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**(R) Rated Capacity System**

1. **Scope**—This SAE Standard applies to cranes when used in lifting service that are equipped with Rated Capacity Systems.

1.1 **Purpose**—The purpose of this document is to establish the minimum performance and tolerance criteria of systems used to warn or to indicate to the operator and/or other responsible persons when the load being lifted approaches, meets and exceeds the rated capacity on the applicable rated capacity chart of the crane.

2. **References**

2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein.

2.1.1 NEMA PUBLICATION—Available from the National Electrical Manufacturers Association, www.NEMA.org, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209.

NEMA-12 (U.S. Code)

2.1.2 IP (INTERNATIONAL ELECTROTECHNICAL COMMISSION) PUBLICATION—Available from American National Standards Institute (ANSI), Customers Service, 25 West 43rd Street, 4th floor, New York, NY 10036-8002. TP: +1 212 642 4900 TF: +1 212 398 0023 email: info@ansi.org URL: webstore.ansi.org.

IP-65 (International Protection Code - IEC 144/855420)

3. **Definitions**

3.1 **Rated Capacity Indicator (RCI)**—A system consisting of devices, when applied to a crane, sense crane loading, boom length (telescopic only), boom angle, and which automatically provide an audible/visual signal when the Actual Load approaches, reaches and/or exceeds the Rated Capacity value.

3.2 **Rated Capacity Limiter (RCL)**—A system consisting of devices which, when applied to a crane, sense crane loading, boom length (telescopic only), boom angle, and which automatically provide an audible/visual signal when the loading conditions approach, reach and/or exceed the rated capacity values. When the Actual Load exceeds the Rated Capacity, the system supplies a signal to a function kick-out system.

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- 3.3 Function Kick-Out System (FKO)**—A device which when activated prevents the loading on the crane to be increased beyond the point at which the FKO occurred.
- 3.4 Crane Configuration**—The physical arrangement of the crane as prepared for the particular operation in conformance with the manufacturers operating instructions and Rated Capacity Chart.
- 3.5 Actual Load**—The weight of the load being lifted including all additional equipment such as wire rope, blocks, slings, etc. as defined by the manufacturers Rated Capacity Chart.
- 3.6 Rated Capacity**—The value shown on the applicable Rated Capacity Chart of the crane for the particular configuration, boom length, angle and/or function of these variables. For radii and/or angles outside those shown on the Rated Capacity Chart, the rated capacity is considered to be zero.
- 3.7 Boom Length**—The straight line through the center line of the boom pivot pin to the centerline of the boom point hoist sheave pin, measured along the longitudinal axis of the boom.
- 3.8 Boom Angle**—The angle between the longitudinal centerline of the boom base section and the horizontal plane.
- 3.9 Radius of Load**—The horizontal distance from a vertical projection of the crane's axis of rotation to the supporting surface, before loading, to the center line of the vertical hoist line(s) or tackle with the load applied.
- 4. Performance Tolerance Criteria**
- 4.1 Warning and Limit Signals**—Visual and/or audible signals shall have the visual signal clearly visible to the operator under any normal operating conditions, and the audible signal shall be sufficiently loud to be heard over engine and machinery noise, and shall be clearly distinguishable from ambient noise.
- 4.1.1 **WARNING SIGNAL - APPROACH TO OVERLOAD**—An audible and visual signal (preferably a yellow light) is to be activated at  $92\% \pm 5\%$  of Rated Capacity. The signal shall continue to function as long as the load, radius or angle parameters exceed the  $92\% \pm 5\%$  values. Also, the warning signal shall be clearly distinguishable from the overload signal.
- 4.1.2 **OVERLOAD AND LIMIT SIGNAL**—An Audible and Visual signal (preferably a red light) is to be activated at no more than 105% of Rated Capacity and also when the radius or angle shall fall outside of the crane's Rated Capacity Chart. Also, when a Rated Capacity Limiter is employed to actuate an optional crane control Function Kick-Out System (FKO), the FKO is to be activated at no more than 105% of Rated Capacity. These signals shall continue to function as long as the load, radius, and angle parameters are exceeded.
- 4.2 Additional Functions**—When actual load, rated capacity, radius, boom angle or boom length are displayed as additional functions of a Rated Capacity System the displayed function is to conform to the following provided that the system accuracy always conforms to 4.1.1 and 4.1.2.
- 4.2.1 **ACTUAL LOAD**—When Actual Load is displayed as an additional function of a Rated Capacity System its accuracy shall be such that the indicated load is  $100\% +10\% -0\%$  of the Actual Load.
- 4.2.2 **RADIUS**—When Radius is displayed as an additional function of a Rated Capacity System its accuracy is to be such that the indicated radius is  $100\% +10\% -0\%$  of the Actual Load Radius.
- 4.2.3 **BOOM LENGTH**—When boom length is displayed as an additional function of a Rated Capacity System its accuracy is to be such that the indicated length is  $100\% \pm 2\%$  of the actual length.

- 4.2.4 **BOOM ANGLE**—When Boom Angle is displayed as an additional function of a Rated Capacity System its accuracy shall be as follows: For boom angles 65 degrees or higher the indicated angle is to be neither greater than the actual boom angle nor more than 2 degrees less than the actual boom angle. For boom angles less than 65 degrees the indicated angle is to be neither greater than the actual boom angle nor more than 3 degrees less than the actual boom angle.
- 4.2.5 **RATED CAPACITY**—Where rated capacity is displayed as an additional function of a Rated Capacity System the capacity displayed shall be the capacity determined from the applicable capacity chart of the crane  $\pm 200$  lb.

**Where the system cannot meet the preceding accuracy criteria, conspicuous labeling or signaling is to be provided indicating that this accuracy cannot be met.**

## 5. **System Mechanical Requirements**

- 5.1 **Shock and Vibration**—The RCI/RCL system shall be able to withstand the shock and vibration of the machine under normal operating conditions while maintaining specified accuracy.
- 5.2 **Protection**—RCI/RCL components directly exposed to the elements (installed externally on the machine) shall be protected to a minimum level of NEMA-12 (U.S. code) or IP-65 (International Protection Code - IEC 144/855420). Components that are installed within manufacturer's machine enclosure shall be protected to manufacturer's specifications.
- 5.3 **Temperature Effect**—Specified accuracy is to be maintained over ambient temperature variations of  $-30$  °C to  $+50$  °C ( $-22$  °F to  $+122$  °F) without external adjustment.
- 5.4 **RFI/EMI**—The RCI/RCL system shall be sufficiently protected against Radio Frequency Interference and Electro-Magnetic Interference under normal (design) operating conditions of the machine.
- 5.5 **Strength Margin**—When any part of the RCI/RCL system is employed in the load supporting system so that its failure could cause the load to be dropped, its strength margin is to be not less than the minimum strength margin of the other load supporting members.
- 5.6 **Operation Check**—The system is to include a means for the operator or other responsible persons to determine that it is operative prior to crane use.
- 5.7 **Testing**—The system is to be performance tested by the installer initially and by the user at intervals recommended by the manufacturer(s), or at any time there is an indication of inaccuracy.

## 6. **General Requirements**

- 6.1 **Installation and Maintenance**—Installation and maintenance of the rated capacity device and maintenance of the crane are to be in accordance with the appropriate manufacturer's recommendations to attain system accuracy.
- 6.2 **Identification**—Labels are to be conspicuously placed on a system component(s), in the operator's cab, and/or displayed on the RCI/RCL giving the following information:
- Identification of applicable load rating chart and rating conditions.
  - Units of measure as applicable.
  - Basic operating instructions and precautions, including recommended intervals for performance testing.
  - Device manufacturer's name, address, device model number and serial number of the RCI/RCL.

**6.3 Manual**—Manual(s) containing installation, operation, test, and service information is (are) to be provided by the manufacturer and shall be available to the operator or to other responsible persons at all times unless the manuals are supplied by the crane manufacturer.

## **7. Performance Evaluation Tests**

**7.1 General Testing Requirements**—Test Personnel are to be familiar with the system operation and the manufacturer's recommended test procedures, and to test the system for all functions.

7.1.1 System tests are to be conducted using appropriately configured crane and specified load rating chart.

7.1.2 For system calibration, or calibration verification, two or more test loads are to be employed for each of the following configurations to establish compliance with 4.1 and 4.2 (unless otherwise specified by the Crane Manufacturer or the Rated Capacity System manufacturer):

- a. Maximum Boom Length and Maximum Radius (Min. Angle).
- b. Maximum Boom Length and Minimum Radius (Max. Angle).
- c. Minimum Boom Length and Maximum Radius (Min. Angle).
- d. Minimum Boom Length and Minimum Radius (Max. Angle) unless the test weight restricts safe operation in this area, then the test shall be made at the minimum safe operating radius.

7.1.3 For periodic calibration checks, two or more test loads are to be employed to activate the alarms.

7.1.4 **TEST DATA**—Test forms are to include, but not be limited to, the following information:

- a. Owner(s)
- b. Crane manufacturer, model, and serial number.
- c. Device manufacturer, model, and serial number.
- d. Crane configuration at time of test, method of test load application, location of load sensor, radius/angle sensor, and test readings.
- e. A statement that the system met (did not meet) the performance criteria of 4.1 and 4.2 or that recalibration was necessary in order to achieve the required accuracy. The system accuracy calibration is to be part of such report.

7.1.5 All test records are to be signed and dated. A copy of the current test record is to be available to the operator upon request.

**7.2 Test Procedures**—The following test procedure or equivalent is to be used:

### **7.2.1 KNOWN WEIGHT**

- a. Test load to be applied by suspending known weights accurate to  $\pm 1\%$ . If the weights of additional equipment such as blocks, slings, sensors, etc., are included in the test load, the total load is to be known to an accuracy of  $\pm 1\%$ . Starting with the load at short radius (load within rating) lift load and increase radius slowly until the limit signal is activated. Measure and record radius. Two or more readings are to be taken with each test load. Similarly, check the warning signal.
- b. Determine the system accuracy in accordance with 7.3.