Consumers
Power
Company

General Offices: 212 West Michigan Avenue, Jackson, MI 49201 • (517) 788-0550

July 29, 1981

Director, Nuclear Reactor Regulation
Att Mr Dennis M Crutchfield, Chief
Operating Reactors Branch No 5
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 -
PALISADES PLANT - ADEQUACY OF STATION ELECTRIC DISTRIBUTION
SYSTEM VOLTAGES ADDITIONAL INFORMATION

NRC letter dated June 24, 1981 requested additional information on the subject of Adequacy of Station Electric Distribution System Voltages. Attached are the questions presented by the NRC and Consumers Power Company responses.

Brian D Johnson

Brian D Johnson
Senior Licensing Engineer

CC Director, Region III, USNRC
NRC Resident Inspector-Palisades

A015
s
1/1

Attachment I

Responses to Additional Information Requests from NRC
Letter dated June 24, 1981

1. CPCo has shown in the speed torque curves that the majority of the Class 1E motors will start, under load, when the motor terminal voltage is 70%. Verify that <u>all</u> Class 1E loads will start when the motor terminal voltage is 70% (or some other specified level) and deliver the capacity required to mitigate the consequences of an accident.

<u>Response to Item 1</u>

The speed torque curves, which were submitted in CPCo letter dated March 3, 1981, show that the 2400V motors will start and operate the required load when the motor terminal voltage is at or above the value shown in Table I of this submittal. The 480V containment cooling fan motors have been earmarked for replacement as a result of environmental qualification requirements which cannot be met by the existing motors. These motors will be designed and tested to start and operate under load conditions at 70% voltage.

The 480V boric acid pump motors are not required to start and operate until the voltage reaches 85% which is the voltage that the motor starter contactors pick up. No curves are available for these motors because of the small size and extremely rapid accelerating time. A voltage of 85% is generally sufficient to overcome the initial starting inertia and also provides sufficient accelerating torque to bring the motor to full speed. Test documentation to support this assumption is not available but CPCo Technical experts are comfortable with the statement.

The 480V charging pump motors are provided with computer generated speed/torque curves for 100% voltage. Our analysis assumes that the motors will start and operate at 70% voltage, but we do not have test documentation to provide absolute proof that our assumption is correct. Absolute proof would have to be obtained by actual test or possibly computer generated speed torque curves for 70% voltage on the motors and full load on the pumps.

2. CPCo has shown that the 460V and 440V motors and the 480V battery chargers do not have sufficient voltage to operate continuously with maximum unit loads concurrent with the offsite grid at 95% of nominal. Moreover, the voltage at the 480V contactors is less than that required to pick up additional loads that may be required by an accident.

   Additionally the instruments needed in an accident situation will not have adequate voltage to provide correct readout under the voltage conditions in question 2 with the 120V AC instrument bus supplying power to the 120V AC preferred instrument bus. It is apparent that the 480V battery charger could be required to operate at less than the rated minimum input voltage (432V) while under a degraded condition without operation of the second level undervoltage relays. Operation under this condition would discharge the batteries. The FSAR assumes that these batteries will be fully charged prior to a design basis accident.

Based upon the above, either demonstrate that our findings are not correct or provide proposed modifications and schedules to correct these deficiencies.

The degraded grid voltage relay setpoint (91.4% ± 0.13%) is higher than the minimum expected continuous operating voltage for 2400V buses 1C and 1D (87.3% of 2400V). The loss of voltage relay setpoint (77.5% ± 3.3%) is higher than the minimum analyzed motor starting transient. Based on the CPCo submittals, it is not evident that the time delay for either the degraded grid voltage relays or the loss of voltage relays is sufficient to ride through all expected motor starting transient dips when the grid is at 95% and the unit loads are maximum. It appears that there may be potential for spuriously separating the Class 1E buses from the offsite source by operation of either the loss of voltage or second level undervoltage relays.

Response to Item 2

Based on changes in the CPCo transmission system and recent improvements in the computer analysis, the 95% value should be disregarded as a reference for any future discussion and should be replaced with 100%. Our review of station log books over several years has shown that 100% is a very realistic value. The acceleration time bar chart, which was submitted as Figure 1 in the March 3, 1981 CPCo letter, shows that at 100% voltage, the emergency motors will start and operate. That includes the 460V and 440V motors.

As stated in the Response to Item 2 in the March 3, 1981 letter, the battery chargers have a reduced output when the input voltage is reduced below its rating. It is not apparent from this statement that operation under reduced voltage would discharge the batteries. It has not been shown that maxiumu unit loads means that the chargers are fully loaded and that a reduced input voltage would result in discharging the batteries. In fact, the chargers do have built-in reserve capacity when the unit is operating under maximum load.

As stated in the Response to Item 6 in the March, 1981 letter, the four 120V a-c preferred busses are normally supplied by inverters from the batteries and battery chargers. It is also possible to power one of these busses at a time using the 120V a-c instrument bus which is connected to the MCCs. No test results are available to show what the effect of a slightly reduced voltage would have on the function of the instruments on the preferred bus. It is our position that a reduction of 5% below the rating of the instrument loop regulated power supply would have an undetectable effect and that if any effect did result, it would cause the instruments to react in a manner that would provide a safer condition in terms of mitigating the consequences of an accident.

The 2400V system is protected by three separate undervoltage relays of different types and settings. These types and settings were previously submitted, but for clarity, Figure II is being submitted again to show the actual time vs percent voltage for the three relays combined. Also shown on Figure II is the voltage vs time profile for the worst case loading of the emergency busses with the system voltage at 100%. The value for 100% should be used as explained above instead of 95%.

TABLE I

SUMMARY OF INSTANTANEOUS VOLTAGES DURING SIS

V 345 AT 1.0 PU

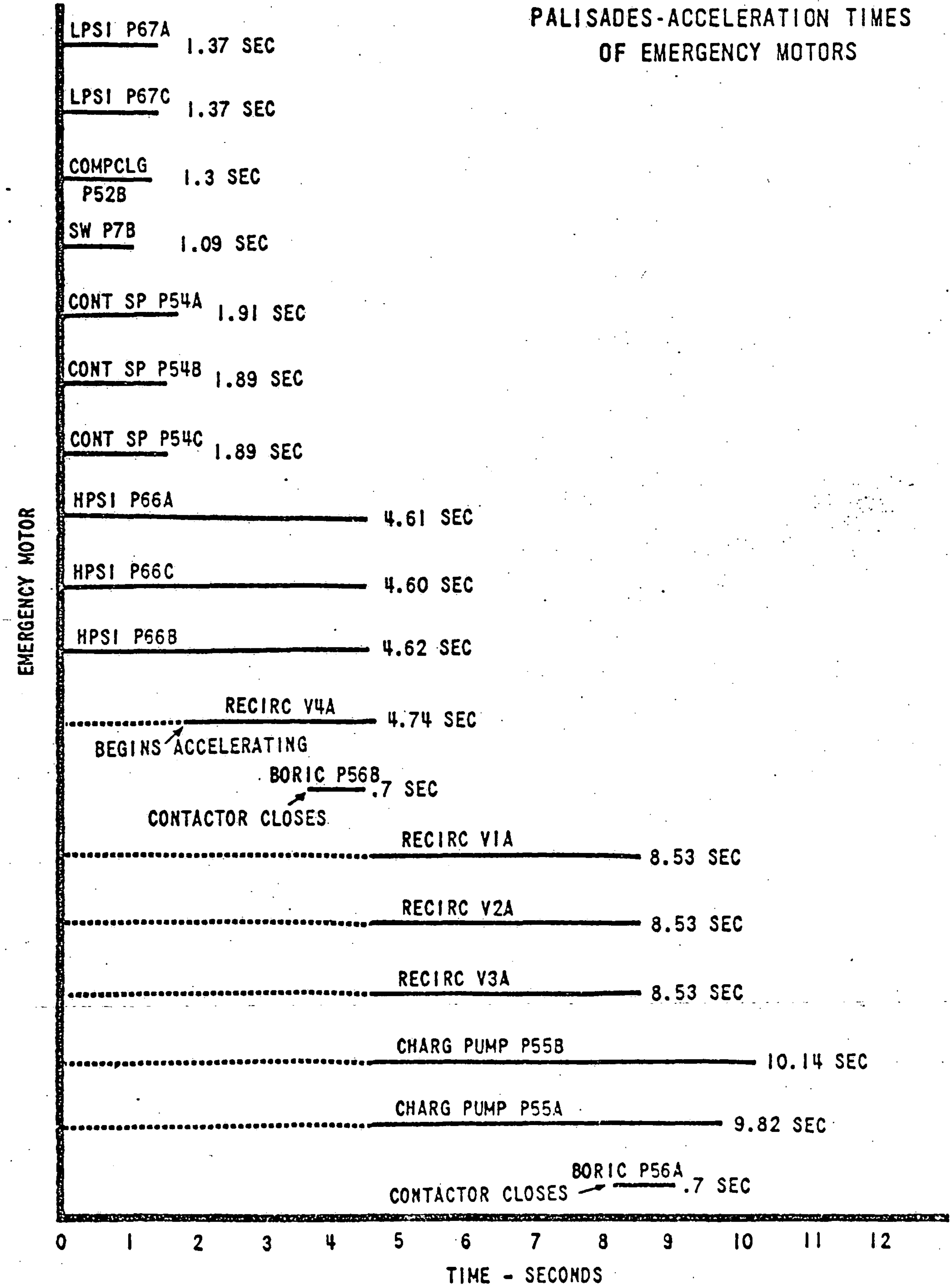
Bus or Motor	(V Rating)	Prestart V	Starting V	Running V
1C	(2400)	0.9516	0.7461	0.9303
Component Cooling P52A (R)	(2300)	0.9511	0.7455	0.9298
Service Water P7B (S)	(2300)	0.9516	0.7354	0.9282
Component Cooling P52C (R)	(2300)	0.9511	0.7455	0.9298
LPSI P67B (S)	(2300)	0.9516	0.7413	0.9294
Containment Spray P54B (S)	(2300)	0.9516	0.7433	0.9299
HPSI P66B (S)	(2300)	0.9516	0.7430	0.9297
Containment Spray P54C (S)	(2300)	0.9516	0.7434	0.9299
13	(480)	0.9296	0.7173	0.9078
11	(480)	0.9216	0.6660	0.8933
Recirc Fan V4A (S)	(460)	0.9216	0.6180	0.8778
Charging Pump P55C (R)	(440)	0.9039	0.6410	0.8750
MCC 1	(480)	0.9213	0.6636	0.8926
Boric Acid P56B (S)	(460)	0.9213	0.6306	0.8755
1D	(2400)	0.9515	0.7444	0.9297
Service Water P7A (R)	(2300)	0.9493	0.7416	0.9274
Service Water P7C (R)	(2300)	0.9493	0.7416	0.9274
LPSI P67A (S)	(2300)	0.9515	0.7401	0.9289
HPSI P66A (S)	(2300)	0.9515	0.7405	0.9289
Component Cooling P52B (S)	(2300)	0.9515	0.7418	0.9292
HPSI P66C (S)	(2300)	0.9515	0.7397	0.9288
Containment Spray P54A (S)	(2300)	0.9515	0.7394	0.9289
12	(480)	0.9211	0.5570	0.8690
Recirc Fan V1A (S)	(460)	0.9211	0.5119	0.8535
Recirc Fan V2A (S)	(460)	0.9211	0.5119	0.8535
Recirc Fan V3A (S)	(460)	0.9211	0.5119	0.8535
Charging Pump P55B (S)	(440)	0.9211	0.5169	0.8559
Charging Pump P55A (S)	(440)	0.9211	0.5128	0.8573
MCC 8	(480)	0.9156	0.5477	0.8631
MCC 2	(480)	0.9204	0.5543	0.8678
Boric Acid P56A (S)	(460)	0.9204	0.5318	0.8535
16	(480)	0.9247	0.7234	0.9035
1E	(2400)	0.9521	0.7533	0.9322

(R) = Running; (S) = Starting

Per unit voltages are on a 2400 V or 480 V Base.

12/10/80

FIGURE 1
PALISADES-ACCELERATION TIMES
OF EMERGENCY MOTORS



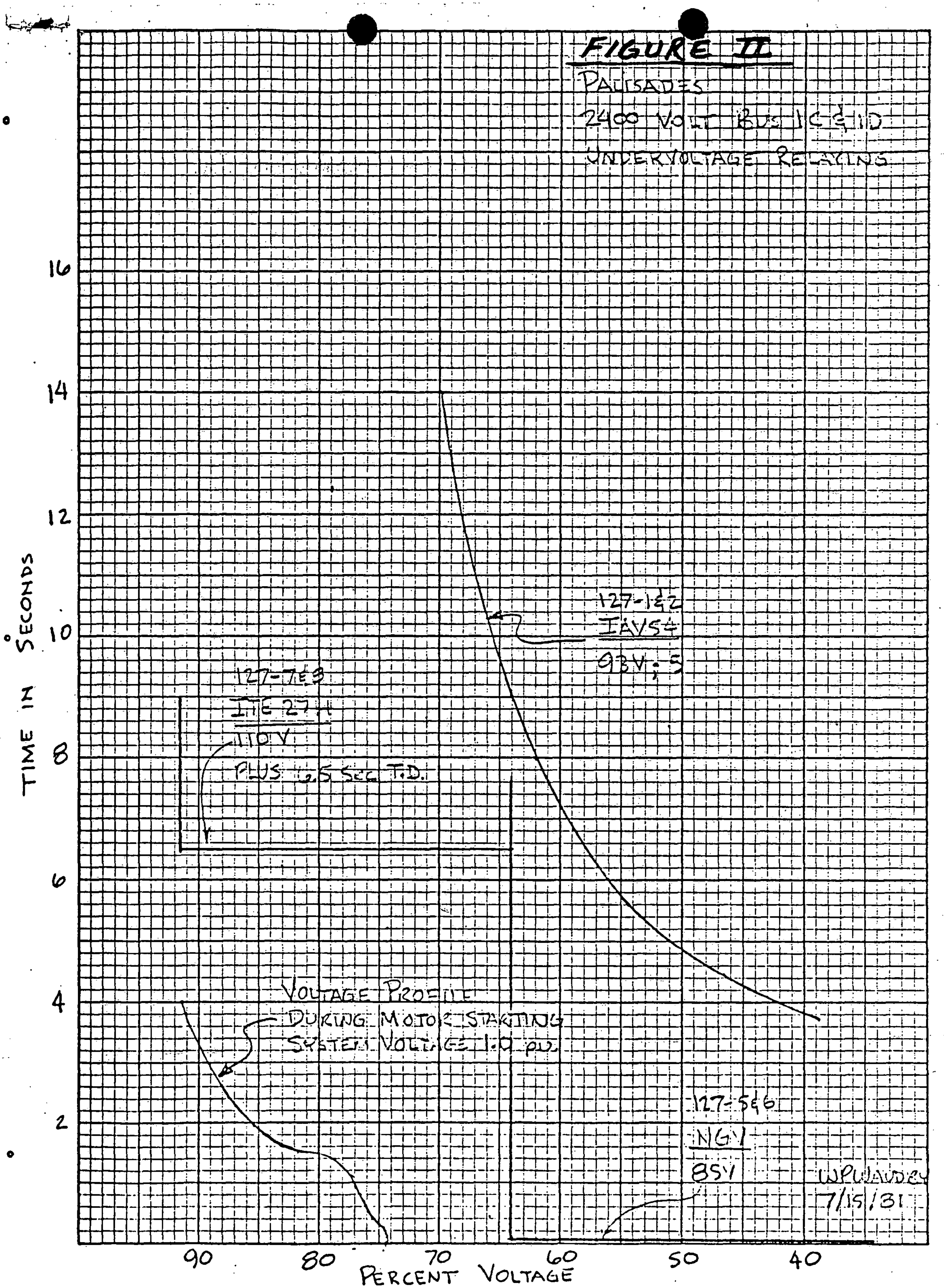


FIGURE II
PALISADES
2400 VOLT BUS 1C & 1D
UNDERVOLTAGE RELAYING
127-1&2
IAV54
93V; 5
127-7&8
ITE 27 H
110V
PLUS 6.5 SEC T.D.
VOLTAGE PROFILE
DURING MOTOR STARTING
SYSTEM VOLTAGE 1.0 PU.
127-5&6
NGV
85V
WPWADEY
7/15/81
TIME IN SECONDS
PERCENT VOLTAGE
2
4
6
8
10
12
14
16
90
80
70
60
50
40