



SURFACE VEHICLE INFORMATION REPORT

J1366™

JUL2024

Issued 1994-10
Reaffirmed 2017-10
Stabilized 2024-07

Superseding J1366 OCT2017

Rating Lift Cranes Operating on Platforms in the Ocean Environment

RATIONALE

Standard is not in active use in the industry. Information is still valid and other standards were based off of this one.

STABILIZED NOTICE

This document has been declared "STABILIZED" by SAE Cranes and Lifting Devices Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2024 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, or used for text and data mining, AI training, or similar technologies, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE J1366_202407

For more information on this standard, visit
https://www.sae.org/standards/content/J1366_202407/

Documents

Standard, visit Sharing Hub

1. Scope—The scope of this SAE Information Report is limited to a lift crane mounted on a fixed or floating platform, lifting loads from a vessel alongside. The size of the vessel is assumed not to exceed that of a workboat as defined in 3.15.

1.1 Purpose—The purpose of this document is to establish the design dynamic loads, the calculation procedures for rated loads, and a load-rating chart format for lift cranes operating in a variety of sea conditions.

2. References

2.1 Applicable Publications—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, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J959—Lifting Crane, Wire-Rope Strength Factors

SAE J987—Rope Supported Lattice-Type Boom Crane Structures—Method of Test

SAE J1093—Latticed Crane Boom Systems—Analytical Procedure

2.1.2 OTHER PUBLICATIONS

1. American Institute of Steel Construction, Inc. (AISC), "Manual of Steel Construction," Eighth Edition (or more current), Chicago, IL, 1980
2. American Petroleum Institute (API) 2C 1988 Standard
3. J. J. Meyers, C. H. Holm, and R. F. McAllister, "Handbook of Ocean and Underwater Engineering," McGraw-Hill Book Company, 1969
4. J. S. Bendat and A. G. Piersol, Random Data: "Analysis and Measurement Procedures," New York, NY, John Wiley and Sons, Inc., 1971
5. M. S. Lonjuet-Higgins, "On the Statistical Distribution of the Heights of Sea Waves," Journal of Marine Research, Vol. II, No. 3, 1952, pp. 245–266
6. W. J. Pierson, Jr., G. Newman, and R. W. James, "Practical Methods for Observing and Forecasting Ocean Waves by Means of Wave Spectra and Statistics," U.S. Navy Hydrographic Office Publication Number 603, Washington, DC, 1955, Reprinted 1960 and 1967
7. J. M. Gere and W. Weaver, Jr., "Analysis of Framed Structure," New York, NY, Van Nostrand Reinhold Company, 1965

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

1. Civil Engineering Laboratory, Technical Memorandum M-51-76-11: "Dynamic Vertical Forces on a Crane Loading (Unloading) a Floating Platform," by C. C. Ward, Port Hueneme, CA, Sept. 1976
2. K. V. Johnson, "Theoretical Overload Factor Effect of Sea State on Marine Cranes," Paper presented at Offshore Technology Conference, 1976 (Paper No. OTC 2584)
3. Civil Engineering Laboratory, Technical Note N-1371: "The Motion of Floating Advanced Base Components in Shoal Water—A Comparison Between Theory and Field Test Data," by D. A. Davis and H. S. Zwibel, Port Hueneme, CA, Jan. 1985
4. V. L. Streeter, "Fluid Mechanics," McGraw-Hill Book Co., 1966
5. T. C. Gillmer, "Fundamentals of Construction and Stability of Naval Ships," United States Naval Institute, 1969

3. Definitions

3.1 Significant Value—The average of the highest one-third of given population values. Population values may refer to wave height, roll, pitch, or yaw angles, etc. The significant value is twice the standard deviation, assuming a zero mean time history.

3.2 Sea State—An indicator relating the height of the waves to sea conditions in relative terms.

3.3 Wave Instrument Reading—Used on the load rating chart indicates the value obtained from a wave buoy or a wave staff that relates to the sea conditions. The wave instrument reading can be analyzed to form the ratio of the average wave height to the average period ($H/\bar{T}$).

3.4 Wave Height—The vertical distance from wave crest to trough.

3.5 Surge—The single amplitude (SA) fore and aft ship motion along the longitudinal axis through the center of gravity (see Figure 1).

3.6 Sway—The SA athwart ship motion along the transverse axis through the center of gravity (see Figure 1).

3.7 Heave—The SA vertical ship motion along the vertical axis through the center of gravity (see Figure 1).

3.8 Roll—The SA angular ship motion about the longitudinal axis through the center of gravity (see Figure 1).

3.9 Pitch—The SA angular ship motion about the transverse axis through the center of gravity (see Figure 1).

3.10 Yaw—The SA angular ship motion about the vertical axis through the center of gravity (see Figure 1).

3.11 Offlead—The percent slope from the vertical in the vertical plane of the boom that locates the position of the load with respect to the tip of the boom.

3.12 Sidelead—The percent slope from the vertical normal to the vertical plane of the boom that locates the position of the load with respect to the tip of the boom.

3.13 Dynamic Rated Load (W_D)—The maximum load that can be lifted under specified dynamic conditions without exceeding allowable strength limits.

3.14 Static Rated Load (W_S)—75% of the maximum load that can be lifted under normal land conditions without exceeding allowable strength limits.

3.15 A Typical Workboad—A vessel of 180-ft length, 40-ft beam, and 1500-long-ton displacement.

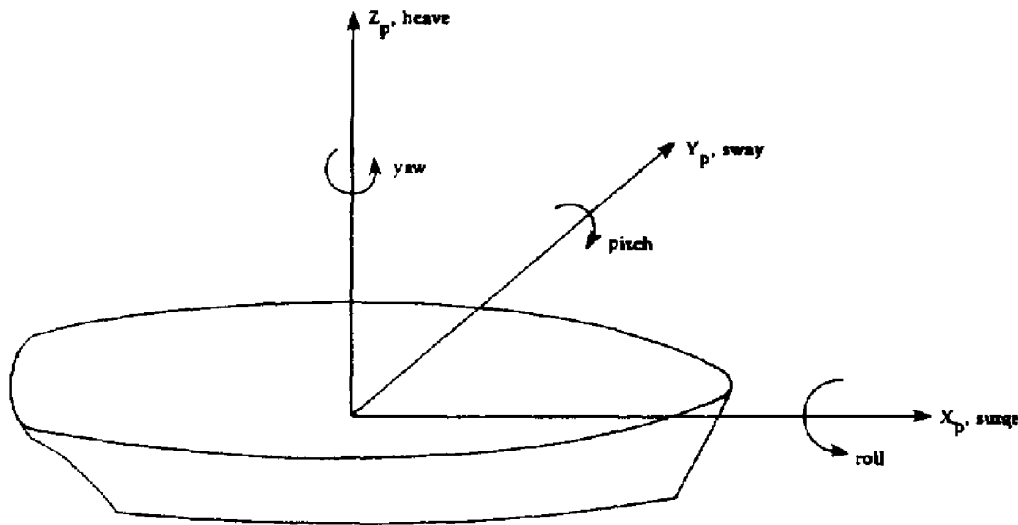


FIGURE 1—PLATFORM MOTION COORDINATE SYSTEM

- 3.16 List**—The angle of inclination of ship about the longitudinal axis through the center of gravity.
- 3.17 Trim**—The angle of inclination of ship about the transverse axis through the center of gravity.
- 3.18 Load Hoist Line Velocity**—The full load hoist speed at the drum based on the maximum rated load for the specified rope.
- 4. Applications**—This document establishes a method of arriving at standard dynamic loads presumed to act on a crane operating in various specified sea conditions. The load factors are used to determine dynamic rated loads for the crane when operating in the specified sea conditions. The dynamic loads specified were arrived at by consultations between crane manufacturers, users, and Navy personnel on the interaction between environmental effects and ship motions.
- 4.1 Crane Manufacturer's Responsibility**—To calculate the static- and dynamic-rated capacity of the crane for the standard specified sea conditions and to publish the rating chart.
- 4.2 User's Responsibility**—To determine sea condition existing when lift work is to be performed so that the proper rated-load column can be selected. The sea condition may be determined by consultation with on-site expert personnel such as ship captain, lift-work superintendent, etc. The appropriate rating thus determined should be relayed to the crane operator and stay in effect until similarly revised.
- 4.3 Customer's Responsibility**—Provide the crane manufacturer with the required response-amplitude operators for the crane supporting vessel. The heave, roll, and pitch response-amplitude operators for a 135 degree incident wave shall be provided for the desired operating water depth.

The response-amplitude operators are complex numbers in polar form for each wave frequency to be considered. They are expressed in terms of the modulus (feet/foot or radius/foot) and amplitude (radians). Additionally, the customer shall specify the location of the crane on the deck of the supporting vessel and the height of the deck above the water. The customer shall also provide the necessary crane parameters such as the desired boom length and number of parts of load hoist line. The customer-supplied information will be used as input for the rating software described in Appendix A.

4.4 Special Considerations Affecting Application

- 4.4.1 Ballasting systems capable of reducing load-induced platform motion throughout the crane operating procedure(s) are to be considered in determination of list and trim loading on the crane (Appendix B).
- 4.4.2 A mooring system of anchor winches capable of adequately limiting platform response to wave action is to be considered in determination of platform motion response factors.
- 4.4.3 A heave-compensating device used in the load-hoist system may allow an increase in the dynamic rated load. The amount of reduction should be based on the crane manufacturer's interpretation of performance test data.
- 4.4.4 For loads lifted from a platform on which a crane is mounted, V_D , A_D , and V_{BP} in Equation 2 are assumed zero, and the picking peak dynamic load is greatly reduced. A rated load greater than the static rated load as defined in 6.3 shall not be used.
- 4.4.5 After the crane lifts the load, the load rating should consider boom point acceleration and load pendulation effects (see Section 9).

5. **Dynamic Load**—The dynamic load being addressed is imposed on the crane at the time of load liftoff from the moving deck of the vessel alongside. Additionally, consideration is directed to the effects of the horizontal displacement in the plane of the boom and normal to the plane of the boom caused by surge and sway of the vessel.

After studying the motions of a workboat, it is assumed that the vertical motion follows wave amplitude and that horizontal motions include sway, surge, and yaw, but exclude drift.

The vertical dynamic load, P (lb), that occurs when the lifted load, W (lb), is directly under the boom tip is given by the equation:

$$\bar{P} = W \left\{ 1 + \left[\frac{K}{gW} (V_D + V_H)^2 + \left(\frac{A_D}{g} \right)^2 \right]^{1/2} \right\} \quad (\text{Eq. 1})$$

where:

g = acceleration due to gravity (ft/s²)

K = vertical structural stiffness component with the load force at appropriate offlead (lb/ft)

V_D = vertical velocity of the workboat deck at the pick point (ft/s)

V_H = velocity of the load hook which includes the load hoist line velocity, parts of line, and the boom point velocity V_{BP} (ft/s)

A_D = acceleration of the workboat deck at the pick point (ft/s²)

Since Equation 1 is a quadratic equation in terms of W , Equation 1 may be solved for W and called W_D :

$$\frac{1}{W_D} = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A} \quad (\text{Eq. 2})$$

where:

$$\begin{aligned} A &= P_{\max}^2 \\ B &= -2P_{\max} - \frac{K(V_D + V_H)^2}{g} \\ C &= 1 - \left(\frac{A_D}{g}\right)^2 \end{aligned} \quad (\text{Eq. 3})$$

Wave heights and periods, V_D , A_D , and V_{BP} are calculated considering the sea spectrum, ship motion response to the spectrum sea, and boom point position. The values for V_D , A_D , and V_{BP} selected for rating purposes, are 90% probability of occurrence values (see Appendix A). The crane is assumed to be in a rating position as shown in Figure 2. Implicit in Equation 2 are the dynamic effects of picking peak dynamic load as well as sidelead and offlead effects.

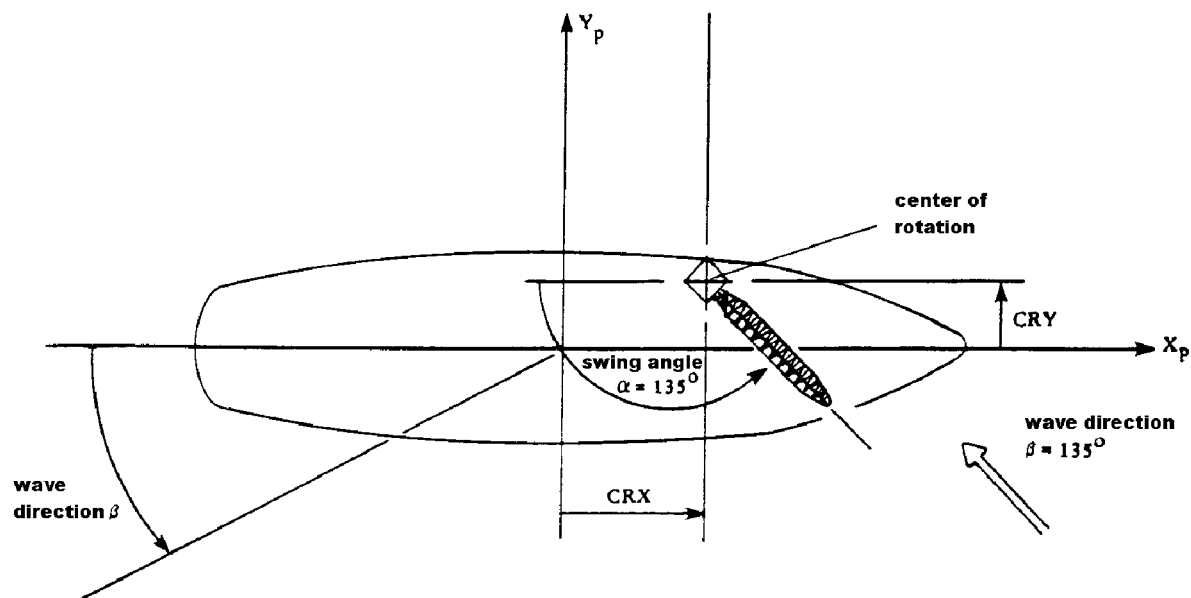


FIGURE 2—STANDARD CRANE RATING CONDITIONS: CRANE ORIENTATION AND SEA DIRECTION

See Table 1 for sidelead and offlead values. Equation 2 is to be used to calculate a series of values for W_D corresponding to values of $\bar{H}/\bar{T}$, such as those listed in Figure 3.

TABLE 1—PERCENT OFFLEAD AND SIDELEAD⁽¹⁾

	Beaufort Wind Height	Significant Wave Height $H_{1/3}$ (ft)	Wave Average Period T (s)	Average Wave Length λ (ft)	Wave Instrument ⁽²⁾ Reading, $\bar{H}/\bar{T}$ (ft/s)	Offlead (%)	Sidelead (%)
Static	—	—	—	—	0	0	2.7
Dynamic	3	1.0	2.4	20.0	0.26	6	3
	4	2.9	3.9	52.0	0.46	8	4
	5	6.9	5.4	99.0	0.79	12	6
	6	13.0	7.0	164.0	1.15	16	8
	7	23.0	8.7	258.0	1.64	22	11

1. Alternatively,

$$\% \text{ offlead or sidelead} = \frac{(180 \text{ ft})(\% \text{ indicated})}{\text{boom tip height above boat deck}}$$

Minimum sidelead not to be less than 2.7% of static load W_s .

2. Readings taken at the center of the Beaufort Wind Force range (table 11-10, Reference 1).

Manufacturer _____

Crane Model _____ Serial Number _____ Boom Length _____

Crane Supporting Platform _____

Distance From Platform Deck to Sea Level _____

Crane Location: _____ Distance From Stern to Center of Rotation _____

Distance From Port Side to Center of Rotation _____

Distance From Platform Deck to Boom Foot _____

[Hoist Line: 7/8 6x25 IWRC - EIPS]

Radius (ft)	Boom Angle (deg)	Static Rating (lb)	Dynamic Ratings at Following Instrument Readings, $\bar{H}/\bar{T}$ (ft/s) 0.26	Dynamic Ratings at Following Instrument Readings, $\bar{H}/\bar{T}$ (ft/s) 0.46	Dynamic Ratings at Following Instrument Readings, $\bar{H}/\bar{T}$ (ft/s) 0.79	Dynamic Ratings at Following Instrument Readings, $\bar{H}/\bar{T}$ (ft/s) 1.15	Dynamic Ratings at Following Instrument Readings, $\bar{H}/\bar{T}$ (ft/s) 1.64
Four-Part Main Hoist Line							
25	78.5	90 000	72 000	56 000	42 900	30 500	
30	75.6	90 000	69 000	56 000	42 900	30 500	
40	69.6	90 000	67 900	56 000	41 900	30 500	
50	63.3	82 000	56 300	46 900	34 700	25 400	
One-Part Whip Hoist Line							
25	80.1	22 700	18 900	16 900	16 300	13 900	11 500
30	76.1	22 700	18 900	16 900	16 300	13 900	11 500
40	70.3	22 700	18 900	16 900	16 200	13 900	11 500
50	64.0	22 700	18 400	16 500	15 800	13 400	11 000

FIGURE 3—MARINE CRANE RATING CHART FOR FLOATING PLATFORM