

VIRGINIA ELECTRIC AND POWER COMPANY.
RICHMOND, VIRGINIA 23261

September 2, 1998

Document Control Desk
United States Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 98-452
NLOS/GDM R2
Docket Nos. 50-280/50-281
License Nos. DPR-32/DPR-37

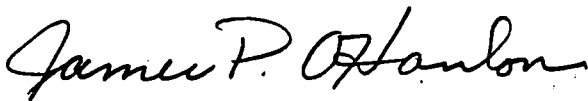
Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
PLANT DESIGN INSPECTION INSPECTOR FOLLOW-UP ITEMS (IFIs)
REQUEST FOR ADDITIONAL INFORMATION

During a July 28, 1998 telephone call between the NRC and Virginia Electric and Power Company staff, design information associated with two IFIs identified in the Surry Plant Design Inspection Report Nos. 50-280, 281/98-201 was discussed. The two IFIs were 50-280/98-201-04, Motor Thermal Overload for 1-SI-P-1B Pump and 50-280/98-201-05, Adequacy of 4160 VAC Electrical Cables to Withstand Fault Current. The discussion was based on a list of information previously requested by the NRC via facsimile on July 21, 1998. The design information was requested to support internal NRC staff evaluations of these two items. At the conclusion of the telephone call, the NRC requested that the information discussed be provided formally. Therefore, we have documented the requested information in the attachment.

If you have any further questions or require additional information, please contact us.

Very truly yours,



James P. O'Hanlon
Senior Vice President - Nuclear

Attachment

Commitments contained in this letter: None.

9809140135 980902
PDR ADOCK 05000280
G PDR

Jept

cc: U.S. Nuclear Regulatory Commission
Region II
Atlanta Federal Center
61 Forsyth Street, SW
Suite 23T85
Atlanta, Georgia 30303

Mr. R. A. Musser
NRC Senior Resident Inspector
Surry Power Station

ATTACHMENT

PLANT DESIGN INSPECTION INSPECTOR FOLLOW-UP ITEMS (IFIs)
SURRY POWER STATION UNITS 1 AND 2

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

IFI 50-280/98-05, Adequacy of 4160 VAC Electrical Cables to Withstand Fault Current

1. Maximum fault current at 4160 volt switchgear from:

Bus 1H will be discussed; 1J, 2H, and 2J are similar. Calculation EE-0334 was reviewed. Only three phase faults will be discussed. Available phase to ground fault current is limited to approximately 1500A.

a) Offsite source:

The fault current delivered from the offsite source is nearly constant for all plant conditions. The current varies from 24000 to 25000 amperes.

b) EDG: 3440 kVA, 4160V, wye, ungrounded.

Direct Axis Subtransient Reactance = 0.298 per unit at rated kVA
Direct Axis Subtransient Short Circuit Time Constant = 0.017 seconds (1 cycle)
at 75 degrees Celsius

Direct Axis Transient Reactance = 0.462 per unit at rated kVA
Direct Axis Transient Short Circuit Time Constant = 0.654 seconds at 75
degrees Celsius

The initial or subtransient value of generator phase current resulting from a fault at the generator terminals:

AC Subtransient Amps =	1600
Maximum DC Component Amps =	2260
Maximum Total RMS Amps =	2770

For calculating the maximum fault current at the 4160 volt switchgear, 1600 amps is assumed; 2770 amps is assumed to evaluate the close and latch breaker ratings.

c) Motors:

The motor contribution varies depending on the plant condition and configuration. The current during normal operating conditions is as low as 650A. The maximum motor contribution is as high as 9000A.

The total short circuit current for Bus 1H is approximately 25,078A during normal operating conditions; this increases to 26,678A with the EDG on the bus. The maximum short circuit current is 33,235A; this occurs with a Unit 1 accident coincident with a Unit 2 trip.

2. Switchgear MVA rating:

The 4160 volt 5HK250 switchgear circuit breakers are rated for 250MVA. This equates to a 33,541 Amps Symmetrical Interrupting rating at the approximate operating voltage of 4300V. The Close and Latch Rating is 80,000 amps RMS.

3. 4160 V breaker tripping time:

The average tripping time between energizing of the trip coil and parting of arcing contacts is 1.5 cycles.

4. Total time delay:

- a) Relay time: 0.25 – 1 cycle
- b) Lockout relay time: 3 cycles (HFA relay)

5. Breaker interrupting time:

The interrupting time between energizing the trip coil and complete interruption is 5 cycles.

6. Maximum asymmetrical short circuit current:

The asymmetrical breaker current interrupting capability is 1.2 times the symmetrical rating. Because the X/R ratio for the safety-related buses is low, i.e., 10-12, the available three-phase short circuit current requires no additional multiplication factor.

7. Cable:

All motors supplied from the safety-related buses are fed with #1 or #2 conductors.

- a) Conductor material copper or aluminum: Aluminum
- b) Cable operating temperature: 90 degrees Celsius
- c) Cable short circuit temperature: 250 degrees Celsius

d) Type of insulation: All have Crosslinked Polyethylene (PEI) insulation. Note that two have neoprene jackets, the remainder have aluminum or galvanized interlocked armor.

8. Calculation to determine the minimum size cable for 4160 volt system:

No calculation has been identified, therefore, we have concluded that one does not exist. IEEE Std. 242-1986 was utilized to evaluate this condition during the recent inspection; however, Surry is not committed to this standard. No design basis standard for Surry has been identified which specifically requires this evaluation, and therefore, we conclude that none applied at the time Surry was licensed.

From IEEE Std. 242, Figure 152 is used to determine a temperature correction factor. For 90°C initial temperature and 250°C maximum short circuit temperature, $K_t = 0.925$. The maximum available fault current is 33,235A. $33,235 \times 0.925 = 30742A$. Based on Figure 151, the minimum conductor for a 5-cycle circuit breaker is 250 MCM AL. The fault current available during normal plant operating conditions is 25,078A. $25,078 \times 0.925 = 23,197A$. Based on Figure 151, the minimum conductor for a 5-cycle circuit breaker is 3/0 AL.

50-280/98-201-04, Motor Thermal Overload for 1-SI-P-1B Pump

9. 1-SI-P-1B motor information: This motor was obtained from another plant (Shearon Harris) after a motor failure was experienced at Surry.

a) Nameplate Data:

300HP, 460V, 1.15 service factor, 1763 full load RPM, 338A full load current, 2005A locked rotor current.

b) Motor test report:

The motor was rated to start its intended load at the Shearon Harris station in less than 2 seconds at 75% terminal voltage. However, the Surry motor application services a smaller pump than the pump used in the Harris application. The motor torque curve is well above the pump curve and can accelerate the pump even below 70% voltage.

c) Motor thermal curve:

A thermal limit curve was provided with the pump. Based on the motor outline drawing, the maximum allowable stall time assuming an 80 degrees Celsius

initial temperature is 10 seconds, and from a 30 degrees Celsius initial temperature is 15 seconds.

d) Motor time current curve:

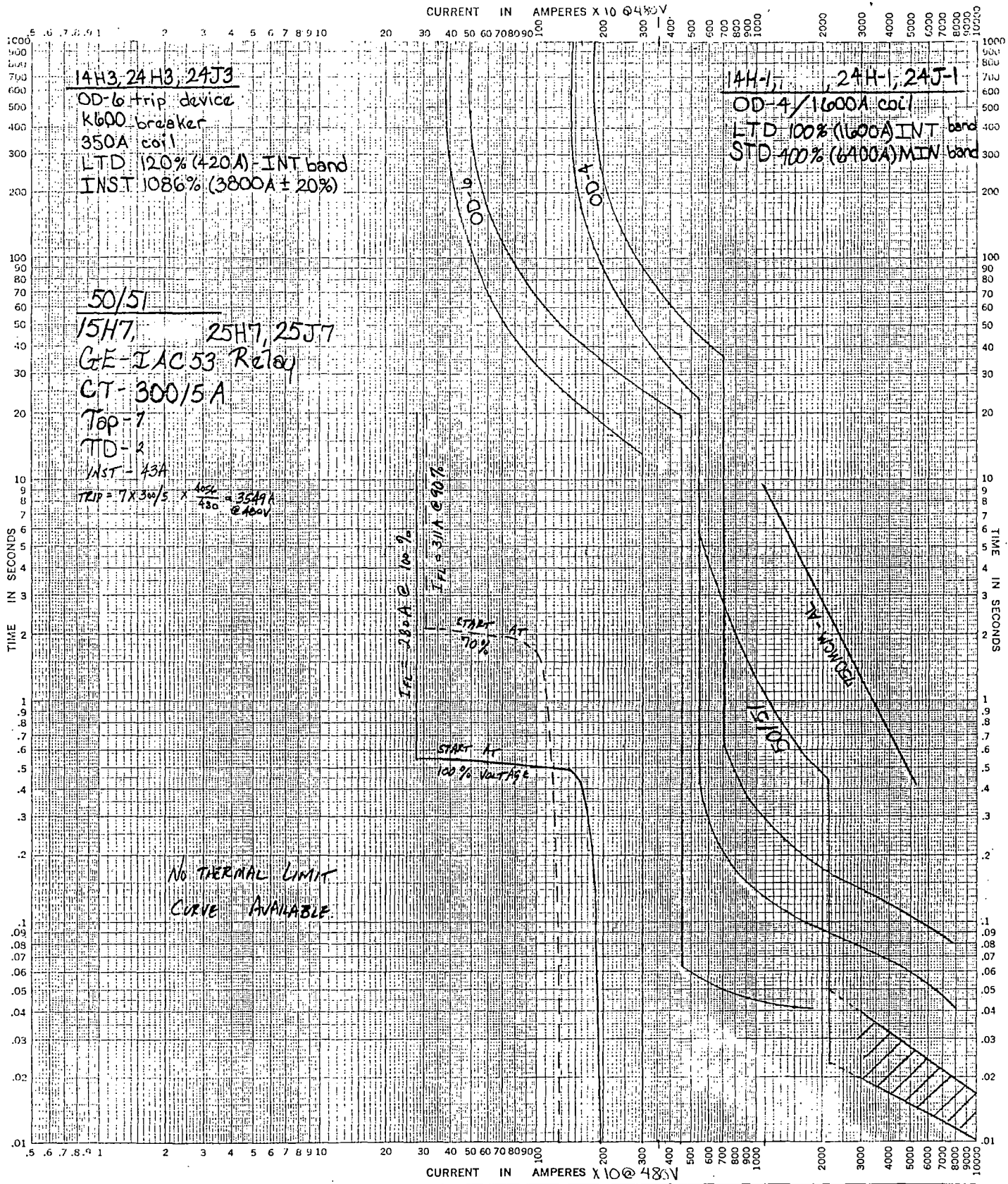
The motor will accelerate its original load (i.e., the Harris plant application) in less than 2 seconds at 75 percent voltage. However, the motor load at Surry is smaller than the originally intended load for the Harris plant application. No current curve exists for the specific Surry application.

10. Breaker coordination curve:

The available data for the 300 HP 1-SI-P-1B and the three 250 HP pumps are attached. The curves for the 300 HP motor show, based on the 80 degree Celsius thermal limit curve provided, that the circuit breaker does not protect the motor for the full range of current. However, this is acceptable in order to ensure that the motor is allowed to start. Based on the limitations of the protective device, if the protection is set faster, it might inhibit the start. No thermal limit curve is available for the other three motors.

11. 1-SI-P-1B Pump Maximum Brake Horsepower and Load Current:

The expected maximum brake horsepower for 1-SI-P-1B for the Surry application is 240. Based on motor power factor, efficiency, etc., the expected load current is 274 amps at 460 V.



SPS LowLoad Safety Injection Pump Motor Fuse Links In

For 14H3, 24H3, 24J3 TIME-CURRENT CHARACTERISTIC CURVES

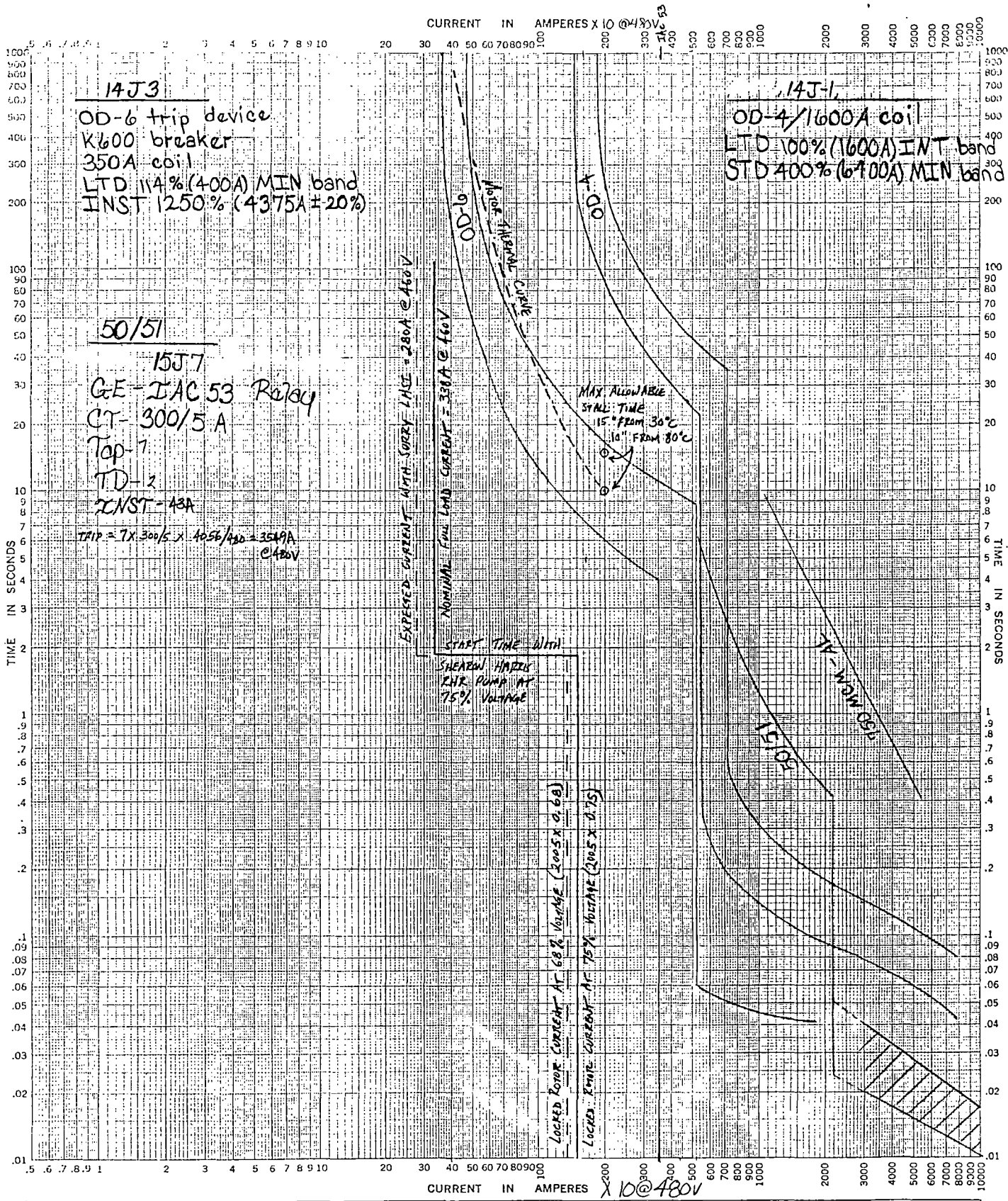
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at 480V Volts a-c at _____ p-f., starting at 25C with no initial load.

2. Curves are plotted to IEE - TD6695 Rev. 5 points so variations should be _____

IEE - TD6694 Rev. 4
GES-700RB

No. _____
 Date _____



SPS: Lowload Safety Injection TIME-CURRENT CHARACTERISTIC CURVES
Pump Motors Fuse Links In

For 14J3

BASIS FOR DATA STANDARDS _____ Dated _____

1. Tests made at 480V Volts a-c at _____ p-f., starting at 25C with no initial load.

2. Curves are plotted to ITE-TX do 95 Rev. 5 Test points so variations should be _____
ITE-ID do 94 Rev. 4
GES-7002B

No. _____ Date _____

March 25, 1974

ANALYSIS OF ACCELERATING TIME

SHOP ORDER NUMBER 74F18135

HORSEPOWER 300

RPM 1763

FRAME 5008P39

VOLTAGE 460

L-SPEC. 961932

	SPECIFIED ON ORDER	TO BE USED IN CALCULATION
ACCELERATING VOLTAGE	<u>75%</u>	<u>75% (345V)</u>

ACCELERATING TIME	<u>5 sec</u>	
-------------------	--------------	--

PUMP INERTIA REFERRED TO MOTOR SHAFT (WK ²) <i>lft²</i>	<u>48</u> 60	<u>48</u> 60
---	----------------------------	----------------------------

PUMP SPEED-TORQUE CURVE - REFERRED TO MOTOR SHAFT	<u>attached</u> N155	<u>attached</u> N155
--	-------------------------	-------------------------

CALCULATED ACCELERATION TIME ~~1.86~~ 1.77 seconds

ASSIGNED ENGINEER John J. Riley DATE 6/12/74

SECOND ENGINEER _____ DATE _____

PLANT NAME CARLINA POWER & LIGHT - SHEPHERD HARBOR #2 and #3

APPLICATION RESIDUAL HEAT REMOVAL PUMPS

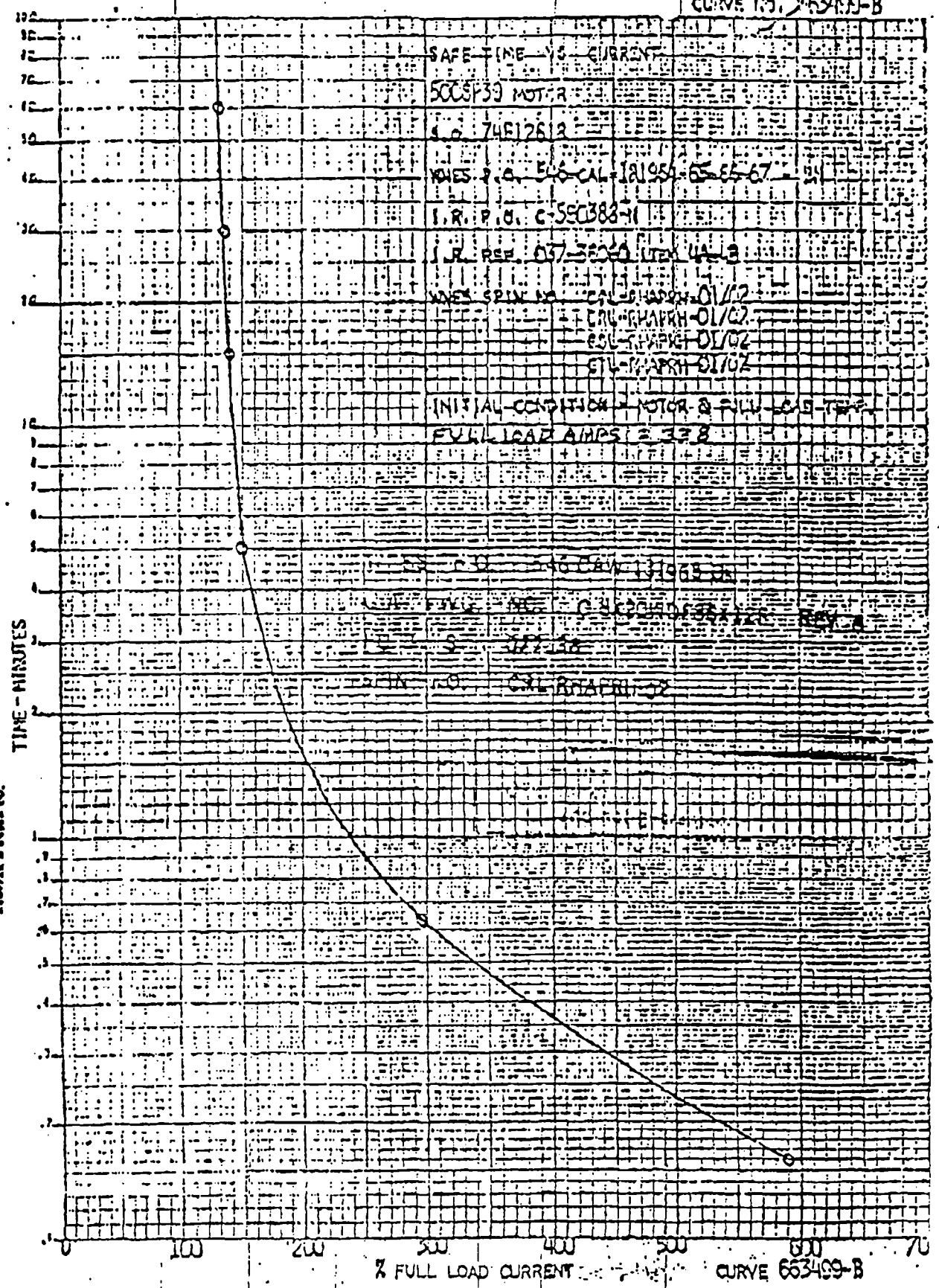
REACTOR SUPPLIER WESTINGHOUSE SAT. UNSAT.
NAME Date

PUMP SUPPLIER INERSOLL - RAND

*6/17/74
RJR*

"NOT LEGIBLE"

CURVE NO. 663409-B



1961

W. ES P.O. 546 CAW-181965-BN

U A I WG. NO. C SX20WDFB6X12F

FU S 077538

NOT LEGIBLE

INDUCTION MOTOR DATA SHEET

74F18136
74F12678

REV 2 - 11/30/73

1 PROJECT C.P.L. SHEARON (HARRIS UNITS 1 THRU 4) S.O. No. 74F18136 Co. No. HA-68500
2 FURNISHED BY WESTINGHOUSE - BUFFALO DATE 10/30/73 BY P.H. KAYE

3 MARK OR ITEM NO. W SPIN # COL/COI/CSI/CTI - RHAPRH-02

PURCHASER'S REQUIREMENTS		DATA FURNISHED BY SUPPLIER	
5 SERVICE	Residual Heat Removal Pump	MAKE	Westinghouse
6 TYPE	Squirrel Cage Induction	FRAME NO.	509270
7 NO. OF UNITS	2/UNIT = 8 Total	HOARSEPOWER	300
8 MOUNTING	Vertical	SERVICE FACTOR	1.15
9 ELEC. CHARACTERISTICS	400 V. 3 PH 60 CY	FULL LOAD RPM	1753
10 SYNCH. SPEED, RPM	1800	FULL LOAD AMP	338
11 HORSEPOWER	300	LOCKED ROTOR AMP	2095
12 SERVICE FACTOR	1.15	STARTING TORQUE, % P.L.	112%
13 ENCLOSURE	HP1	PULL-OUT TORQUE, % P.L.	236%
14 INSULATION CLASS	B	EFF. FULL LOAD, %	92.4
15 INSULATION TREATMENT	Thermalastic Epoxy	EFF. 1/4 LOAD, %	92.7
16 AMBIENT TEMP. C	40	EFF. 1/2 LOAD, %	92.0
17 STATOR TEMP RISE, C	90 by resistance	P.F. FULL LOAD, %	90.0
18 BEARING TYPE		P.F. 1/4 LOAD, %	88.3
19 BEARING TEMP RELAY	N/A	P.F. 1/2 LOAD, %	82.9
20 BEARING THERMOUPLE	No	P.F. LOCKED ROTOR	29%
21 HALF COUPL. OR SHEAVE MTD. BY		SPACE HTS., TOTAL WATTS	220
22 ROTATION	CCW	RADIAL BEARING - TYPE	Ball
23 WT OF DRIVEN EQUIP.	AP	THRUST BEARING - TYPE	Angular Contact Ball
24 BREW. TORQ. DRYN. EQUIP.		BEARING SERVICE - HR.	130,000 Hours
25 OVERSIZE COND. BOX	Yes	NORMAL BRG. OPER. TEMP. C	85°C Max.
26 COND. BOX LOCATION	SEE G/A DRAW.	NET WEIGHT - LB.	See Outline Dwg.
27 SPACE HEATERS, VOLTAGE, PHASE	230 V A.C. 1PH, 60CY	OIL COOL. SYS. REQ'D	NA
28 SPLIT END SCILLS		BRG. OIL PRES. RANGE, PSI	NA
29 TERMINAL LUGS, TYPE		BRG. OIL REQ'D EA. BRG. CPM	1/4
30 STATOR HIGH TEMP DEVICE	Yes Chromel Const.	NAME PLATE CODE LETTER	F
31 ADJUSTABLE SLIDE RAILS		PERMISSIBLE STARTS PER HR.	
32 SOLEPLATES		MOTOR AT AMBIENT TEMP	See Outline Dwg
33 PROJECT ELEV., FT.	Below 3300	MOTOR AT RATED TOTAL TEMP	
34 SHAFT (HOLLOW, SOLID)		TYPE SEALED INSUL. SYS.	Thermalastic Epoxy
35 COUPLING (SELF-RELEASE)		DESCRIPTION OF INSUL. SYS.	Class B
36 SOLID, NONREVERSING			
37 ADJUSTABLE, FLEXIBLE			
38 VERT. MAX DOWNTHRUST		Torque - Speed Curve #	663497-C
39 VERT. MAX UPTHURST		Safetime - Current Curve #	663499-B
40 VERT. MIN UPTHURST		Motor Outline Dwg. #	82-26-2-A
41 VERT. MIN DOWNTHRUST			
42 (WITH MOTOR RUNNING)		Note: "Attention - Mr. S. C. J. Thruth	
43 SIDE THRUST		Westinghouse NES" shall be as	
44 MAX REVERSE SPEED		manufacturer's distribution list	
45 DRAIN PLUG AND VENT		for motor torque - speed curve,	
46 AIR INTAKE SCREENS	Yes	safetime - current curve, and	
		motor outline drawing.	
48 Motor shall meet W.E. Spec 67267A and			
49 E Spec 95235 for safeguard equipment.			
50			
51			
52 REMARKS		REMARKS	
53 ALL PERFORMANCE DATA BASED ON NORMAL RATED		ALL PERFORMANCE DATA BASED ON NORMAL RATED	
54 VOLTAGE AND FREQUENCY		VOLTAGE AND FREQUENCY	
55 ITEMS 36-44 APPLY TO VERTICAL MOTORS ONLY		INDICATE IF DATA IS ESTIMATED	
56			
57			
58			
59			
60 *VIEWED FROM END OPPOSITE COUPLING END			

U . 4 1 1 9 4 7 .

