



SURFACE VEHICLE STANDARD	J1063™	MAR2026
	Issued	1974-01
	Revised	2026-03
Superseding J1063 JUN2013		
(R) Cantilevered Boom Crane Structures - Method of Test		

RATIONALE

SAE J1063 had not been updated since its last revision in June 2013. Since that time, its equivalent standard for lattice cranes, SAE J987, had undergone an extensive revision, with its most recent version published in November 2019. That revision clarified content and was edited to more closely follow the SAE Standards Development Style Manual. This revision of SAE J1063 harmonizes its content with that of SAE J987, more closely follows the SAE Standards Development Style Manual, and clarifies content for the reader. This revision provides the following changes to the latest published version:

- Added the term “Structures” to the title.
- Edited the document to more closely follow the SAE Standards Development Style Manual.
- Updated the illustration for Figure 1 to more closely represent cranes currently being manufactured.
- Added SAE Standards J1028, J1078, and J1257 to the References section and included contact address, telephone, and email information for SAE International.
- Updated the reference to ASTM E251 to its current title, ASTM E0251-20a.
- Removed the reference to Joseph Marin, “Mechanical Behavior of Engineering Materials,” a publication which is no longer in print or available.
- Moved the position of several figures within the document to create a better flow through the document.
- Changed the title of Section 3 to “Terms and Definitions.”
- Editorial and grammatical changes made to Section 3 for clarity.
- Added definition for “Boom extension system” (see 3.1).
- Added definition for “Boom hoist system” (see 3.2).
- Edited the note in 3.4 to improve clarity.

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- Added definition for “Rated Load (RL)” (see 3.10).
- Added definition for “Rated Radius (RR)” (see 3.11).
- Revised wording of “Live Load Stress Condition” to “Working Load Stress Conditions” (see 3.12).
- Revised wording of “Live Load Stress” to “Working Load Stress” (see 3.13).
- Revised the description in the definition for “Loading” (see 3.17).
- Added definition for “Specified” (see 3.18).
- Reordered Section 3 to account for additional definitions.
- Moved Nomenclature to Appendix A.
- Added Section 4 (“Applications”) to harmonize with wording in SAE J987, which is an equivalent test standard for Lattice Cranes.
- Incorporated the previous Section 5 (“Limitations”) into the new Section 4 (“Applications”).
- Previous Section 6 (“Method of Loading”) became new Section 5 (“Methods of Testing”).
- Editorial and grammatical changes made to Section 5, 5.1, 5.2, and 5.3 for the purpose of clarity.
- Moved Table 1 from its position between previous Section 7 (“Facilities, Apparatus, and Material”) and Section 8 (“Preparations for Test”) to a more appropriate location between new Section 8 (“Test Procedure and Records”) and Section 9 (“Stress Criteria”).
- Editorial changes were made to Section 7 for the purpose of clarity and to harmonize wording with SAE J987.
- Editorial changes and additions were made to Section 8 for the purpose of clarity and to harmonize wording with SAE J987.
- The note in 9.2.1 was removed as this is no longer a necessarily true statement. Advancements in computing and the type of rosette gages now offered make using them in stress concentration areas more common.
- Editorial changes were made to Table 1 for the purpose of clarity. The term “Suspension” was changed to “Boom hoist mechanism.” The term “Extension cylinder” was changed to “Boom extension system.” These updated terms were added to Section 3 (“Definitions”).
- Previous Section 10 (“Stress Evaluation Notes”) was changed to Section 9 (“Stress Criteria”).
- Figure 2 was retraced to improve image clarity.
- Appendix A (“Nomenclature”) was added to harmonize with SAE J987. This information had been in the previous version’s Section 4.
- Appendix B (“Strength of Materials”) was added to harmonize with SAE J987. This information had been in the previous version’s Section 10.
- Figure B1 was retraced to improve image clarity.
- Figure B2 was redrawn to improve image clarity.

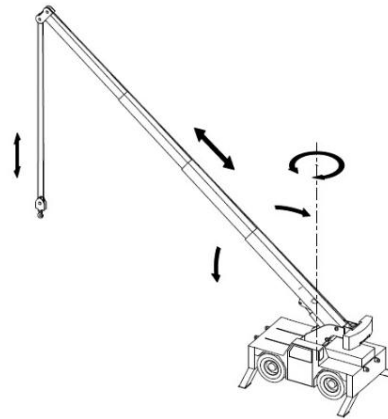
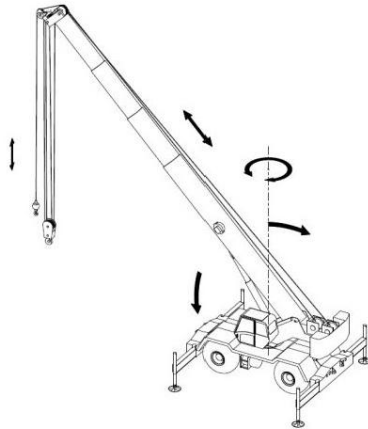
- Appendix C (“Column Buckling Stress”) was added to harmonize with SAE J987. This information had been in the previous version’s Section 10.
- Figure C1 was redrawn to improve the image clarity.
- Figure C2 was retraced to improve image clarity.
- Appendix D (“Test Conditions and Strength Margins”) was added to harmonize with SAE J987. This information had been in the previous version’s Section 12. Editorial changes were made to harmonize with the current wording of SAE J987.
- Appendix E (“Suggested Report Format”) was added to harmonize with SAE J987.
- Figure E1, E2, and E3 were replaced with updated images.
- Appendix E image was added for Figure E4.
- Appendix F was added to clarify the definition of T: “Horizontal distance from the load center to the front pad reaction center for each boom section under consideration.” Figure F1 was added to clarify the description.
- Reference callouts (sections, paragraphs, tables, figures, equations, and appendices) were updated for all sections.

1. SCOPE

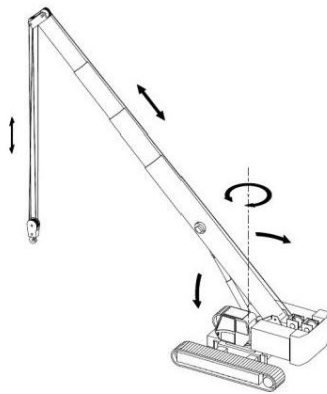
This SAE Standard applies to mobile, construction-type lifting cranes utilizing cantilevered boom crane structures and associated jibs (see Figure 1).

1.1 Purpose

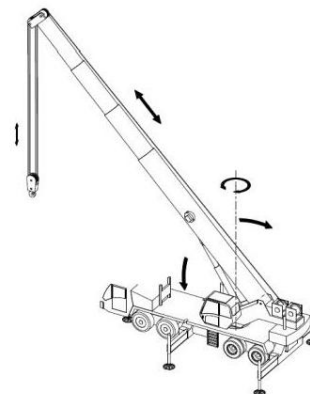
The purpose of this test method is to provide a systematic, nondestructive procedure for determining the stresses induced in cantilevered boom crane structures under specified conditions of static loading through use of resistance-type electric strain gages and to specify appropriate acceptance criteria for specified loading conditions.



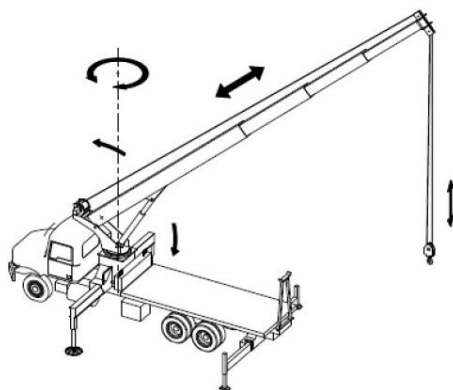
WHEEL MOUNTED CRANES
TELESCOPING BOOM



CRAWLER CRANE
TELESCOPING BOOM



TRUCK CRANE
TELESCOPING BOOM



COMMERCIAL TRUCK-MOUNTED CRANES
TELESCOPING BOOM

The boom may consist of a base boom from which one or more boom extensions are telescoped for additional length. These are some typical configurations.

Figure 1 - Typical construction-type cranes with cantilevered booms



Documents

Document Sharing Hub

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 1-877-606-7323 (U.S. and Canada only) or 1-724-776-4970 (outside U.S. and Canada), www.sae.org.

SAE J1028 Mobile Crane Working Area Definitions

SAE J1078 A Recommended Method of Analytically Determining the Competence of Hydraulic Telescopic Cantilevered Crane Booms

SAE J1257 Rating Chart for Cantilevered Boom Cranes

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9500, www.astm.org.

ASTM E0251-20a Standard Test Methods for Performance Characteristics of Metallic Bonded Resistance Strain Gages

2.1.3 Column Research Council Publications

Available from Column Research Council, Cushing-Malloy, Inc., Ann Arbor, MI 1960.

Guide to Design Criteria for Metal Compression Members

3. TERMS AND DEFINITIONS

For Nomenclature, see Appendix A.

3.1 BOOM EXTENSION SYSTEM

Means of controlling the boom length.

3.2 BOOM HOIST SYSTEM

Means of supporting the boom and controlling the boom angle. Typically, this is done with, but not limited to, a boom hoist cylinder.

3.3 STRAIN (ϵ)

Deformation of material at any given point with respect to a specific plane passing through that point, expressed as change in length per unit length.

3.4 STRESS (S)

The intensity of internal force accompanying strain, expressed in force per unit area. For purposes of this test method, stress is related to measured strain by the uniaxial stress equation:

$$S = E \cdot \varepsilon \text{ (Within the proportional limit)} \quad (\text{Eq. 1})$$

where:

S = stress

E = modulus of elasticity, for the material involved (see Appendix B).

ε = strain

NOTE: The simple uniaxial stress equation can be insufficient for some areas of crane structures under biaxial stress and special consideration should be given in such cases (see Section B.1).

3.5 YIELD POINT (S_y)

The stress at which a disproportionate increase in strain occurs, without a corresponding increase in stress. For purposes of this standard, yield point is to be considered as the minimum yield point or yield strength specified by the appropriate standard or by the manufacturer for the material used.

3.6 CRITICAL BUCKLING STRESS (S_{cr})

The average stress which produces an incipient buckling condition in column-type members (see Appendix C).

3.7 INITIAL REFERENCE TEST CONDITION

The defined no stress or zero stress condition of the crane structure after “break-in” (see 7.3) as established by:

- Supporting the structure on blocking to minimize the effects of gravity; or
- The crane structure components in an unassembled state, or any alternate method that will establish the zero stress condition.

Under this condition, the initial reference reading for each gage is obtained, N_1 .

3.8 DEAD LOAD STRESS CONDITION

The completely assembled crane structure on the test site, in the specified configuration and position, ready to accept or pick up the specified working load at the rated radius. Under this condition, the second reading for each gage is obtained, N_2 .

NOTE: Although the hook, block, slings, etc., are considered part of the suspended load, they may be suspended by the crane when this reading is obtained.

3.9 DEAD LOAD STRESS (S_1)

The stress computed, as defined in 3.4, by using the difference in the readings obtained in 3.8 and 3.7 for each gage, ($N_2 - N_1$).

3.10 RATED LOAD (RL)

The rated load is any load rating as specified by the manufacturer’s applicable capacity chart.

3.11 RATED RADIUS (RR)

The rated radius is any radius as specified by the manufacturer's applicable capacity chart.

3.12 WORKING LOAD STRESS CONDITION

The completely assembled crane structure on the test site, in the specified configuration and position, supporting the specified load. Under this condition, the third reading for each gage is obtained, N_3 .

3.13 WORKING LOAD STRESS (S_2)

The stress computed, as defined by 3.4, by using the difference in the readings obtained in 3.12 and 3.7 for each gage, ($N_3 - N_1$).

3.14 RESULTANT STRESS (S_r)

The maximum stress induced in the structure as a result of dead load stress (S_1) or the working load stress (S_2), whichever is greater in absolute magnitude.

3.15 COLUMN AVERAGE STRESS (S_{ra})

The direct compression stress in a column or the average stress computed from the several gages loaded at the section (see Appendix C).

3.16 COLUMN MAXIMUM STRESS (S_{rm})

The maximum compression stress in a column computed from the plane of buckling, as established from the several gages located at the section (see Appendix C).

3.17 LOADINGS

The application of weights and/or forces of the magnitude specified, under the condition specified.

3.18 SPECIFIED

The stated requirements of the manufacturer, the user, the testing agency, or any agreement between these parties.

4. APPLICATIONS

4.1 This test method is intended to describe the approximate maximum loading conditions to which any component of the entire load-supporting structure of a crane is subjected (see Table 1). In some cases, a more severe loading condition(s) may be indicated by analysis. In these cases, the more severe condition(s) should be added to or substituted for the specified test loading condition(s). It also classifies stress area Types I, II, III, and IV (see 9.1, 9.2, 9.3, and 9.4) and defines limits for each class. Results should be used to correlate boom calculation results for Class III stress areas as given, e.g., by SAE J1078 boom calculation method. Test results for Class I stress areas throughout the structure should be used to check any available calculations. This test method evaluates Class II stress areas for which calculations are seldom available. Class IV stress areas, where disproportionately high stress readings can occur, should be reviewed for better insight by calculation methods.

4.2 This method applies to load-supporting structures as differentiated from power transmitting mechanisms. It is restricted to measuring stresses under static conditions and a general observation after overload conditions. This method does not apply to lift capacity on tires.

4.3 The procedures outlined are intended to supplement basic design analysis.

4.3.1 A production boom system (serially produced) can be rated by the methods outlined in SAE J1078, but a prototype of this system should be subjected to the following test procedures as documentation of its capability.

4.3.2 A production boom system that has been rated by the methods of 4.3.1 may be used on another machine without retesting by the methods specified herein. This can be done only if the same analytical procedure shows its stress levels will be less than in the original application and provided the supporting structure is as rigid as the original mounting. Rigidity of the supporting structure is determined by the change in the slope of the boom foot axis as test loads are applied.

4.3.3 A specially designed boom system (not serially produced) similar to a known and tested design may be rated by the methods of SAE J1078. The applicable overload test conditions specified (see Table 1) should also be applied as proof of competence.

4.4 Personnel competent in the analysis of structures and the use of strain-measuring instruments are required to specify and oversee the testing.

5. METHODS OF TESTING

5.1 Suspended Load

A specified load that is suspended at a specified radius and held stationary, just clear of the ground, while strain readings are recorded.

NOTE: The weight of the hook, block, excess parts of hoisting rope, slings, and rigging shall be included as part of the specified suspended load. The minimum required parts of hoisting rope shall not be considered part of the working load.

5.2 Side Load (SL)

When a test specifies side loading, the force displacing the suspended load should be horizontal and perpendicular to the plane containing the axis of the superstructure rotation and the centerline of the undeflected boom. The side load shall be 3% of the rated load (0.03 RL) in each direction, applied at the load. N3 is recorded for each direction (see 3.12 and the note in 8.4.6).

NOTE: Side loading is applied to simulate the dynamic effects associated with machine operation including a 9 m/s (20 mph) wind loading.

5.3 Deadman Load

A specified load that is applied against an anchor affixed to the ground or another stable structure, rather than a freely suspended load, while strain readings are recorded. Deadman loading may be used, but caution shall be exercised to assure accurate simulation of working load stress condition testing. Because positioning with this system is difficult, deadman loading is not acceptable for tests from Table 1 which require side load.

6. FACILITIES, APPARATUS, AND MATERIAL

6.1 A concrete or other firm supporting surface, sufficiently large enough to provide for unobstructed accomplishment of the tests required.

6.2 Means to measure levelness of the crane; accuracy 0.1% of grade.

6.3 Means for determining the rated radius to an accuracy of $\pm 1\%$ not to exceed 0.15 m (6 inches).

- 6.4 Means for producing transverse displacement of the suspended load and means for measuring the magnitude of the displacing force; accuracy $\pm 3\%$ of measured force.
- 6.5 Temperature compensated strain gages conforming to ASTM E0251-20a, cement, waterproofing compounds, and other necessary gage installation equipment.

Strain indicating or recording instruments. It is the intent that commercially available, high quality, reliable instruments be used in the performance of this test. Accuracy of the indicating instrument or the recording system shall be determined to be $\pm 2\%$ over the range of 0 to 3000 μ (m/m) (in/in) strain (determined in suitable increments). Calibration may be accomplished by electrical shunts or by pre-calibrated strain bar.

- 6.6 Test weights and lifting apparatus of known weights accurate to within $\pm 1\%$.

7. PREPARATIONS FOR TEST

- 7.1 Perform a structural analysis. An analysis of each structure sufficient to locate highly stressed areas shall be made. These areas can include uniformly high-stressed areas, stress concentration areas, column buckling areas, and local plate buckling areas (see 9.1 to 9.4). The strain gage location and direction shall be determined from this analysis, as well as from the use of other experimental or computer aided techniques where necessary.
- 7.2 Perform a detailed inspection of crane to ensure that all mechanical adjustments and condition of load-supporting components conform to manufacturer's published recommendations. Check that the crane is equipped in compliance with the test specification.
- 7.3 A previously unworked crane should be given a "break-in" run at or near the anticipated test loadings to mechanically relieve residual stresses that developed during manufacturing and to minimize the possibility of "gage zero shift" during the test.
- 7.4 Configure the crane structure to a state required for inspection and strain gage installation. A thorough inspection after the "break-in" run can reveal areas of high stress, which have exceeded yield, as evidenced by paint checking, scale flaking, or other indications of permanent deformation not revealed by prior analysis (see 7.1).
- 7.5 Bond strain gages at points determined by prior analysis (see 7.1) and any areas selected as a result of the inspection conducted in 7.4. Only competent personnel using the strain gage manufacturer's recommended materials, tools, and practices should be employed to ensure that gages are of the correct type, properly oriented, and securely bonded to measure strains correctly.
- 7.6 Determine minimum yield strength and the modulus of elasticity for the material at each gage location by referring to the material certifications, if available, applicable standards, or Appendix B. Determine critical buckling stress where applicable (see Appendix C). Record these values on the test data summary sheet (see Appendix E).

8. TEST PROCEDURES AND RECORDS

8.1 Final Test Preparation

- 8.1.1 Use the crane's specified rating charts as outlined in SAE J1257 to prepare a procedure based upon the applicable cantilever boom crane tests (see Table 1).
- 8.1.2 Service and adjust the crane to assure specified conditions of lubrication; fuel supply, coolant supply, tire inflation; track tension; bolts, pins, rope fittings, and other load-bearing components; clutches, brakes, and other power-transmission components. At all times during testing, the crane shall be set up and operated in conformance with the manufacturers' specifications.