SAE INTERNATIONAL

SURFACE VEHICLE RECOMMENDED PRACTICE

J820™ MAR2025

Issued 1962-04
Reaffirmed 1998-07
Revised 2025-03

Superseding J820 JUN2017

Crane Hoist Line Speed and Power test Procedure

RATIONALE

To review and update the technical requirements to reflect newer drive technologies and to add SI units along with various editorial revisions.

1. SCOPE

This document applies primarily to mobile cranes that lift loads by means of a drum and hoist line mechanism. It can be used to determine the hoist line speed and power of other hoist line mechanisms if the load can be held constant and hoist line travel distance is sufficient for the accuracy of the line speed measurements prescribed. This recommended practice applies to all mechanical, hydraulic, and electric powered hoist mechanisms.

1.1 Object

The object of this test is to determine the hoist line speed that a mobile crane develops while hoisting a specified load with a specified condition of rope layers on the drum. The specified load and the hoist line speed values are used to calculate the hoist line power.

2. REFERENCES

There are no referenced publications specified herein.

3. DEFINITIONS

3.1 SPECIFIED

Recommendations or requirements stated by the manufacturer, the user, the testing agency, or any agreement between these parties.

3.2 HOIST LINE

A wire or synthetic rope or similar line that operates in conjunction with sheaves and a drum for the purpose of lifting and supporting loads.

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3.3 HOIST LINE POWER

A rate of doing work, derived by mathematically correlating measured values of time, distance, and force; normally expressed as kilowatts, horsepower, or torque per unit time.

3.4 LOAD

The mass in kilograms or pounds of the hook block and other items suspended from the hook block, as arranged to make up the specified load weight.

4. LIMITATIONS

4.1 For the test conditions, do not exceed the manufacturer's maximum rated loads. The maximum rated loads are frequently based on structure or stability limitations.

4.2 For hoist mechanisms that are powered by hydraulic systems, the system pressures, flows, and temperatures will affect the performance of the hoisting mechanism and need to be checked and confirmed to be operating within the manufacturer's specifications.

4.3 For hoist mechanisms that are powered by electrical systems, the electric current and voltage available to operate the hoisting mechanism will be affected by battery state of charge and temperature, electrical supply capacity, and the state of the electrical control system.

5. TOOLS AND EQUIPMENT REQUIRED

5.1 Tachometer of range suitable to indicate engine speed; accuracy ±1% of revolutions per minute measured.

5.2 Means for weighing test weights, hook block, slings, and other load components; accuracy ±0.5% of the weight measured.

5.3 Test weights or other loading means as required to make up the specified load within ±0.5% of the total weight specified.

5.4 Means to measure and record:

a. Line travel distance; accuracy ±1% of measured value

b. Line travel time; accuracy ±1% of measured value

c. Load line force; accuracy ±2% of values recorded throughout range of values measured

6. PROCEDURE

6.1 Service and adjust the machine to be tested in accordance with the manufacturer's instructions.

6.2 Operate the machine under partial load to ensure operator proficiency and proper machine function. New machines should be operated for a minimum of 4 hours to ensure proper function. Inspect, adjust, and service the machine as specified by the manufacturer at the conclusion of the initial operation. Inspect and maintain adjustments after the machine is operated to assure that the engine, clutches, brakes, and other power-transmitting components remain within the manufacturer's recommended tolerances.

6.3 Assemble a test load as specified.

6.4 Arrange the hoisting tackle on the machine in accordance with the manufacturer's instructions using the minimum parts of hoist line necessary to assure safe and smooth operation while hoisting the specified load.

NOTE: It is desirable to use a single part line in order to reduce tackle friction; however, safety and load travel distance may dictate need for multiple part lines.

6.5 Attach the specified load to the hoist line and install line speed and force sensing and recording instruments.

6.6 Perform sufficient trial runs of hoisting the specified load to assure that:

a. The machine operator is familiar with the procedures for operation.

b. The machine is warmed up to normal operating temperatures.

c. The instruments are functioning properly.

d. The rope stays on the same layer on the drum throughout the duration of the test.

6.7 For engine powered machines, the engine is to run at full throttle. For battery powered machines, the batteries need to be at least 80% of full charge. And for externally powered machines, full supply power should be available. Smoothly engage the hoist and lift the load. While the load is being lifted, measure and record:

a. Hoisting force

b. Hoist line travel distance

c. Time

Repeat this operation to obtain a total of five recorded runs.

7. COMPUTATIONS AND RECORDS

7.1 For each test run, record the average line force and line distance using only that portion of the records where the recorded hoisting force remains constant within ±2% of average on the test summary sheet (see Figure 1).

7.2 Calculate the average hoist line speed and record it on the test summary sheet (see Figure 1).

7.3 Calculate the hoist line power in kilowatts or horsepower for each recorded run as shown in Equation 1:

$$KW = \frac{LS}{1000\,P} \quad \text{OR} \quad HP = \frac{LS}{550\,P} \qquad \text{(Eq. 1)}$$

where:

L = load: newtons or pounds

S = line speed: meters per second or feet per second

P = number of parts in the hoist line

Record these values on the test summary sheet (see Figure 1).

7.4 Calculate the average hoist line power for all recorded runs and record this value on the test summary sheet.

7.5 If the power of any individual run deviates more than ±2% from the arithmetic mean for all the runs, the test should be rerun.

HOIST LINE SPEED AND POWER
TEST SUMMARY

PLACE OF TEST: DATE:

CRANE MANUFACTRUE AND MODEL:
SERIAL NUMBER:

WINCH MANUFACTURE AND MODEL:
SERIAL NUMBER:

WINCH MOTOR MANUFACTRUE AND MODEL:
SERIAL NUMBER:

ENGINE MANUFACTURE AND MODEL:
SERIAL NUMBER:
RPM DURING TEST: RATED RPM:

PUMP MANUFACTURE AND MODEL:
SERIAL NUMBER:

TYPE OF DRUM: DRUM DIA. ROPE DIA.

NUMBER OF ROPE LAYERS USED FOR TEST:

RIGGED FOR HOIST LINE PARTS BOOM LENGTH:

TEST NO.	LOAD	AVERAGE LINE FORCE	LINE DISTANCE	AVERAGE LINE SPEED	POWER	POWER DEVIATION FROM AVERAGE
1						
2						
3						
4						
5						
AVERAGE						

REMARKS:

TEST ENGINEER

Figure 1 - Test data summary sheet