Omaha Public Power District

1623 HARNEY ■ OMAHA, NEBRASKA 68102 ■ TELEPHONE 536-4000 AREA CODE 402

May 21, 1982
LIC-82-208

Mr. Robert A. Clark, Chief
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Branch No. 3
Washington, D.C. 20555

Reference: Docket No. 50-285

Dear Mr. Clark:

Adequacy of the Fort Calhoun Station
Electrical Distribution System Voltages

The Omaha Public Power District's letter dated March 19, 1982 transmitted the District's response to the Commission's February 11, 1982 letter regarding the subject undervoltage protection issue. To complete the undervoltage analysis for the Fort Calhoun Station's Class 1E engineered safeguards motors, the District stated in the March 19, 1982 letter that an evaluation of the plant's present undervoltage relay trip setpoints would be conducted and the speed-torque/current curves for the engineered safeguards pumps-motors would be provided to the Commission upon receipt from the District's vendors. To date, the District has only received the subject curves for the component cooling water (CCW) pumps/motors. The discussion below demonstrates that the CCW pumps/motors can successfully operate during transient conditions, without subsequent damage. The discussion also demonstrates that the CCW pumps/motors will operate satisfactorily at the present settings for the undervoltage relay setpoints. Based on the schedule provided by the District's vendors, the District expects to provide the Commission with the remaining speed-torque/current curves for the raw water pumps, charging pumps, and containment ventilation fans by October 1, 1982. The District will similarly evaluate the present undervoltage relay setpoints based upon the operating characteristics for these pumps and motors and will raise the undervoltage trip setpoints, if necessary.

The following discussion summarizes the District's position regarding the operation of the CCW pumps with respect to off-normal voltage levels. The attached CCW pump speed-torque curve (Curve No. S.T.) provided by Ingersoll-Rand has been superimposed on the speed-torque curves (Drawing A-11944) for the CCW pump motor to facilitate the undervoltage analysis. Based on attached Drawing A-11944, the following sequence of events would occur if the CCW pumps were started at 70% of

A015
s
1/1

nameplate voltage. The motor and pump would accelerate to 75% of synchronous speed, then the pump-motor combination would stall due to the pump torque requirements being greater than the torque output of the motor. At 75% synchronous speed (1350 RPM), the motor would be drawing approximately 315% of full load current. Utilizing attached Drawing A-11945, approximately 1.7 seconds would elapse from the time of initial motor energization until reaching the stalled condition at 75% rated speed. After the motor stalls, it would continue to draw 315% of full load current for approximately 30 to 110 seconds, during which time the motor circuit breaker would trip due to overcurrent. This overcurrent trip is designed to protect the motor during starting from the consequences of a locked rotor and the subsequent overheating of the motor due to a lack of air flow. However, in the case of the overcurrent trip being induced by undervoltage, the motor at trip would be operating at approximately 1350 RPM, creating a significant air flow across the motor for cooling purposes. Thus, the consequences of the CCW motor overheating due to undervoltage conditions is less severe than that due to a locked rotor, therefore, the CCW motor is fully protected from damage due to an overcurrent trip induced by an undervoltage condition. The 70% of nameplate voltage was selected for this illustrative undervoltage example because the lowest CCW motor speed-torque curve was drawn at this level. The previously described sequence of events would only occur in the event of an undervoltage relay failure because these relays are presently set to trip at 72%-77.3% of bus voltage with a minimum time delay of 8 seconds. However, 72% of 460 volts at the bus corresponds to approximately 70% of 460 volts at the motor's terminals. Therefore, the undervoltage relays would trip the entire bus before the overcurrent protection would trip the individual motors.

The next relevant point of discussion is the minimum voltage required to successfully accelerate the CCW pump-motors to full speed and thus, to a safe operating level. Interpolating between the 70% voltage curve and the 90% voltage curve (Drawing A-11944), it is demonstrated that the motors reach breakdown torque at approximately 77% of nameplate voltage. This 77% minimum operating level corresponds well with the 77.3% maximum undervoltage bus trip setting.

The above analysis demonstrates that the CCW motors can successfully accelerate to full speed and operate at the clearly extraordinary undervoltage conditions detailed above. However, as detailed in the District's March 19, 1982 letter, the minimum steady state voltage that the operating CCW motors could be exposed to is 89% of nameplate (460 volts). Additionally, undervoltage protection is afforded the CCW motors during accident conditions at the Fort Calhoun Station because the undervoltage relays strip the offsite power buses and transfer to diesel power at 90% bus voltage.

Based on the information provided in the District's March 19, 1982 letter and the above analysis for the CCW pump motors, the District believes these motors are adequately protected from damage due to undervoltage conditions. Also, the existing undervoltage relay setpoints provide sufficient protection for the CCW motors and presently there is no reason to raise the setpoints.

Sincerely,

W. C. Jones
Division Manager
Production Operations

Attachments

cc: LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Avenue, N.W.
Washington, D.C. 20036

Ingersoll-Rand

AC-3A,B,C
Comp. Cooling Water Pumps

I.R. REFERENCE NO: _____
CURVE NO: S.T.
DATE: 4/26/82

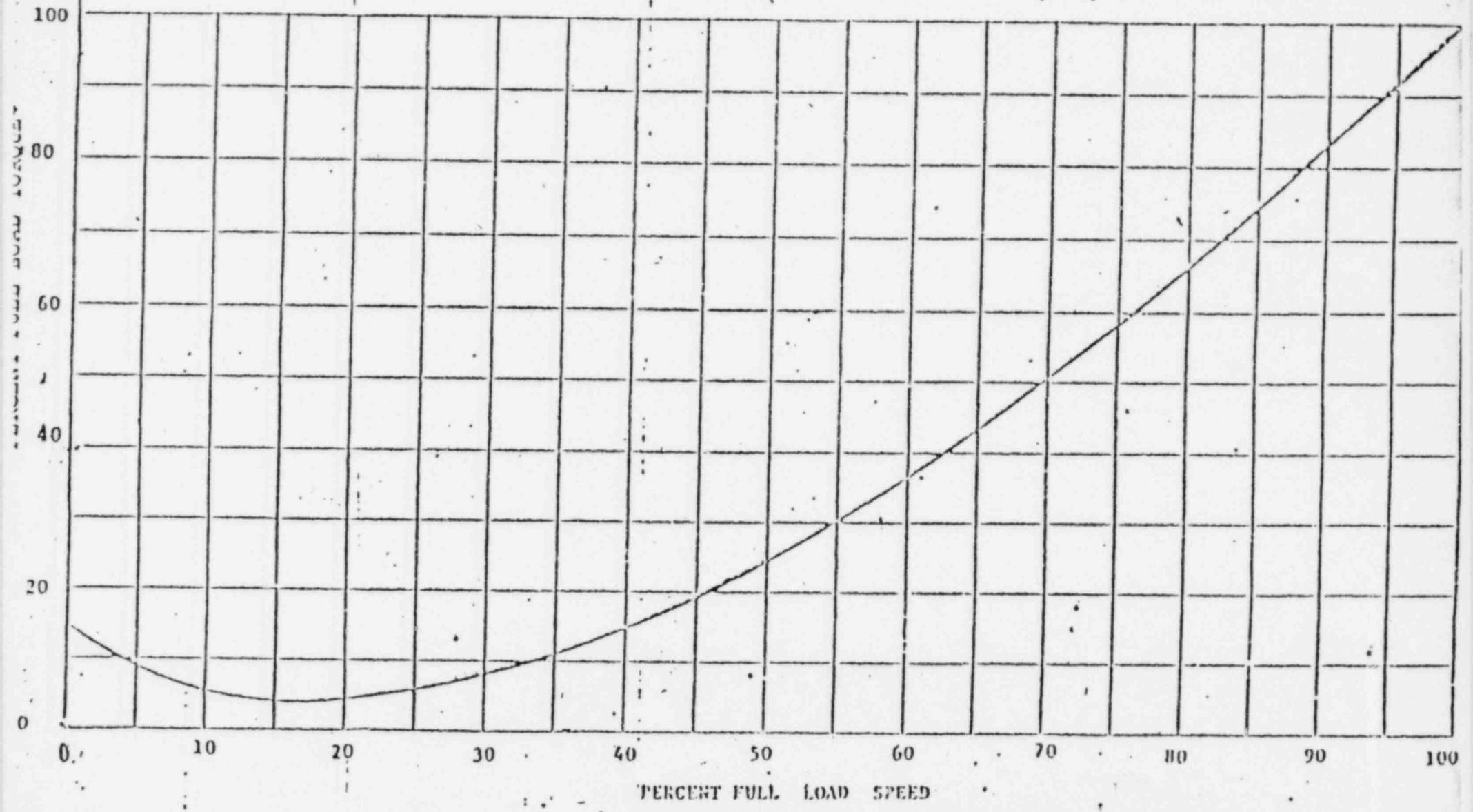
CUSTOMER: Omaha Public Power
100% FULL LOAD SPEED 1750 RPM

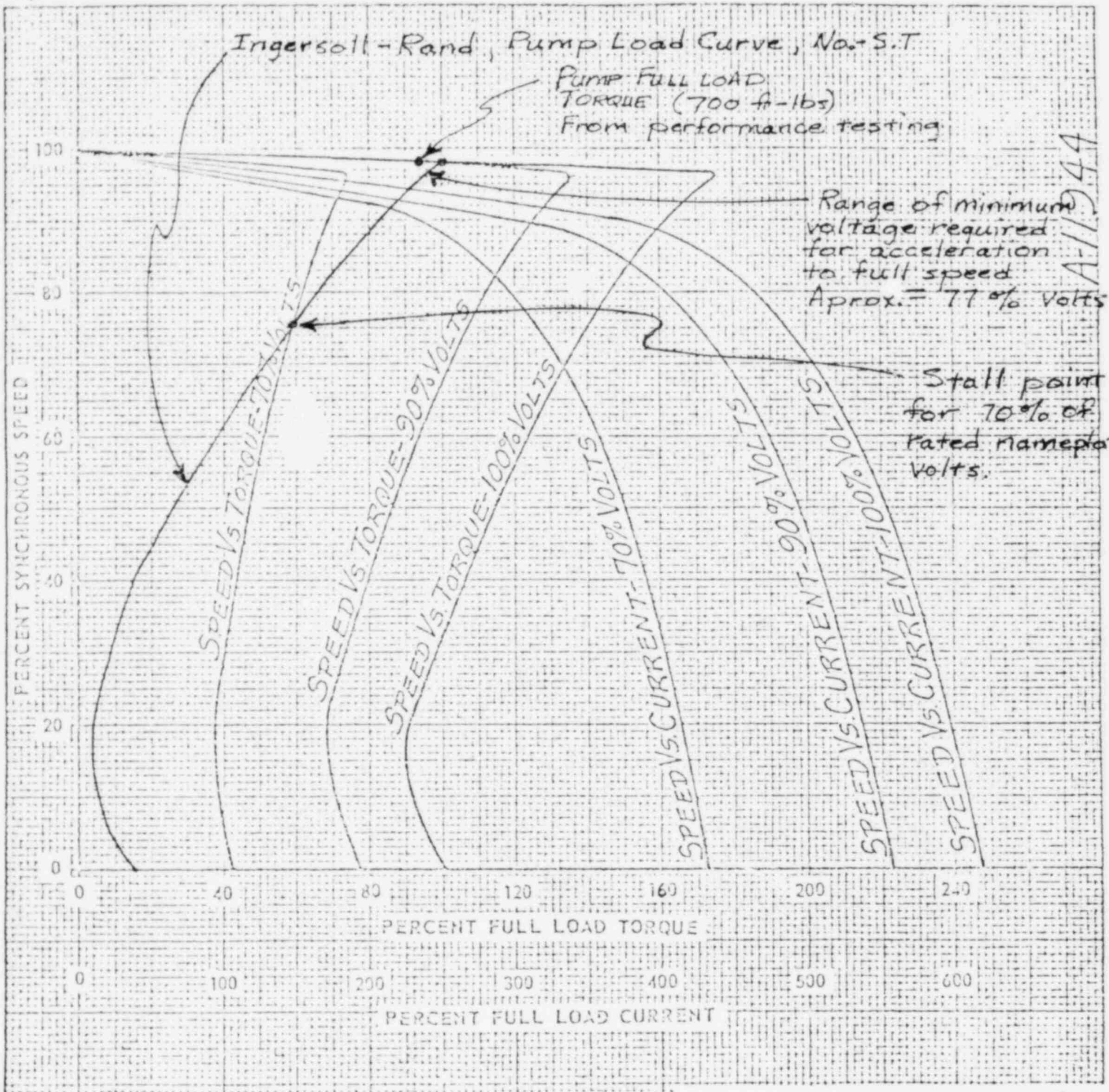
PUMP SIZE: 8 x 18 SE-A

Pump Serial No. 0969-693.

RATING GPM: _____
TDH FT: _____

100% FULL LOAD TORQUE 750 FT. LBS. AT DESIGN FLOW





8-8-73
W.D.S.

A-11944

SIEMENS-ALLIS, INC.

INDUCTION MOTOR
CALCULATED
SPEED VS TORQUE & CURRENT
CURVE

H.P. 250 R.P.M. -1765
VOLTS 460 PH. 3
AMPS 295 HZ 60

COMPONENT COOLING PUMP
AC-3A, AC-3B, AC-3C

2098-20129 A

SIEMENS-ALLIS INC.-NORWOOD, OHIO

250 H.P.-1800 SYN. R.P.M.-3 PH.-60 HZ.-460 VOLTS

TYPE-RG FRAME-445TS

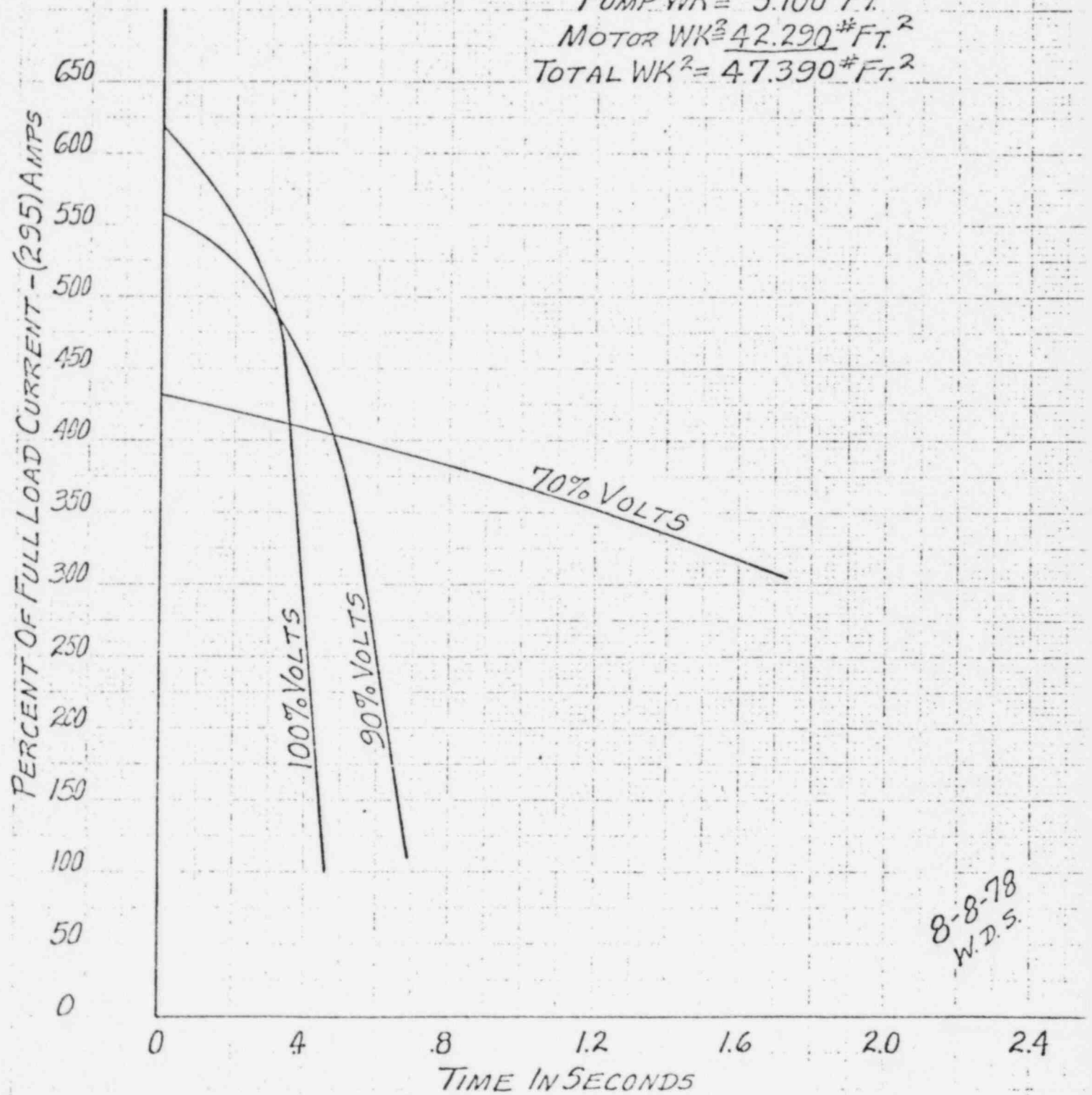
CURRENT VS. ACCELERATION TIME

COMPONENT COOLING PUMP AC-3A, AC-3B, AC-3C

PUMP WK^2 = 5.100 #Ft.^{2}

MOTOR WK^2 = 42.290 #Ft.^{2}

TOTAL WK^2 = 47.390 #Ft.^{2}



8-8-78
W.D.S.

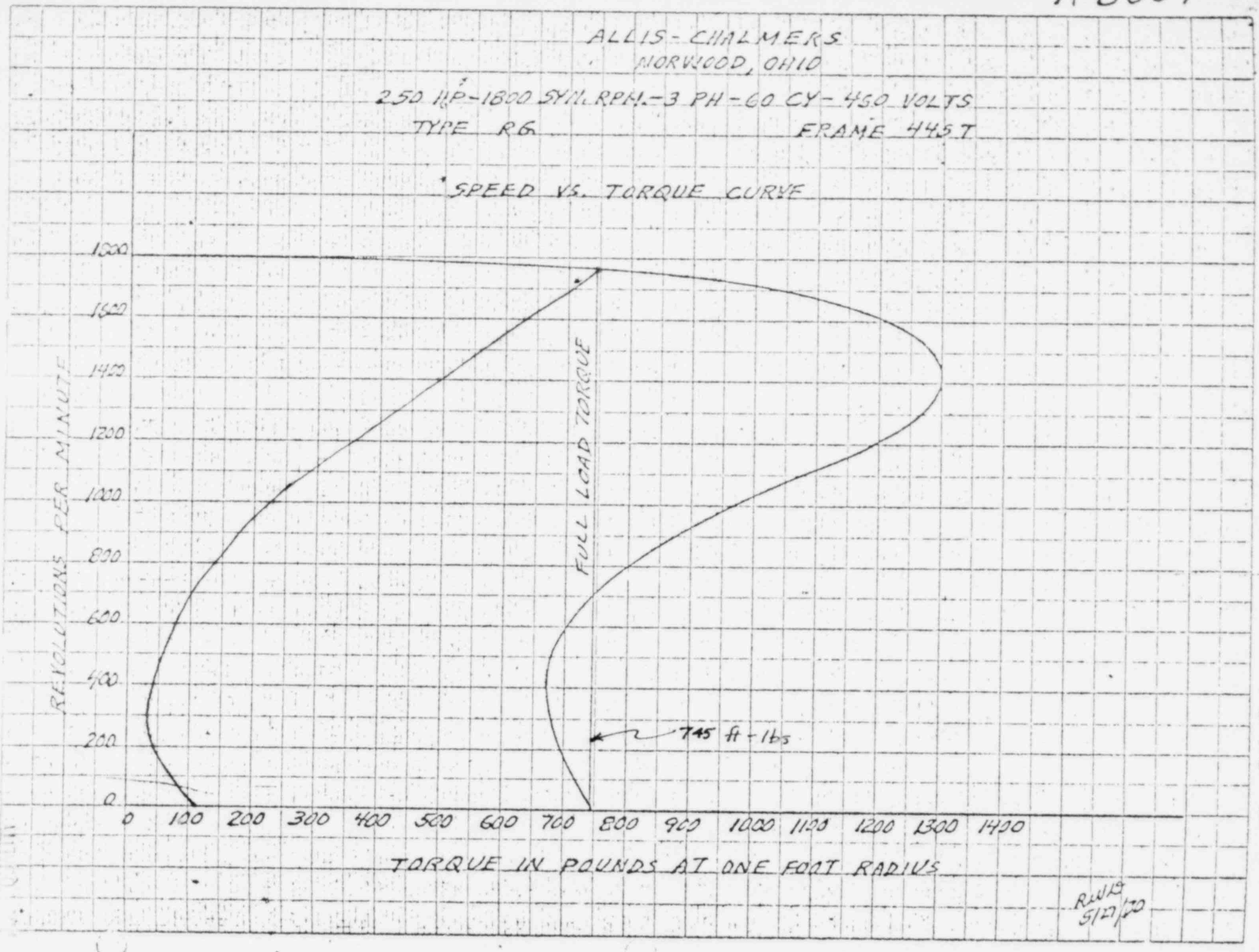
A-11945

A-8001

ALLIS-CHALMERS
NORWOOD, OHIO

250 H.P. - 1800 SYN. R.P.M. - 3 PH - 60 CY - 450 VOLTS
TYPE R6 FRAME 445T

SPEED VS. TORQUE CURVE



RWP 5/20/20

A-8001

AC-3ABC