*. AWS B3.0-41. New York: American Welding Society, Inc, 1941.³

[3] *Recommended Practices for Automotive Welding Design*. AWS D8.4-61. New York: American Welding Society, Inc, 1961.³

[4] *Standard Qualification of Welding Procedures and Welders for Piping and Tubing*. AWS D10.9-69. New York: American Welding Society, Inc, 1969.³

²Available from the Society of Automotive Engineers, Two Pennsylvania Plaza, New York, N.Y. 10001.

³Available from the American Welding Society, Inc, United Engineering Center, 345 East 47 Street, New York, N.Y. 10017.



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American National Standards

The standard in this booklet is one of nearly 4,500 standards approved to date by the American National Standards Institute, formerly the USA Standards Institute.

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