

ELECTRICAL POWER SYSTEMS

ACTION (Continued)

- c. With two of the above required offsite A.C. circuits inoperable, demonstrate the OPERABILITY of two diesel generators by performing Surveillance Requirement 4.8.1.1.2.a.4 within one hour and at least once per 8 hours thereafter, unless the diesel generators are already operating; restore at least one of the inoperable offsite sources to OPERABLE status within 24 hours or be in at least HOT STANDBY within the next 6 hours. With only one offsite source restored, restore at least two offsite circuits to OPERABLE status within 72 hours from time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
- d. With two of the above required diesel generators inoperable, demonstrate the OPERABILITY of two offsite A.C. circuits by performing Surveillance Requirement 4.8.1.1.1.a within one hour and at least once per 8 hours thereafter; restore at least one of the inoperable diesel generators to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. Restore at least two diesel generators to OPERABLE status within 72 hours from time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.8.1.1.1 Each of the above required independent circuits between the offsite transmission network and the onsite Class 1E distribution system shall be:

- a. Determined OPERABLE at least once per 7 days by verifying correct breaker alignments, indicated power availability, and
- b. Demonstrated OPERABLE at least once per 18 months during shutdown by transferring (manually and automatically) unit power supply from the normal circuit to the alternate circuit.

4.8.1.1.2 Each diesel generator shall be demonstrated OPERABLE:

- a. In accordance with the frequency specified in Table 4.8-1 on a STAGGERED TEST BASIS by:
 - 1. Verifying the fuel level in the day fuel tank.
 - 2. Verifying the fuel level in the fuel storage tank.

ELECTRICAL POWER SYSTEM

SURVEILLANCE REQUIREMENTS (Continued)

3. Verifying the fuel transfer pump can be started and transfers fuel from the storage system to the day tank.
 4. Verifying the diesel starts from ambient condition and accelerates to at least 900 rpm in ≤ 15 seconds.
 5. Verifying the generator is synchronized, loaded to 2850 Kw in ≤ 60 seconds, and operates for ≥ 60 minutes.
 6. Verifying the diesel generator is aligned to provide standby power to the associated emergency busses.
- b. At least once per 92 days by verifying that a sample of diesel fuel from the fuel storage tank obtained in accordance with ASTM-D270-65, is within the acceptable limits specified in Table 1 of ASTM D975-74 when checked for viscosity, water and sediment.
- c. At least once per 18 months during shutdown by:
1. Subjecting the diesel to an inspection in accordance with procedures prepared in conjunction with its manufacturer's recommendations for this class of standby service.
 2. Verifying that the automatic sequence time delay relays are OPERABLE at their setpoint $\pm 10\%$ of the elapsed time for each load block.
 3. Verifying the generator capability to reject a load of ≥ 596 kw and maintain voltage at 4160 ± 500 volts and frequency at 60 ± 3 Hz.
 4. Verifying the generator capability to reject a load of 2850 Kw without exceeding 75% of the difference between nominal speed and the overspeed trip setpoint, or 15% above nominal, whichever is lower.
 5. Simulating a loss of offsite power by itself, and:
 - a) Verifying de-energization of the emergency busses and load shedding from the emergency busses.



ENGINEERING REPORT

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Fairbanks Morse
Engine DivisionFILE
NUMBER VTS-985-072282-02RSUBJECT ARKANSAS POWER & LIGHT, ARKANSAS NUCLEAR ONE-UNIT 2
FAIRBANKS MORSE OPPOSED PISTON 12 CYL 38TD8 1/8 ENGINES
RATED 2850 KW @ 900RPM - STANDBY POWER SUPPLY SERVICE

DATE July 22, 1982

PREPARED
BY V.T. StonehockerREPORT
TITLE VOLTAGE DIP AND FREQUENCY DEVIATION PREDICTIONS
FOR VARIOUS LOADINGS AND LOAD SITUATIONSAPPROVED
BYGENERAL:

This report covers a computer study of the effect of loads on the 12 cylinder 38TD 8-1/8 x 10 OP diesel engine furnished to Arkansas Power and Light under FM Sales Order (S.O.) 205925. The study includes an analysis of the customer's loads as defined on Bechtel Drawing 6600-2, E-2021, Revision 0. The study also includes investigations of possible loadings that could be allowed on these units while not exceeding the parameters of Nuclear Regulatory Commission Guide Line 1.9, which states: "The diesel generator unit design should be such that at no time during the loading sequence should the frequency and voltage decrease to less than 95 percent of nominal and 75 percent of nominal, respectively" and further; "Frequency should be restored to within 2 percent of nominal, and voltage should be restored to within 10 percent of nominal within 60 percent of each load-sequence time interval." (Under earlier guide lines, recovery was required in 40% of the time interval).

This study consisted of three (3) parts, as follows. The first part consisted of adjusting the computer program and/or its basic input parameters such that the computer predicted output was substantially the same as observed engine-generator set performance (This process is referred to as "normalizing"):

The second part consisted of reducing the customer's data to a form acceptable for program input. This consisted primarily of extracting data from the motor speed/torque curve, load table (E-2021) and customer furnished motor data tables, and forming tables of data on computer input coding sheets.

The third phase consisted of inputting various loading combinations into the program and analyzing the data for determining the load acceptance capability of the engine within the limits of the stated guide line.

These three parts will now be discussed in detail.

NORMALIZING COMPUTER PROGRAM

The basic computer program was originally developed and normalized to the Colt-Pielstick (°C2) engine to also fit the observed results obtained with the opposed piston (OP) engine type.

Figure 2 shows the computer output against the observed results after the program and parameter adjustments were completed.

The program was then run for the customer's data with no further adjustments to the basic parameters.

Rev. 1 - SKVA for 480V motors corrected to 480 volt (was originally calculated on 460 volt).

Numerous corrections per AP&L letter of Aug. 17, 1982

Addition on page 5 of discussion of effect of overlapping of loads.

Addition of new Figure 2, Figures 3&4 renumbered from 2&3.

VTS 9/30/82



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DATE July 22, 1982	
PREPARED BY V.T. Stonehocker	
APPROVED BY	

Fairbanks Morse
Engine Division

SUBJECT ARKANSAS POWER & LIGHT, ARKANSAS NUCLEAR ONE-UNIT 2
FAIRBANKS MORSE OPPOSED PISTON 12 CYL 38TD8 1/8 ENGINES
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REPORT TITLE VOLTAGE DIP AND FREQUENCY DEVIATION PREDICTIONS
FOR VARIOUS LOADINGS AND LOAD SITUATIONS

ANALYSIS OF CUSTOMER'S LOAD TABLE

The load tables were analyzed and loadings regrouped into time slots for each of the load conditions, i.e. Loss of Coolant Accident (LOCA), Main Steam Line Rupture (MSLR), and Loss of Offsite Power (LOP). This data is summarized in Table I. This data forms the basis for the load step inputs (Coding Sheet 2) for the program (See Appendix A).

Where motor torque data was available, generally in the form of the speed vs torque curve, this data was reduced to a tabular form at 5% speed increments. This is included in Appendix A (on Coding Sheet No. 3).

Where motor data was not available or where motors were of a small rating, a "standard motor" was assumed. A standard motor is one having a two (2) second acceleration time and having a load profile as follows:

Time-Seconds	"Standard Motor"	Loading
0		1.2 *MKW (120%)
.5		1.2 *MKW (120%)
1.0		1.3 *MKW (130%)
1.5		1.6 *MKW (160%)
1.7		2.0 *MKW (200%)
1.8		2.5 *MKW (250%)
1.9		2.5 *MKW (250%)
2.00		1.0 *MKW (100%)

Where MKW = Motor HP * .746 / .9 and the motor is assumed to take 2 seconds to obtain rated speed. This table results in a degree of severity of 148%, which is a number in the range derived from the analysis of several known motors.

$$\text{Degree of Severity} = \frac{\text{Mean KW during acceleration} * 100}{\text{KW of motor at rated output}}$$

To use the "Standard motor", it is only necessary to define the motor size MHP2, and set FLG02 at 2. The program takes care of all calculations otherwise necessary for its purposes.



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FOR VARIOUS LOADINGS AND LOAD SITUATIONSPREPARED
BY V.T. StonehockerAPPROVED
BY

Where a small motor is started simultaneously with a large motor, the small motor HP is added to the large motor HP and then this combined HP (KW) is used in the calculation using the speed-torque data for the large motor. [This has been analyzed to be the worst case condition. If the small motor were to pull in at a time differing from the large motor, either earlier or later, the net effect would be less severe]. "Standard" motors are assumed where indicated in the following table.

Step	Time/Sec	- MOTORS HP OR STD -			Notes
		LOCA	MSLR	LOP	
1	0	Std(140)	Std(135)	Std(81/181)	
2	4.5 or 5.5	800	800	800	
3	10	600	600	-	
4	15	450/500	450/500	450/500	1
5	20	150(2x75)	150	-	
6	25	455	455	-	2
7	50	105	105	105	3
8	60	105	105	105	3
9	70	Std(50/100)	Std(50/100)	Std(40/90)	
10	80	Std(41/37)	Std(41/37)	Std(36/32)	
11	90	Std(25)	Std(635/35)	Std(610/10)	
12	>120	118/98)	Std(97)	Std(107)	

- Notes 1. 500 HP was used in all computations. (Unit 1/Unit 2)
 2. 450 HP motor S/T curve at 455 HP
 3. 100 HP motor S/T curve at 105 HP

Where the locked rotor current was given, inrush power (SKVA) was calculated on the basis of the locked rotor current using

$$SKVA = I_{LR} * E * \sqrt{3} / 1000.$$

For all others, SKVA was assumed

$$SKVA = 6.5 * HP \text{ rating.}$$

 (1 KVA / HP).

The running load (KW-R Load in Table 1) of motor was taken from Drawing E-2021. Where that was not given, it was assumed to equal

$$MKWS = HP * .746 / .9 \text{ (90\% motor efficiency assumed).}$$



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PREPARED
BY V.T. StonehockerAPPROVED
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Inertia of the motors (WR^2) was generally not given. A value was assumed using a formula developed from the values of several known motors. Examination of the first computer runs indicated too short an acceleration rate on some motors. The WR^2 value was then adjusted to a value that would give a motor acceleration time a small amount (10%) larger than the values for acceleration noted in the motor data.

All of this data is summarized on Table I and/or on the coding sheets (Appendix A).

After examining the data, it was decided to run the program for the following conditions:

- 1) Unit 2 under LOCA conditions because of the 100 HP loading at Step 9. Otherwise, this is the same as Unit 1 LOCA, and very similar results would be expected.
- 2) Unit 1 under MSLR conditions because of the 635 HP loading at Step 11. Otherwise, this is the same as Unit 2 MSLR and very similar results would be expected.
- 3) Unit 1 under LOP conditions because of the 610 HP loading at Step 11. Otherwise, this is the same as Unit 2 LOP and very similar results would be expected.

Tables II, III and IV summarize the results for the conditions indicated above.

It should be noted that none of the loadings analyzed resulted in the unit having a frequency deviation large enough to exceed 2% (98% nominal value). The 800 and 600 HP motors do result in a significant voltage dip but not exceeding the guide line value.

A plotting of the frequency and voltage versus time curves is possible from the data derived from the computer printout, but it was not deemed appropriate to do so for the small values noted. It should be noted that loads that result in a maximum frequency deviation of less than .25% be disregarded entirely as they are smaller than the accuracy of the process of calculation. The computer printouts are included as appendix B.

The frequency recovers in a short enough time that there should be no problem with these units, in regard to meeting the NCR parameters as stated in the first paragraph of this report. None of the loads analyzed resulted in a frequency deviation greater than 2% (deviation to 98% of nominal), and therefore the frequency recovery is effectively "zero" in all cases. The voltage recovery is also very short (generally less than 1/2 second) and therefore poses no problem.



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FAIRBANKS MORSE OPPOSED PISTON 12 CYL 38TD8 1/8 ENGINES
RATED 2850 KW @ 900RPM - STANDBY POWER SUPPLY SERVICE

DATE July 22, 1982

PREPARED BY V.T. Stonehocker

REPORT TITLE VOLTAGE DIP AND FREQUENCY DEVIATION PREDICTIONS
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APPROVED BY

Of special concern to the customer, was the case where, due to time drift, set-ability or repeatability of the sequencing control relays, motors of one step might overlap or coincide with the start of motors from the next step. The customer had indicated that timer accuracy was subject to an error or variance of plus or minus ten percent (+/- 10%). [Letter GE-82-35 dtd Apr 5, 1982].

Figure 2 shows, in bar chart form, the period of time during which the loads of each step may occur (within +/- 10% of the prescribed time). It may be noted that there is no overlap on loadings before Step 7, and there is the possibility of overlap on all steps beyond Step 7 (except step 11 and 12 - step 12 is manual loads, and is not considered a viable case).

Since there are a great many possibilities to consider in this overlapping situation, it was decided to analyze only the worst case conditions, and only those where the resulting loading would be great. The worst case condition occurs when there is coincidence of loadings. Every other condition will be less severe. It has been observed from actual test results, that additional loadings added to a unit after the point that the governor and voltage regulator have been fully turned on, are accepted by the engine with little additional effect. (The rate of recovery is reduced and the time of recovery is extended somewhat, but the maximum deviations are not significantly altered.)

Table V gives the detail of the loads for these overlapping or coincidental situations. While there is not the possibility of an exact coincidence for overlapping of the loads of Steps 5 and 6, these loads are close enough to have some effect on each other. The worst case condition of coincidence was therefore assumed for this step as well. Since the worst case conditions for coincidence of Steps 7 and 8, or 8 and 9, or 9 and 10, or 10 and 11 for the LOCA case, still resulted in very small loadings, these were not specifically analyzed. The loadings shown in the boxes were analyzed by inputting the appropriate data to the computer program. The results for these loads are shown in Table VI.

No problems are evident with these loads that would indicate the unit's inability to perform within the parameters of the NRC guideline.



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PREPARED
BY V.T. StonehockerREPORT
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BY ENGINE CAPABILITYVoltage Capability

The voltage acts independently of the frequency for small (within 10%) deviations of frequency, and is primarily influenced only by the inrush of current to which the machine is subjected. The amount of voltage dip is also not significantly influenced by the load on the unit. (However, the rate of recovery of the voltage is influenced by the load on the unit). Therefore, the voltage dip capability can be calculated directly if the amount of SKVA is known. For a given voltage dip allowable, the permissible SKVA can be calculated. The formulae are as follows:

$$ED = \text{Voltage Dip} = \frac{100}{1 + \frac{KVA * 100}{SKVA * CX''d}}$$

$$SKVA = \frac{KVA * 100}{\frac{100}{ED} - 1 * CX''d}$$

Where SKVA = Inrush power = $I_{LR} * V * \sqrt{3} / 1000$, or $6.5 * HP$
 KVA = Generator Rated KVA
 $CX''d = (X'_{du} - X''_{du}) * 2/3 + X''_{du}$
 Where X'_{du} = Transient reactance
 X''_{du} = Subtransient reactance.

Frequency/Load Capability

A series of computations were run wherein the base load level was held constant for various levels of loads added. The results were tabulated (See Table V - Appendix B) and the values were plotted and interpolated to determine the maximum load that could be added to a unit already loaded to some base value without exceeding the 5% frequency deviation (95% of nominal value). The results of these tabulations are shown in Figures 3 and 4.

Figure 3 shows the load that can be added to a base load without exceeding 5% frequency deviation, regardless of the recovery time (Note: Recovery time is indicated along the top edge of the curved line). Any loading within the enclosed area is acceptable.

Figure 4 shows the loads acceptable if there is a restriction of time involved. Note that this may result in less capability than the 5% frequency deviation (shown by the dashed line).

None of the loads in the customer's load table approached these load restrictions.



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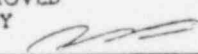
Fairbanks Morse
Engine DivisionFILE
NUMBER VTS-985-072282-02R

SUBJECT ARKANSAS POWER & LIGHT, ARKANSAS NUCLEAR ONE-UNIT 2
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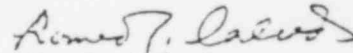
In using this information to estimate the size of future loads, when those loads involve motors, the following technique should be used:

1. Calculate the motor KW = Motor HP * .746/.9 and sum all motors for that step.
2. Multiply motor HP by 1.5 (typical severity factor), particularly if the motors are known to require more than 1 to 1.5 second to accelerate to speed.
3. Add any other (KW) load to the motor loads and use this as the "Load Addition" for Figure 3 or 4.

NOTE: In checking this report and reviewing the inputs used for No Load Field Voltage, Full Load Field Voltage and Maximum Field Voltage (lines 6, 7 & 8 of Appendix B1) (also see Coding Sheets - Appendix A1), a .5 multiplier was used. However, because these voltages are converted into per unit values (using Full Load Field Volts as a base) in their usage throughout this computer program, this .5 multiplier cancelled out in the process of conversion to per unit values.

VERIFICATION

I have reviewed the equations on which this report is based and verified the inputs against those tabulated on Bechtel dwg. E-2021 Rev. 0, and thereby confirm that this report is applicable and correct.


R. T. Calud
9/27/82



ENGINEERING REPORT

Fairbanks Morse
Engine Division

FILE NUMBER VTS-985-072282-02R

SUBJECT ARKANSAS POWER & LIGHT, ARKANSAS NUCLEAR ONE-UNIT 2
FAIRBANKS MORSE OPPOSED PISTON 12 CYL 38TD8 1/8 ENGINES
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PREPARED BY V. T. Stonehocker

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APPROVED BY *[Signature]*

TABLE I

LOAD STEP SUMMARIES

Load Step 1 - Time = ∅	HP	KW	SKVA	KW R LOAD	UNIT NO. 1			UNIT NO. 2		
					LOCA	MSLR	LOP	LOCA	MSLR	LOP
Mtr OP Valves (10 Sec ACC)	100 (80)**	83 (66)	650† (520)	83 (66)	X	X	-	X	X	-
Nucl Stm Sup Sys Inst	(40)	33	-		Xr	Xr	Xr	Xr	Xr	Xr
120V Reg Inst Bus	(27)	22	-		Xr	Xr	Xr	Xr	Xr	Xr
Battery Chargers	(200)	166	-		Xr	Xr	Xr	Xr	Xr	Xr
Control Rm Emerg Air Filt Fan	5	4	33†	4	X	-	-	X	-	-
⊙Turb Turn Gr Oil Pur. [2 only]	40	33	241	33	-	-	-	-	-	X
⊙Turb Turn Gr [2 only]	60	57/39	382/217	50	-	-	-	-	-	X
⊙Oil Lift Pump (3x5)	15	12	115	12	-	-	X	-	-	X
⊙Main FW Pump Turb Turn Gr	2	2	21	2	-	-	X	-	-	X
⊙Main FW Pump (AC LO Pump)	20	17	130†	17	-	-	X	-	-	X
⊙Computer Inverter (40 KVA)	(30)	25	(332)		Xr	Xr	Xr	Xr	Xr	Xr
Diesel Gen Start Air Comp (2x5)	10	8.2	70	8.2	X	X	X	X	X	X
Reactor Clnt Pump Lift Pumps	8.6	7	56†	7	-	-	X	-	-	X
Swgr Rm Exh Fans	25	21	149	21	X	X	X	X	X	X
Total HP Motors					140	135	81	140	135	181
AKW Loads					246	246	246	246	246	246
SKVA					902	869	541	902	869	1164
Running KW					116	112	67	116	112	150

SKVA = LRA * V * √3 or 6.5 * HP†
KW = HP * .746/.9

⊙ Non-1E Loads

* Assumption

† Values calculated by 6.5 * HP are indicated †

KW R Load = KW Running Load - Taken from Dwg. #-2021.

Where not given, motor KW is used.

Numbers in parenthesis in HP columns given as HP in motor data tables, assumed to be KW loading - KW = .746 X HP/.9

** Notes with motor data indicates 80 1HP motors.

Xr considered as resistive load only.



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APPROVED BY

TABLE I - (CONT'D)

LOAD STEP SUMMARIES

Step	Description	HP	KW	SKVA	KW R LOAD	UNIT NO. 1			UNIT NO. 2		
						LOCA	MSLR	LOP	LOCA	MSLR	LOP
<u>Step 2 - Time = 4.5 or 5.5 Seconds</u>											
	Service Water Pump	800	663	4921	622	X	X	X	X	X	X
<u>Step 3 - Time = 10 Sec</u>											
	High Press Safety Inj Pump	600	497	3531	390	X	X	-	X	X	-
<u>Step 4 - Time = 15 Sec</u>											
	Low Press Safety Inj Pump										
	Diesel Unit 1	450	373	2623	352	X		X	-	-	-
	Diesel Unit 2	500**	414	2954	352	-	-	-	X		X
					166		X				
					166					X	
<u>Step 5 - Time = 20 Sec</u>											
	Containment Cl Fans (2x75)	150	124.3	1044	124	X	X	-	X	X	-
<u>Step 6 - Time = 25 Sec</u>											
	Cont Spray Pumps	450	373	2695	373	X	X	-	X	X	-
	NaOH Add Pump	5	4	35	4	X	X	-	X	X	-
	Totals	455	377	2730	377						
<u>Steps 7 & 8 @ 50 Sec & 60 Sec</u>											
	Charging Pumps	100	82.8	499	61	X	X	X	X	X	X
	Charging Pump Rm Unit Clr	5	4	37.4	4	X	X	X	X	X	X
	Totals	105	87	536	65						

Use L/T vs SPD for CP @ 105 HP.

** Use in all computations, all units.



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TABLE I - (CONT'D)

LOAD STEP SUMMARIES

LOAD STEP SUMMARIES	HP	KW	SKVA	KW R LOAD	UNIT NO. 1			UNIT NO. 2		
					LOCA	MSLR	LOP	LOCA	MSLR	LOP
Step 9 - Time = 70 Sec Diesel 2 only										
Boric Acid Makeup Pump (2x25)	50	41.4	284	41.4	-	-	-	X	X	X
Emerg DG Exh Fan (2x15)	30	25	176	25	X	X	X	X	X	X
Intk Struct Exh Fan	10	8.3	67	8.3	X	X	X	X	X	X
Pent Rm Exh Fan	10	8.3	65†	8.3	X	X	-	X	X	-
			Total HP		50	50	40	100	100	90
			SKVA		308	308	243	592	592	527
			R Load		42	42	33	83	83	75
Step 10 - Time = 80 Sec										
Shutdown Ht Exch Rm U Clr (2x10)	20	16.6	133	16.6	X	X	X	X	X	X
Swgr Rm Unt Clrs (2x5)	10	8.3	75	8.3	X	X	X	X	X	X
HPSI Pump Rm U Clr	5	4.1	36	4.1	X	X	-	X	X	-
Aux Bldg Elec Rm U Clr [1]	5	4.1	37	4.1	X	X	X	-	-	-
Aux Bldg Elec Rm U Clr [2]	1	1	6.9	1	-	-	-	X	X	X
Boric Acid M.U. Pump Rm U Clr	1	1	12	1	X	X	X	X	X	X
			Total HP		42	42	37	37	37	32
			SKVA		288	281	254	252	252	218
			R Load		35	35	31	31	31	27
Step 11 - Time = 90 Sec										
Emerg FW Pump [Diesel 1 only]	600	497	3516	435	-	X	X	-	-	-
Emerg FW Pump Rm Clr	10	8.3	67	8.3	-	X	X	-	X	X
Elec Equip Rm Exh Fan	25	20.7	149	20.7	X	X	-	X	X	-
			Total HP		25	635	610	25	35	10
			SKVA		149	3732	3583	149	216	67
			R Load		21	464	443	21	29	8



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FAIRBANKS MORSE OPPOSED PISTON 12 CYL 38TD8 1/8 ENGINES
RATED 2850 KW @ 900RPM - STANDBY POWER SUPPLY SERVICE

DATE July 22, 1982

PREPARED BY V.T. Stonehocker

REPORT TITLE VOLTAGE DIP AND FREQUENCY DEVIATION PREDICTIONS
FOR VARIOUS LOADINGS AND LOAD SITUATIONS

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TABLE I - (CONT'D)

LOAD STEP SUMMARIES

Step 12 & Beyond - > 2 Min	HP	KW	SKVA	KW R LOAD	UNIT NO. 1			UNIT NO. 2		
					LOCA	MSLR	LOP	LOCA	MSLR	LOP
Press Prop Htrs (200 HP)	(200)	166	-	-	-	-	Xr	-	-	Xr
Hydrogen Recomb (100 HP)	(100)	83	-	-	Xr	-	-	Xr	-	-
Boric Acid Tank (Pipe Htrs(50 HP)	(50)	41	-	-	-	-	Xr	-	-	Xr
Contrl Rm AC Comp	50	41.4	301	41.4	X	X	X	X	X	X
Cavity Clg Fan	40	33.2	283	4	-	-	X	-	-	X
Cont Bldg Recirc Fan (2x15)	30	24.9	193	24.9	X	X	-	X	X	-
Control Rm AC Unit	10	8.2	67	8.2	X	X	X	X	X	X
Hydr Purge Sup & Exh Fans (2x10)	20	16.4	135	16.4	X	-	-	-	-	-
Elec Rm Unit Clr	3	2.5	19.5†	2.5	X	X	X	X	X	X
Battery Rm Exh Fan	2	1.7	18.3	1.7	X	X	X	X	X	X
Diesel Oil Trans Pump	2	1.7	13.0†	1.7	X	X	X	X	X	X
Hyd Purge Sys Seal Wtr Pump	1	1	11	1	X	-	-	X	-	-
				Total HP	118	97	107	98	97	107
				SKVA	758	612	702	623	612	702
				R Load	98	80	60	81	80	60
				AKW	83	Ø	207	83	Ø	207



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TABLE II

SUMMARY OF LOAD TABLE - LOCA CONDITIONS

UNIT 2 RESULTS GIVEN

Step No. Time*	UNITS												
	1	2	3	4	5	6	7	8	9	10	11	12	
	Ø	4.5(5.5)	10	15	20	25	50	60	70	80	90	120	
Existing Load	KW	Ø	362	984	1292	1644	1768	2145	2210	2275	2316(2358)	2350(2389)	2371(2410)
Added KW Load	KW	246	Ø	[-83]	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	83
Motor HP	HP	140	800	600	450(500)	150	455	105	105	50(100)	42(37)	25	118(98)
KW	KW	116	663	497	373(414)	124	377	87	87	41(83)	35(31)	21	98(81)
Running KW	KW	116	622	390	352	124	377	65	65	41(83)	35(31)	21	98(81)
Final Loading	KW	362	984	1292	1644	1768	2145	2210	2275	2316(2358)	2350(2389)	2371(2410)	2552(2574)
SKVA	SKVA	902	4921	3531	2623(2954)	1044	2730	536	536	308(592)	288(252)	149	758(623)
Corrected SKVA	CSKVA	965	4921	3531	2623(2954)	1044	2730	536	536	308(592)	288(252)	143	773(639)
Results **													
Voltage Dip	%	4.95	21.0	16.0	13.8	5.34	12.8	2.81	2.81	3.10	1.34	.80	3.34
Time @ Max Dip	Sec	.03	.13	.10	.09	.03	.08	.02	.02	.02	.01	.005	.02
Time @ 90%	Sec	-	.33	.21	.15	-	.13	-	-	-	-	-	-
Time @ recov.	Sec	.10	.50	.36	.31	.11	.29	.06	.06	.06	.03	.02	.07
Frequency Dip	%	.57	1.22	.76	.78	.50	.72	.33	.33	.17	.10	.09	.27
Time @ Max Dip	Sec	.44	.40	.41	.42	.51	.42	.58	.58	.59	.95	1.22	.05
Time @ 98%	Sec	-	-	-	-	-	-	-	-	-	-	-	-
Time @ Recov.	Sec	1.26	1.09	.91	1.05	.72	.95	.69	.69	.64	.97	1.24	.63

* Time from initiation of start signal (+/- 10%). (Numbers in parenthesis are for Unit 2.)
** Time from point of step change.



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PREPARED BY V.T. Stonehocker
APPROVED BY *[Signature]*

TABLE III

SUMMARY OF LOAD TABLE - MSLR CONDITIONS

UNIT 1 RESULTS GIVEN

Step No. Time*	UNITS												
	1	2	3	4	5	6	7	8	9	10	11	12	
Existing Load	Ø	358	980	1287	1453	1577	1954	2019	2084	2126(2167)	2161(2198)	2625(2227)	
Added KW Load	246	Ø	[-83]	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	
Motor HP	135	800	600	450(500)	150	455	105	105	50(100)	42(37)	635(35)	97	
KW	112	663	497	373(414)	124	377	87	87	42(83)	35(31)	526(29)	80	
Running KW	112	622	390	166	124	377	65	65	42(83)	35(31)	464(29)	80	
Final Loading	358	980	1287	1453	1577	1954	2019	2084	2126(2167)	2161(2198)	2625(2227)	2705(2307)	
SKVA	869	4921	3531	2623(2954)	1044	2730	536	536	308(592)	288(252)	3732(216)	612	
Corrected SKVA	953	4921	3531	2623(2954)	1044	2730	536	536	308(592)	288(252)	3732(216)	612	
Results**													
Voltage Dip	%	4.80	21.0	16.0	13.8	5.34	12.8	2.80	2.80	1.64	1.53	16.8	3.20
Time @ Max Dip	Sec	.03	.13	.10	.09	.03	.08	.02	.02	.01	.01	.11	.02
Time @ 90%	Sec	-	.33	.21	.15	-	.13	-	-	-	-	.23	-
Time @ recov.	Sec	.10	.50	.36	.31	.11	.29	.06	.06	.03	.03	.39	.07
Frequency Dip	%	.57	1.22	.76	.78	.50	.72	.33	.33	.12	.11	.69	.16
Time @ Max Dip	Sec	.44	.40	.41	.42	.51	.42	.58	.58	.80	.88	.59	.52
Time @ 90%	Sec	-	-	-	-	-	-	-	-	-	-	-	-
Time @ Recov.	Sec	1.26	1.09	.91	1.05	.72	.96	.69	.69	.83	.91	.83	.68

* Time from initiation of start signal (+/- 10%). (Numbers in parenthesis are for Unit 2.)
** Time from point of step change.



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TABLE IV

SUMMARY OF LOAD TABLE - LOP CONDITIONS UNIT 1 RESULTS GIVEN

Step No.	UNITS	UNIT 1 RESULTS GIVEN								
		1	2	3	4	5	6	7	8	9
Time*	Sec	∅	4.5/5.5	15	50	60	70	80	90	> 2 Min.
Existing Load	KW	∅	313(396)	935(1018)	1287(1370)	1352(1435)	1417(1500)	1450(1575)	1481(1602)	1924(1610)
Added KW Load	KW	246	∅	∅	∅	∅	∅	∅	∅	207
Motor HP	HP	81(101)	800	450(500)	105	105	40(90)	37(32)	610(10)	107
	KW	67(150)	663	373(414)	87	87	33(75)	31(27)	443(8)	60
Running KW	KW	67(150)	622	352	65	65	33(75)	31(27)	443(8)	60
Final Loading	KW	313(396)	935(1018)	1287(1370)	1352(1435)	1417(1500)	1450(1575)	1481(1602)	1924(1610)	2191(1877)
SKVA	SKVA	541(1164)	4921	2623(2954)	536	536	243(527)	254(218)	3583(67)	702
Corrected SKVA	CSKVA	621(1220)	4921	2623(2954)	536	536	243(527)	254(218)	3583(67)	731
Results**										
Voltage Dip	%	3.25	21.0	13.8	2.8	2.8	1.17	1.35	16.2	3.80
Time @ Max Dip	Sec	.02	.13	.09	.02	.02	.01	.01	.10	.02
Time @ 90%	Sec	-	.33	.15	-	-	-	-	.21	-
Time @ recov.	Sec	.07	.50	.31	.06	.06	.03	.03	.37	.08
Frequency Dip	%	.50	1.22	.78	.34	.34	.11	.10	.68	.42
Time @ Max Dip	Sec	.45	.40	.42	.57	.57	.89	.94	.41	.47
Time @ 90%	Sec	-	-	-	-	-	-	-	-	-
Time @ Recov.	Sec	1.30	1.09	1.01	.69	.69	.93	.95	.86	.64

* Time from initiation of start signal. (Numbers in parenthesis are for Unit 2.)
 ** Time from point of step change.



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FOR VARIOUS LOADINGS AND LOAD SITUATIONSPREPARED
BY V.T. StonehockerAPPROVED
BY

TABLE V

TIMES OF CONCURRENT LOADINGS OR SIGNIFICANT OVERLAP
(Worst Case Condition Occurs on Concurrence of Loads)

OVERLAPS	LOCA	MSLR	LOOP
Steps 5&6 20-25 Sec (.5 Sec GAP)	EXLD 1644 KW MHP $150 + 455 = 605$ HP MLKW $124 + 377 = 501$ KW SKVA $1001 + 2728 = 3729$	1453 Same as LOCA	N/A
Steps 7&8 50-60 Sec (1 Sec OL)	EXLD 2145 MHP $105+105=210$ MLKW $65+65=130$ SKVA $613+613=1226$	1954 Same as LOCA	1287 Same as LOCA
Steps 8&9 60-70 Sec (3 Sec OL)	EXLD 2210 MHP $105+50(100)=155(205)$ MLKW $65+41(8)=106(148)$ SKV $613+299(571)=912(1184)$	Same as LOCA	$105+40(90)=145(190)$ $65+33(75)=98(140)$ $613+234(506)=849(1117)$
Steps 9&10 70-80 Sec (5 Sec OL)	EXLD 2275 MHP $50(100)+41(37)=91(137)$ MLKW $41(83)+34(31)=75(114)$ SKVA $299(571)+281(246)=580(817)$	2084 Same as LOCA	1417(1500) $40(90)+36(32)=76(122)$ $33(75)+30(27)=66(102)$ $234(506)+248(212)=482(718)$
Steps 10&11 80-90 Sec (7 Sec OL)	EXLD 2316(2358) MHP $41(37)+25=66(62)$ MLKW $34(31)+21=55(52)$ SKVA $281(246)+143=424(389)$	$2125(2167)$ $41(37)+635(35)=676(72)$ $34(31)+464(29)=498(60)$ $282(246)+3722(206)=4004(452)$	$1450(1575)$ $36(32)+610(10)=646(42)$ $30(27)+443(8)=473(35)$ $248(212)+3580(64)=3828(276)$

EXLD = Existing Load
MHP = Motor Horsepower Ratings
MLKW = Motor Running Load - KW
SKVA = Inrush KVA



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TABLE VI

SPECIAL CASES - OVERLAPPING OR CONCURRENT LOADINGS

LOAD TABLE		LOCA	MSLR	LOOP
Steps Merged		586	10511	7-8
Time Range	Sec	20-25	80-90	80-90
Overlap/Gap	Sec	.5 Gap	7 Sec Overlap	7 Sec Overlap
Existing Load		1644	2125	1450
Motor HP		605	676	646
Running Load		501	498	473
CSKVA Inrush		3729	4004	3828
<u>Results**</u>				
Voltage Dip	%	16.8	17.8	17.1
Time @ Max Dip	Sec	.11	.11	.11
Time @ 90% Rec.	Sec	.23	.25	.24
Time @ recov.	Sec	.39	.42	.40
Frequency Dip	%	1.22	.90	.85
Time @ Max Dip	Sec	.41	.40	.41
Time @ 90% Rec.	Sec	-	-	-
Time @ Recov.	Sec	1.46	.91	.93



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TABLE VII

% Base Load	Added Load	Net %	Max. % Dev.	Recover TDMX	Added Load To		
					3 Second Limit	5% Limit	100% Limit
0	0	75	3.82	1.3	79.5		
0	0	80	4.52	1.5			
0	0	85	5.35	1.8		83	
0	0	90	6.31	2.0			
0	0	95	7.39	2.3			
10	285	75	4.76	1.8	71.5		
	285	80	5.71	2.0		76.3	
	285	85	6.81	2.3			
	285	90	8.06	2.6			
20	570	65	3.83	1.6	65		
	1995	70	4.70	1.9			
	2138	75	5.73	2.2		71.5	
	2280	80	6.93	2.5			
25	712.5	25	1.01	.42			
	1425	50	2.16	1.9			
	1568	55	2.66	1.2			
	1710	60	3.31	1.5			
	1853	65	4.12	1.8			62.5
	1995	70	5.09	2.1		69.5	
	2137.5	75	6.23	2.40			
30	855	55	2.79	1.3			
	1710	60	3.52	1.6			
	1853	65	4.40	1.9			60.3
	1995	70	5.47	2.30		68	
40	1140	50	2.38	1.2			
	1568	55	3.05	1.5			56.6
	1710	60	3.90	1.9			
	1853	65	4.95	2.3			
	1995	70	6.22	2.7		65.2	
50	1425	50	2.48	1.3			54.
	1565	55	3.23	1.7			
	1710	60	4.21	2.2			
	1853	65	5.28	2.8			
	1995	70	6.42	3.5			

est 63
13% @ 20 sec not recovering
20% @ 20 sec not recovering

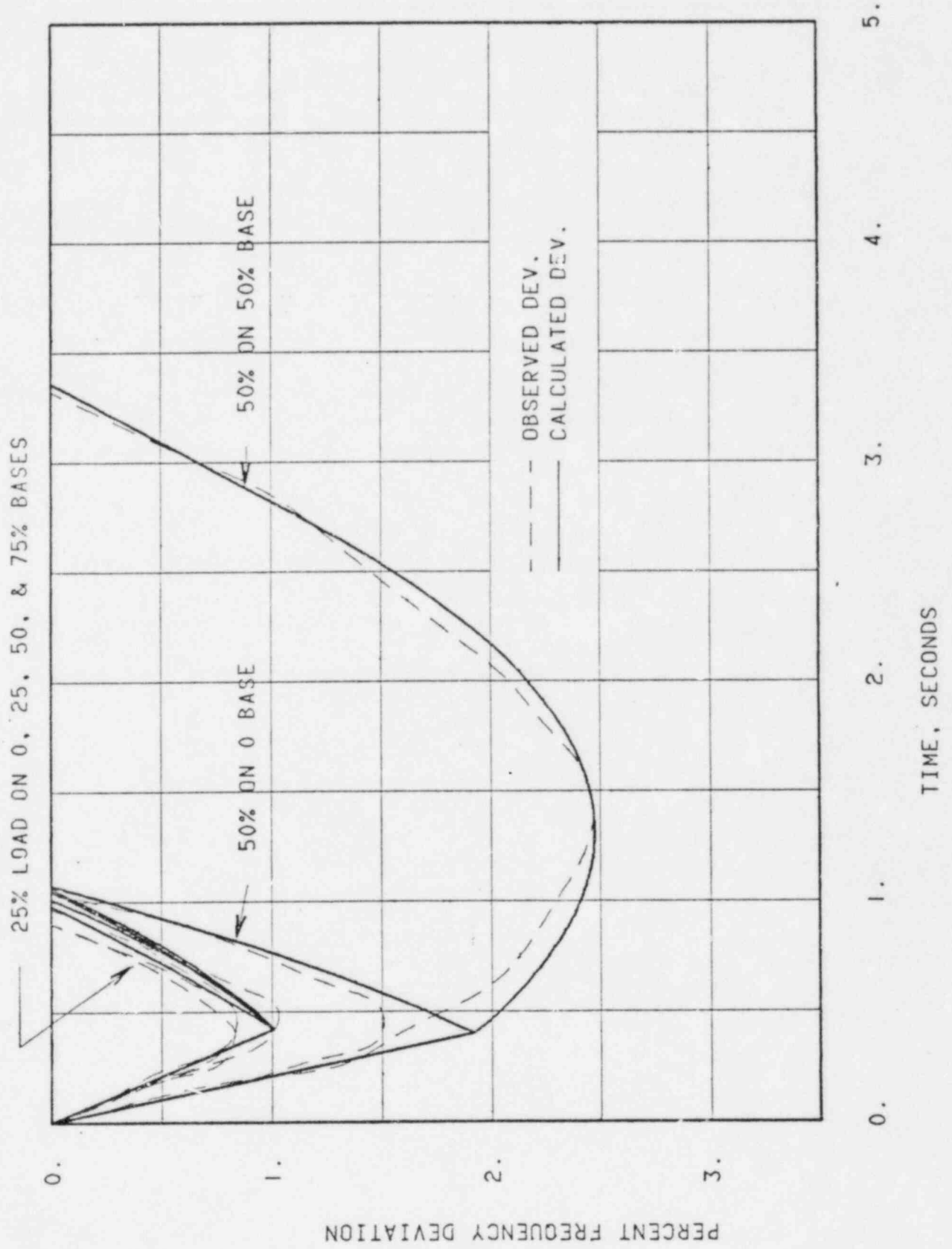


FIGURE 1. OP ENGINE BASIC DATA CURVE FIT. 2850 KW @ 900 RPM, 34572 WRSO.

DIETZEN CORPORATION
 MADE IN U.S.A.

NO. 333-20 DIETZEN GRAPH PAPER
 20 X 20 PER INCH

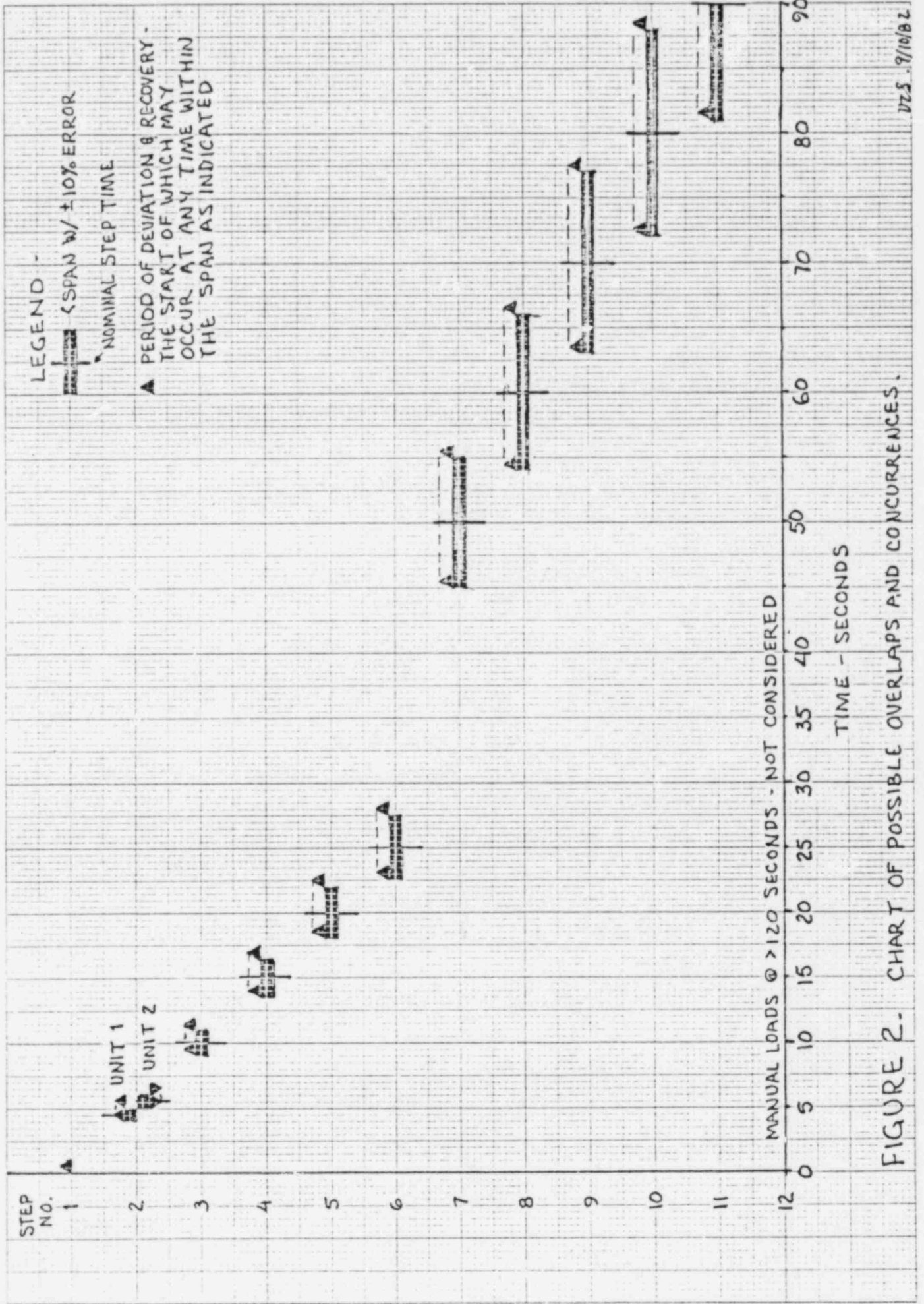


FIGURE 2. CHART OF POSSIBLE OVERLAPS AND CONCURRENCES.

VTS-9/10/82

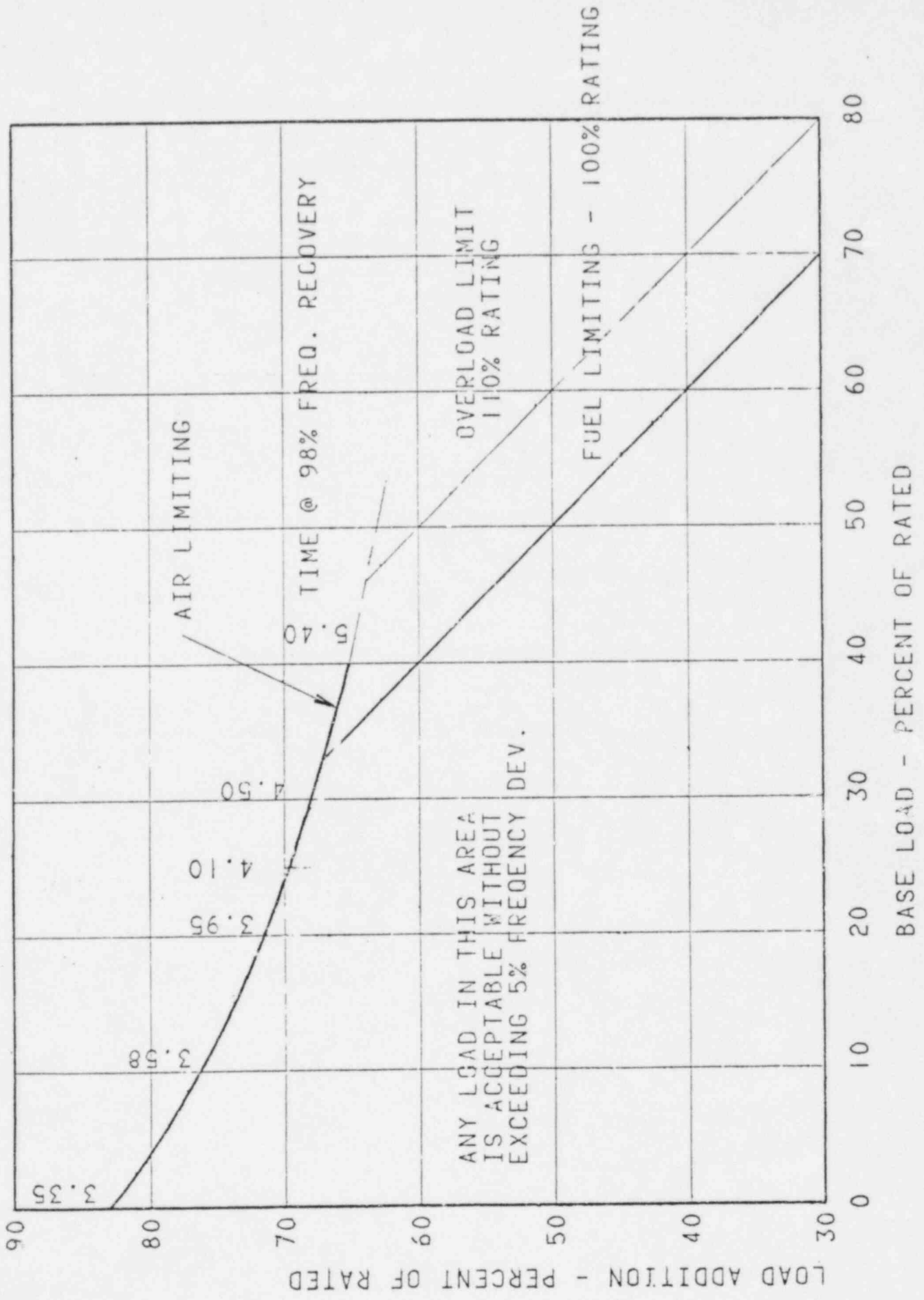


FIGURE 3. OP ENGINE CAPABILITY. 2850 KW @ 900 RPM, 34572 WR2.

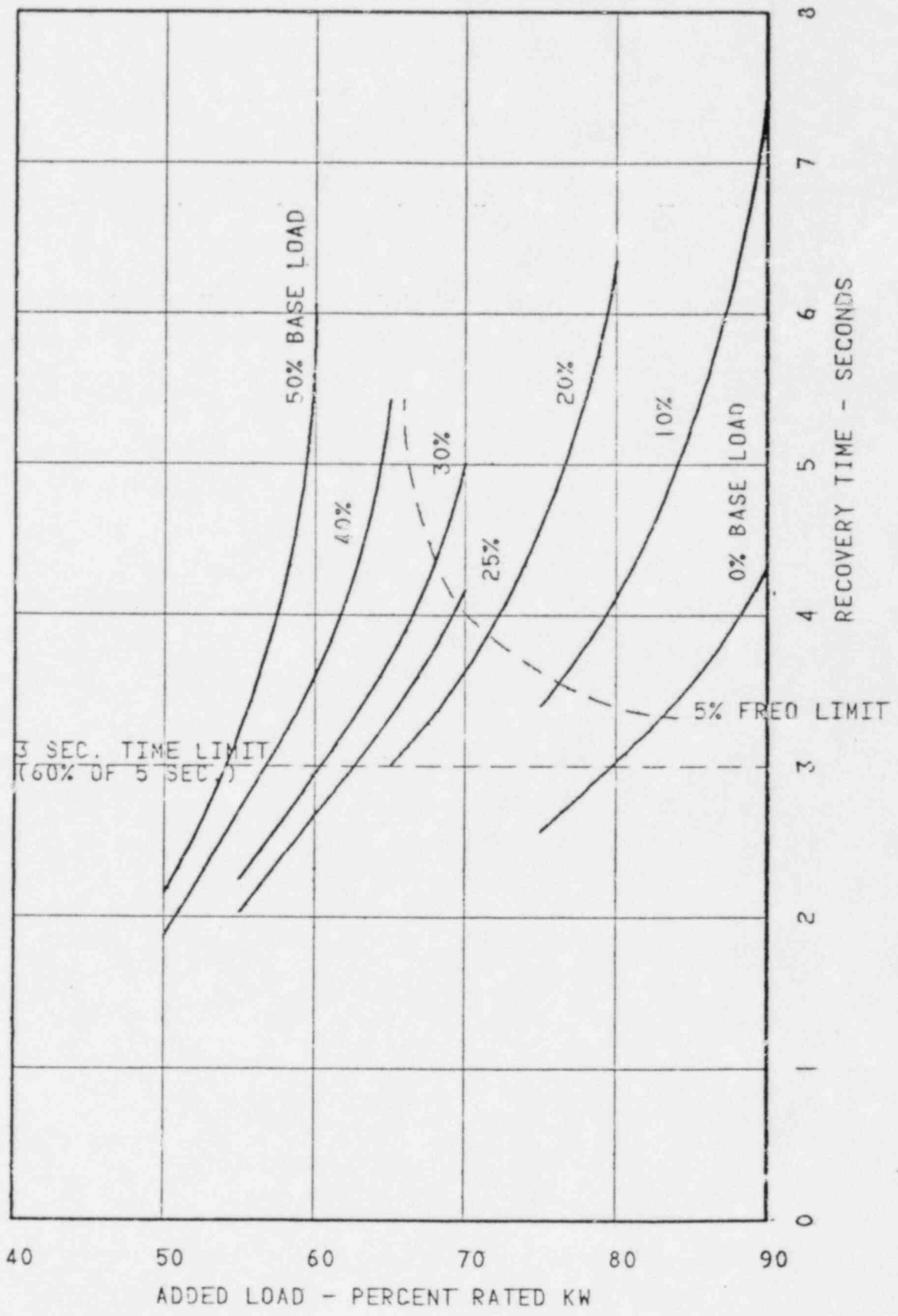


FIGURE 4. OP ENGINE LOAD CAPABILITY AND LIMITS
2850 KW AT 900 RPM, 34572 WRSQ

FREQUENCY AND VOLTAGE EXCURSION
PREDICTION PROGRAM - AN320010

Input data coding sheets:

Sheet 1.

Input data - Format 8F10.0 (Enter a Decimal Point in All Numbers)

(Read 1)	Symbol	Columns	Value
Transient Reactance	X'du	01-10	26.2
Sub-Transient Reactance	X"du	11-20	13.4
Generator Time Constant	T'do	21-30	5.08
Percent Recovery Voltage	RXV	31-40	90
Full Load Field Volts	FLFV	41-50	72
No Load Field Volts	NLFV	51-60	52
Maximum Field Volts-Forcing	MXFV	61-70	45.5
Generator Rated KVA	GRKVA	71-80	4063

(Read 2)	Symbol	Columns	Value
Engine Rated Load - KW	ERKW	01-10	2850
Engine Rated Speed - RPM	ERPM	11-20	900
Number of Cylinders	CYL	21-30	12
Percent Overload Capability	POL	31-40	120
Strokes per Cycle	SPC (2 or 4)	41-50	2
Engine-Generator Inertia Lb-Ft-Sq	EWR2	51-60	34572.5
Percent Recovery Frequency	RXF	61-70	98
Rack Dead Time Constant	RDTCT (.015)	71-80	.027

(Read 3)	Symbol	Columns	Value
Exciter Recovery Constant	ERC (5 to 10)	01-10	5
Generator Dip Constant	GDC (1667)	11-20	1667
System Dip Constant	SCN (575)	21-30	420
Percent Base Load Constant	XML (.45) Dec	31-40	51
Load Recovery Constant	LRR (.125) "	41-50	25
Time Increment - Seconds	TINC (.1)	51-60	1
Voltage Overshoot Constant	VOSC (.6) Dec	61-70	6
Friction Horsepower Ratio	FHPR (.15) "	71-80	15

(Read 4)	Symbol	Columns	Value
Governor Dead Band	GDB (.1 - .25)	01-10	.1
Flag 20 - See Note 4, Sht 2	FLG20	11-20	2
Exponent of Existing Load**	EXLF (1.- 2.)	21-30	1.5
Turbocharger Constant**	TURBO	31-40	1
Turbo-Charger Rate Factor**	TCRF	41-50	95
Gov. Proportionality Rate Factor	GPRF (1.-1.5)	51-60	1.35
		61-70	
		71-80	

** See Note 5, Sheet 2.

LOAD DATA FOR STEP No. 1.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Loca Value	MSLR	
Existing Load - KW	EKW	01-10	0	-	-
Added Load - KW See Note 1	AKW	11-20	246	-	-
In Rush Load - Motor Starting	SKVA	21-30	902	-	-
Motor Horse Power-See Note 2 & 3	MHP1	31-40	140	-	-
New Time, Start of Step - Sec	NTM	41-50	0	-	-
				CASE	I I II

- NOTES:
- For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 - Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 - MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 - Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 - For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input 0.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Expontential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is not used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (precent decay as a decimal)
raised to the reciprical of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the last step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist of at least one /* card.

Composite

Sheet 4

MOTOR DATA FOR STEP No. 1, MOTOR No. 1.
 If this sheet is used, do not use a Sheet 3 for the same step.

MOTOR DATA - Alternate Method - KW vs Time Data. See Sht 3 for Primary Method.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	1800
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	150
Motor Horsepower	MHP2	21-30	140
Motor Load in KW-Running Load	MLKW	31-40	116
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	75

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag	FLG01	01-10	0
Cube Curve Motor Load Calculation	FLG03	11-20	0
Motor Load in KW vs TIME	FLG02 (Note 8)	21-30	2

LOCA	MSCR
---	---
---	---
---	---
---	---
---	---
CASE I	II

NOTES: 8. Use a "2" for defining a "Standard Motor". Data is not required. Omit Time and KW data below. If Motor Definition data is put in (above), it will not be used in any of the calculations.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

Column	TIME	Column	LOAD - KW
(Read 8b1)		(Read 9b1)	
1	01-10	01-10	---
2	11-20	11-20	---
3	21-30	21-30	---
4	31-40	31-40	---
5	41-50	41-50	---
6	51-60	51-60	---
7	61-70	61-70	---
8	71-80	71-80	---
(Read 8b2)		(Read 9b2)	
9	01-10	01-10	---
10	11-20	11-20	---
11	21-30	21-30	---
12	31-40	31-40	---
13	41-50	41-50	---
14	51-60	51-60	---
15	61-70	61-70	---
16	71-80	71-80	---
(Read 8b3)		(Read 9b3)	
17	01-10	01-10	---
18	11-20	11-20	---
19	21-30	21-30	---
20	31-40	31-40	---
21	41-50	41-50	---

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - - /*.

LOAD DATA FOR STEP No. 2.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Loca Value	MSLR
Existing Load - KW	EKW	01-10	362.1	358.
Added Load - KW See Note 1	AKW	11-20	0.	---
In Rush Load - Motor Starting	SKVA	21-30	4921.	---
Motor Horse Power-See Note 2 & 3	MHP1	31-40	800.	---
New Time, Start of Step - Sec	NTM	41-50	4.5 (5.5)	---
			CASE I	II

- NOTES:
- For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 - Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 - MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 - Use $FLG20 = 0$ for the case of no accumulated resistive loading or when no effect is desired.
If $FLG20 = 1$, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
If $FLG20 = 2$, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 - For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input 0.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Expontential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is % used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (precent decay as a decimal)
raised to the reciprical of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the lsst step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist fo at least one /* card.

MOTOR DATA FOR STEP No. 2, MOTOR No. 1.

Sheet 3

If this sheet is used, do not use a Sheet 4 for the same step.

MOTOR DATA - 21 sets maximum per motor. Terminate last motor of a step with /*.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	885.
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	551 5000.
Motor Horsepower	MHP2	21-30	800.
Motor Load in KW-Running Load	MLKW	31-40	622.
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	75.

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag (Note 6)	FLG01	01-10	∅.
Cube Curve Motor Load Calculation	FLG03 (Note 6)	11-20	∅.
Motor Load in KW vs TIME (Sheet 4)	FLG02 (Note 7)	21-30	∅.

- NOTES: 6. If Load-Torque data is to be inputted, Cols 01-10 & 11-20, must be ∅. Otherwise, put a 1 in Cols 01-10, or 11-20, but NOT both.
7. Use Sheet 4 for data in the form of KW (or KVA) versus TIME.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

Percent Speed	Column (Read 8a1)	Percent Motor Torque from Curve	Column (Read 9a1)	Percent Load Torque from Curve
1	∅	100.	01-10	15.
2	5	100.	11-20	8.
3	10	100.	21-30	4.
4	15	100.	31-40	3.
5	20	100.	41-50	4.
6	25	100.	51-60	6.
7	30	100.	61-70	9.
8	35	100.	71-80	13.
		(Read 8a2)	(Read 9a2)	
9	40	100.	01-10	17.
10	45	100.	11-20	20.
11	50	100.	21-30	26.
12	55	100.	31-40	31.
13	60	100.	41-50	35.
14	65	100.	51-60	40.
15	70	100.	61-70	48.
16	75	107.	71-80	56.
		(Read 8a3)	(Read 9a3)	
17	80	135.	01-10	62.
18	85	169.	11-20	72.
19	90	198.	21-30	80.
20	95	189.	31-40	90.
21	100	100.	41-50	98.

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - /*.

LOAD DATA FOR STEP No. 3.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Value	LocA	MSLR
Existing Load - KW	EKW	01-10	984		980
Added Load - KW See Note 1	AKW	11-20	0		
In Rush Load - Motor Starting	SKVA	21-30	3531		
Motor Horse Power-See Note 2 & 3	MHP1	31-40	600		
New Time, Start of Step - Sec	NTM	41-50	10		
				CASE I	II

- NOTES:
- For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 - Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 - MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 - Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 - For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input 0.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is not used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (percent decay as a decimal)
raised to the reciprical of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the lsst step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist fo at least one /* card.

MOTOR DATA FOR STEP No. 3, MOTOR No. 1.
 If this sheet is used, do not use a Sheet 4 for the same step.

MOTOR DATA - 21 sets maximum per motor. Terminate last motor of a step with /*.
 LOCA MSCR (same).

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	3525
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	174
Motor Horsepower	MHP2	21-30	600
Motor Load in KW-Running Load	MLKW	31-40	390
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	22

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag (Note 6)	FLG01	01-10	0
Cube Curve Motor Load Calculation	FLG03 (Note 6)	11-20	0
Motor Load in KW vs TIME (Sheet 4)	FLG02 (Note 7)	21-30	0

- NOTES: 6. If Load-Torque data is to be inputted, Cols 01-10 & 11-20, must be 0. Otherwise, put a 1 in Cols 01-10, or 11-20, but NOT both.
 7. Use Sheet 4 for data in the form of KW (or KVA) versus TIME.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

Percent Speed	Column (Read 8a1)	Percent Motor Torque from Curve	Column (Read 9a1)	Percent Load Torque from Curve
1	0	70	01-10	15
2	5	71	11-20	19
3	10	73	21-30	5
4	15	74	31-40	4
5	20	76	41-50	4
6	25	78	51-60	6
7	30	81	61-70	8
8	35	84	71-80	10
		(Read 8a2)	(Read 9a2)	
9	40	88	01-10	14
10	45	93	11-20	17
11	50	106	21-30	22
12	55	123	31-40	26
13	60	141	41-50	31
14	65	156	51-60	37
15	70	166	61-70	43
16	75	172	71-80	50
		(Read 8a3)	(Read 9a3)	
17	80	175	01-10	57
18	85	173	11-20	64
19	90	168	21-30	72
20	95	157	31-40	80
21	100	100	41-50	88

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - /*

UNIT - 1 - 500HP

UNIT - 2 - 450HP

~~SHEET~~

MOTOR DATA FOR STEP No. 4, MOTOR No. . Sheet 3
 If this sheet is used, do not use a Sheet 4 for the same step.

MOTOR DATA - 21 sets maximum per motor. Terminate last motor of a step with /*.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	178 ϕ
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	329. (311.6)
Motor Horsepower	MHP2	21-30	500 (450)
Motor Load in KW-Running Load	MLKW	31-40	352 166.
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	75

CASE I II

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag (Note 6)	FLG01	01-10	ϕ
Cube Curve Motor Load Calculation	FLG03 (Note 6)	11-20	ϕ
Motor Load in KW vs TIME (Sheet 4)	FLG02 (Note 7)	21-30	ϕ

NOTES: 6. If Load-Torque data is to be inputted, Cols 01-10 & 11-20, must be ϕ . Otherwise, put a 1 in Cols 01-10, or 11-20, but NOT both.
 7. Use Sheet 4 for data in the form of KW (or KVA) versus TIME.

USE 500HP DATA FOR ALL STEPS

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

Percent Speed	Column (Read 8a1)	Percent Motor Torque from Curve 500HP	Column (Read 9a1)	Percent Load Torque from Curve 450HP
1	01-10	100	01-10	13
2	11-20	102	11-20	8
3	21-30	103	21-30	5
4	31-40	104	31-40	4
5	41-50	107	41-50	4
6	51-60	110	51-60	5
7	61-70	113	61-70	7
8	71-80	117	71-80	9
(Read 8a2)				
9	01-10	121	01-10	12
10	11-20	125	11-20	15
11	21-30	132	21-30	19
12	31-40	142	31-40	24
13	41-50	164	41-50	28
14	51-60	182	51-60	33
15	61-70	193	61-70	38
16	71-80	198	71-80	44
(Read 9a2)				
17	01-10	200	01-10	50
18	11-20	196	11-20	57
19	21-30	185	21-30	62
20	31-40	162	31-40	72
21	41-50	100	41-50	78

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - /*

LOAD DATA FOR STEP No. 5.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	LOCA Value	MSLR
Existing Load - KW	EKW	01-10	1644.	1453.
Added Load - KW See Note 1	AKW	11-20	0.	
In Rush Load - Motor Starting	SKVA	21-30	1044.	
Motor Horse Power-See Note 2 & 3	MHP1	31-40	150.	
New Time, Start of Step - Sec	NTM	41-50	20.	
			CASE I	II

- NOTES:
1. For a load rejection (Off-Load) situation, the value should include a minus (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
 If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
 If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 5. For Turbocharged engines, for TURBO, input 1.
 For blower scavenged or naturally aspirated engines, input 0.
 For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
 For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
 (For N/A or Blower Scavenged, EXLF is not used)
 For TCRF, input .7 for a decay rate of 50% in 2 seconds,
 or calculate factor as follows: (precent decay as a decimal)
 raised to the reciprical of the time (in seconds) for that decay
 will give factor to put in as TCRF.

Use the following only if this is the last step of the program run:

End of Data - enter a /* as the last physical input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist of at least one /* card.

2*75 = 150 HP
CONTAINMENT CLR FANS.
Sheet 3

MOTOR DATA FOR STEP No. 5, MOTOR No. 1.
If this sheet is used, do not use a Sheet 4 for the same step.

MOTOR DATA - 21 sets maximum per motor. Terminate last motor of a step with /*.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	1190
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	340
Motor Horsepower	MHP2	21-30	150
Motor Load in KW-Running Load	MLKW	31-40	124
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	75

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag (Note 6)	FLG01	01-10	0
Cube Curve Motor Load Calculation	FLG03 (Note 6)	11-20	1
Motor Load in KW vs TIME (Sheet 4)	FLG02 (Note 7)	21-30	0

- NOTES: 6. If Load-Torque data is to be inputted, Cols 01-10 & 11-20, must be 0. Otherwise, put a 1 in Cols 01-10, or 11-20, but NOT both.
7. Use Sheet 4 for data in the form of KW (or KVA) versus TIME.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

Percent Speed	Column (Read 8a1)	Percent Motor Torque from Curve	Column (Read 9a1)	Percent Load Torque from Curve
1	0	01-10	187	01-10
2	5	11-20	218	11-20
3	10	21-30	231	21-30
4	15	31-40	230	31-40
5	20	41-50	222	41-50
6	25	51-60	219	51-60
7	30	61-70	218	61-70
8	35	71-80	215	71-80
		(Read 8a2)		(Read 9a2)
9	40	01-10	212	01-10
10	45	11-20	209	11-20
11	50	21-30	204	21-30
12	55	31-40	201	31-40
13	60	41-50	197	41-50
14	65	51-60	194	51-60
15	70	61-70	189	61-70
16	75	71-80	189	71-80
		(Read 8a3)		(Read 9a3)
17	80	01-10	188	01-10
18	85	11-20	201	11-20
19	90	21-30	231	21-30
20	95	31-40	260	31-40
21	100	41-50	190	41-50

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - /*.

LOAD DATA FOR STEP No. 6.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Loca Value	MSLA
Existing Load - KW	EKW	01-10	1768'	1577
Added Load - KW See Note 1	AKW	11-20	0.	
In Rush Load - Motor Starting	SKVA	21-30	2.730 .2730	
Motor Horse Power-See Note 2 & 3	MHP1	31-40	452.	
New Time, Start of Step - Sec	NTM	41-50	25.	
			CASE I	II

NOTES: 1. For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.

- Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
- MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
- Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
- For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input 0.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is not used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (percent decay as a decimal)
raised to the reciprical of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the lsst step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist fo at least one /* card.

MOTOR DATA FOR STEP No. 6, MOTOR No. 1.
If this sheet is used, do not use a Sheet 4 for the same step.

Sheet 3

MOTOR DATA - 21 sets maximum per motor. Terminate last motor of a step with /*.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	<u>178</u> ϕ . - - - - -
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	<u>335</u> . - - - - -
Motor Horsepower	MHP2	21-30	<u>455</u> . - - - - -
Motor Load in KW-Running Load	MLKW	31-40	<u>377</u> . - - - - -
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	<u>75</u> . - - - - -

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag (Note 6)	FLG01	01-10	- - - - - ϕ -
Cube Curve Motor Load Calculation	FLG03 (Note 6)	11-20	- - - - - ϕ -
Motor Load in KW vs TIME (Sheet 4)	FLG02 (Note 7)	21-30	- - - - - ϕ .

NOTES: 6. If Load-Torque data is to be inputted, Cols 01-10 & 11-20, must be ϕ .
Otherwise, put a 1 in Cols 01-10, or 11-20, but NOT both.
7. Use Sheet 4 for data in the form of KW (or KVA) versus TIME.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

Percent Speed	Column (Read 8a1)	Percent Motor Torque from Curve	Column (Read 9a1)	Percent Load Torque from Curve	
1	0	01-10	100.	01-10	15.
2	5	11-20	101.	11-20	16.
3	10	21-30	104.	21-30	7.
4	15	31-40	106.	31-40	5.
5	20	41-50	109.	41-50	5.
6	25	51-60	112.	51-60	6.
7	30	61-70	115.	61-70	9.
8	35	71-80	119.	71-80	12.
		(Read 8a2)		(Read 9a2)	
9	40	01-10	125.	01-10	17.
10	45	11-20	130.	11-20	21.
11	50	21-30	137.	21-30	26.
12	55	31-40	152.	31-40	32.
13	60	41-50	172.	41-50	37.
14	65	51-60	184.	51-60	44.
15	70	61-70	194.	61-70	51.
16	75	71-80	198.	71-80	58.
		(Read 8a3)		(Read 9a3)	
17	80	01-10	198.	01-10	66.
18	85	11-20	192.	11-20	75.
19	90	21-30	192.	21-30	82.
20	95	31-40	180.	31-40	93.
21	100	41-50	100.	41-50	98.

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - - /*.

LOAD DATA FOR STEP No. 798.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	7 LOCA Value	MSLR	8 LOCA	MSLR
Existing Load - KW	EKW	01-10	2145	1954	2210	2019
Added Load - KW See Note 1	AKW	11-20	0	---	---	---
In Rush Load - Motor Starting	SKVA	21-30	536	---	---	---
Motor Horse Power-See Note 2 & 3	MHP1	31-40	105	---	---	---
New Time, Start of Step - Sec	NTM	41-50	50	---	60	---
			CASE I	II	I	II

NOTES: 1. For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.

2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.

3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.

4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.

5. For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input 0.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is not used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (precent decay as a decimal)
raised to the reciprical of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the lsst step of th: program run:

End of Data - enter a /* as the last physical input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist fo at least one /* card.

MOTOR DATA FOR STEP No. 7 & 8, MOTOR No. 1/1.
If this sheet is used, do not use a Sheet 4 for the same step.

Sheet 3

MOTOR DATA - 21 sets maximum per motor. Terminate last motor of a step with /*.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	1725
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	85
Motor Horsepower	MHP2	21-30	105
Motor Load in KW-Running Load	MLKW	31-40	65
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	25

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag (Note 6)	FLG01	01-10	0
Cube Curve Motor Load Calculation	FLG03 (Note 6)	11-20	1
Motor Load in KW vs TIME (Sheet 4)	FLG02 (Note 7)	21-30	0

NOTES: 6. If Load-Torque data is to be inputted, Cols 01-10 & 11-20, must be 0. Otherwise, put a 1 in Cols 01-10, or 11-20, but NOT both.
7. Use Sheet 4 for data in the form of KW (or KVA) versus TIME.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

Percent Speed	Column (Read 8a1)	Percent Motor Torque from Curve	Column (Read 9a1)	Percent Load Torque from Curve
1	0	01-10	258	01-10
2	5	11-20	242	11-20
3	10	21-30	227	21-30
4	15	31-40	216	31-40
5	20	41-50	207	41-50
6	25	51-60	197	51-60
7	30	61-70	189	61-70
8	35	71-80	183	71-80
		(Read 8a2)		(Read 9a2)
9	40	01-10	176	01-10
10	45	11-20	171	11-20
11	50	21-30	166	21-30
12	55	31-40	162	31-40
13	60	41-50	161	41-50
14	65	51-60	161	51-60
15	70	61-70	164	61-70
16	75	71-80	168	71-80
		(Read 8a3)		(Read 9a3)
17	80	01-10	177	01-10
18	85	11-20	193	11-20
19	90	21-30	213	21-30
20	95	31-40	193	31-40
21	100	41-50	100	41-50

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - /*

LOAD DATA FOR STEP No. 9.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Loca Value	MSLR
Existing Load - KW	EKW	01-10	2275.	2084.
Added Load - KW See Note 1	AKW	11-20	∅	
In Rush Load - Motor Starting	SKVA	21-30 #1	308.	308.
Motor Horse Power-See Note 2 & 3	MHP1	31-40 #1	5∅	50.
New Time, Start of Step - Sec	NTM	41-50	7∅	
			CASE ← I II	

- NOTES:
- For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 - Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 - MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 - Use FLG2∅ = ∅ for the case of no accumulated resistive loading or when no effect is desired.
If FLG2∅ = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
If FLG2∅ = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 - For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input ∅.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Expontential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is not used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (precent decay as a decimal)
raised to the reciprical of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the last step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run,
prior to the /* card (provided as part of the "Execute Job Control")
should consist of at least one /* card.

MOTOR DATA FOR STEP No. 9, MOTOR No. 1.

Sheet 4

If this sheet is used, do not use a Sheet 3 for the same step.

MOTOR DATA - Alternate Method - KW vs Time Data. See Sht 3 for Primary Method.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	1800
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	50
Motor Horsepower	MHP2	21-30	500 #1 (100) #2
Motor Load in KW-Running Load	MLKW	31-40	41 (83)
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	75
			CASE II
(Read 7)			
Unloaded Motor Flag	FLG01	01-10	0
Cube Curve Motor Load Calculation	FLG03	11-20	0
Motor Load in KW vs TIME	FLG02 (Note 8)	21-30	2. I STD

NOTES: 8. Use a "2" for defining a "Standard Motor". Data is not required. Omit Time and KW data below. If Motor Definition data is put in (above), it will not be used in any of the calculations.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

	Column	TIME	Column	LOAD - KW
	(Read 8b1)		(Read 9b1)	
1	01-10	-----	01-10	-----
2	11-20	-----	11-20	-----
3	21-30	-----	21-30	-----
4	31-40	-----	31-40	-----
5	41-50	-----	41-50	-----
6	51-60	-----	51-60	-----
7	61-70	-----	61-70	-----
8	71-80	-----	71-80	-----
	(Read 8b2)		(Read 9b2)	
9	01-10	-----	01-10	-----
10	11-20	-----	11-20	-----
11	21-30	-----	21-30	-----
12	31-40	-----	31-40	-----
13	41-50	-----	41-50	-----
14	51-60	-----	51-60	-----
15	61-70	-----	61-70	-----
16	71-80	-----	71-80	-----
	(Read 8b3)		(Read 9b3)	
17	01-10	-----	01-10	-----
18	11-20	-----	11-20	-----
19	21-30	-----	21-30	-----
20	31-40	-----	31-40	-----
21	41-50	-----	41-50	-----

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - /*.

LOAD DATA FOR STEP No. 10.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Loca #1 Value	Loca #2 Value	MCLR #1 Value	MCLR #2 Value
Existing Load - KW	EKW	01-10	2316	(2358)	2126	(2167)
Added Load - KW See Note 1	AKW	11-20	Ø	---	---	---
In Rush Load - Motor Starting	SKVA	21-30	288	(252)	288	(252)
Motor Horse Power-See Note 2 & 3	MHP1	31-40	42	(37)	42	(37)
New Time, Start of Step - Sec	NTM	41-50	Ø	---	---	---

CASE I | II

- NOTES:
1. For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 4. Use FLG2Ø = Ø for the case of no accumulated resistive loading or when no effect is desired.
 If FLG2Ø = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
 If FLG2Ø = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 5. For Turbocharged engines, for TURBO, input 1.
 For blower scavenged or naturally aspirated engines, input Ø.
 For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
 For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
 (For N/A or Blower Scavenged, EXLF is not used)
 For TCRF, input .7 for a decay rate of 50% in 2 seconds,
 or calculate factor as follows: (percent decay as a decimal)
 raised to the reciprical of the time (in seconds) for that decay
 will give factor to put in as TCRF.

Use the following only if this is the last step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist of at least one /* card.

MOTOR DATA FOR STEP No. 10, MOTOR No. 1/1.
 If this sheet is used, do not use a Sheet 3 for the same step.

Sheet 4

MOTOR DATA - Alternate Method - KW vs Time Data. See Sht 3 for Primary Method.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	<u>1800</u>
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	<u>56</u>
Motor Horsepower	MHP2	21-30	<u>42</u> (<u>37</u>)
Motor Load in KW-Running Load	MLKW	31-40	<u>35</u> (<u>31</u>)
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	<u>25</u>

CASE II I

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag	FLG01	01-10	<u>0</u>
Cube Curve Motor Load Calculation	FLG03	11-20	<u>0</u>
Motor Load in KW vs TIME	FLG02 (Note 8)	21-30	<u>2</u> <u>I</u> <u>STD</u>

NOTES: 8. Use a "2" for defining a "Standard Motor". Data is not required. Omit Time and KW data below. If Motor Definition data is put in (above), it will not be used in any of the calculations.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

	Column	TIME	Column	LOAD - KW
	(Read 8b1)		(Read 9b1)	
1	01-10	-----	01-10	-----
2	11-20	-----	11-20	-----
3	21-30	-----	21-30	-----
4	31-40	-----	31-40	-----
5	41-50	-----	41-50	-----
6	51-60	-----	51-60	-----
7	61-70	-----	61-70	-----
8	71-80	-----	71-80	-----
	(Read 8b2)		(Read 9b2)	
9	01-10	-----	01-10	-----
10	11-20	-----	11-20	-----
11	21-30	-----	21-30	-----
12	31-40	-----	31-40	-----
13	41-50	-----	41-50	-----
14	51-60	-----	51-60	-----
15	61-70	-----	61-70	-----
16	71-80	-----	71-80	-----
	(Read 8b3)		(Read 9b3)	
17	01-10	-----	01-10	-----
18	11-20	-----	11-20	-----
19	21-30	-----	21-30	-----
20	31-40	-----	31-40	-----
21	41-50	-----	41-50	-----

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - /*

LOAD DATA FOR STEP No. 11.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	LOCAL #1 #2		MSLR #1 #2	
			Value			
Existing Load - KW	EKW	01-10	2350	(2389)	2161	(2198)
Added Load - KW See Note 1	AKW	11-20	0			
In Rush Load - Motor Starting	SKVA	21-30	143		3732	(216)
Motor Horse Power-See Note 2 & 3	MHP1	31-40	25		635	(35)
New Time, Start of Step - Sec	NTM	41-50	90			
CASE I					#	

- NOTES:
- For a load rejection (Off-Load) situation, the value should include a minus (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 - Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 - MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 - Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 - For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input 0.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is not used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (percent decay as a decimal)
raised to the reciprical of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the last step of the program run:

End of Data - enter a /* as the last physical input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist of at least one /* card.

MOTOR DATA FOR STEP No. 11, MOTOR No. 1.
 If this sheet is used, do not use a Sheet 3 for the same step.

MOTOR DATA - Alternate Method - KW vs Time Data. See Sht 3 for Primary Method.

(Read 6)	Symbol	Columns
Motor Speed - RPM	MRPM	01-10
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20
Motor Horsepower	MHP2	21-30
Motor Load in KW-Running Load	MLKW	31-40
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50

Value.	MSLR #1	#2
1860	660	35.
25	635	35.
25	464	29.
25		

LOC #2
MSLR #1
CASE I
CASE II

(Read 7)	Symbol	Columns
Unloaded Motor Flag	FLG01	01-10
Cube Curve Motor Load Calculation	FLG03	11-20
Motor Load in KW vs TIME	FLG02 (Note 8)	21-30

---	0	0
---	0	0
---	2	1

STO

NOTES: 8. Use a "2" for defining a "Standard Motor". Data is not required. Omit Time and KW data below. If Motor Definition data is put in (above), it will not be used in any of the calculations.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

	Column (Read 8b1)	TIME	Column (Read 9b1)	LOAD - KW
1	01-10	-----	01-10	-----
2	11-20	-----	11-20	-----
3	21-30	-----	21-30	-----
4	31-40	-----	31-40	-----
5	41-50	-----	41-50	-----
6	51-60	-----	51-60	-----
7	61-70	-----	61-70	-----
8	71-80	-----	71-80	-----
	(Read 8b2)		(Read 9b2)	
9	01-10	-----	01-10	-----
10	11-20	-----	11-20	-----
11	21-30	-----	21-30	-----
12	31-40	-----	31-40	-----
13	41-50	-----	41-50	-----
14	51-60	-----	51-60	-----
15	61-70	-----	61-70	-----
16	71-80	-----	71-80	-----
	(Read 8b3)		(Read 9b3)	
17	01-10	-----	01-10	-----
18	11-20	-----	11-20	-----
19	21-30	-----	21-30	-----
20	31-40	-----	31-40	-----
21	41-50	-----	41-50	-----

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - - /*.

LOAD DATA FOR STEP No. 12.

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	LOCA #1 Value	#2	MSLR #1	#2
Existing Load - KW	EKW	01-10	2321	(2410)	2625	(2227)
Added Load - KW See Note 1	AKW	11-20	83		φ	φ
In Rush Load - Motor Starting	SKVA	21-30	258	(623)	612.	
Motor Horse Power-See Note 2 & 3	MHP1	31-40	118	(98)	97	
New Time, Start of Step - Sec	NTM	41-50	12φ			

CASE I | II

- NOTES:
1. For a load rejection (Off-Load) situation, the value should include a minus (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
 If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
 If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 5. For Turbocharged engines, for TURBO, input 1.
 For blower scavenged or naturally aspirated engines, input 0.
 For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
 For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
 (For N/A or Blower Scavenged, EXLF is not used)
 For TCRF, input .7 for a decay rate of 50% in 2 seconds, or calculate factor as follows: (percent decay as a decimal) raised to the reciprocal of the time (in seconds) for that decay will give factor to put in as TCRF.

Use the following only if this is the last step of the program run:

End of Data - enter a /* as the last physical input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist of at least one /* card.

MOTOR DATA FOR STEP No. 12, MOTOR No. 1.
 If this sheet is used, do not use a Sheet 3 for the same step.

Sheet 4

MOTOR DATA - Alternate Method - KW vs Time Data. See Sht 3 for Primary Method.

(Read 6)	Symbol	Columns	Loca Value. 12	MSCR 12
Motor Speed - RPM	MRPM	01-10	1800	
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	100	
Motor Horsepower	MHP2	21-30	118 (98)	97
Motor Load in KW-Running Load	MLKW	31-40	98 (81)	80
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	75	
CASE I				
(Read 7)			CASE I	
Unloaded Motor Flag	FLG01	01-10		0
Cube Curve Motor Load Calculation	FLG03	11-20		0
Motor Load in KW vs TIME	FLG02 (Note 8)	21-30	2	1

NOTES: 8. Use a "2" for defining a "Standard Motor". Data is not required. Omit Time and KW data below. If Motor Definition data is put in (above), it will not be used in any of the calculations.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

	Column TIME (Read 8b1)	Column LOAD - KW (Read 9b1)
1	01-10	01-10
2	11-20	11-20
3	21-30	21-30
4	31-40	31-40
5	41-50	41-50
6	51-60	51-60
7	61-70	61-70
8	71-80	71-80
9	(Read 8b2)	(Read 9b2)
10	01-10	01-10
11	11-20	11-20
12	21-30	21-30
13	31-40	31-40
14	41-50	41-50
15	51-60	51-60
16	61-70	61-70
17	71-80	71-80
18	(Read 8b3)	(Read 9b3)
19	01-10	01-10
20	11-20	11-20
21	21-30	21-30
22	31-40	31-40
23	41-50	41-50

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - (1*)

1* end.

LOAD DATA FOR STEP No. LOP-1.

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Value
Existing Load - KW	EKW	01-10	ϕ
Added Load - KW See Note 1	AKW	11-20	246
In Rush Load - Motor Starting	SKVA	21-30	541 541 (1164) (181)
Motor Horse Power-See Note 2 & 3	MHP1	31-40	81
New Time, Start of Step - Sec	NTM	41-50	ϕ

- NOTES:
1. For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
 If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
 If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 5. For Turbocharged engines, for TURBO, input 1.
 For blower scavenged or naturally aspirated engines, input 0.
 For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
 For PC Turbo, input EXLF = 2. (Expontential) or fit to suit.
 (For N/A or Blower Scavenged, EXLF is not used)
 For TCRF, input .7 for a decay rate of 50% in 2 seconds,
 or calculate factor as follows: (precent decay as a decimal)
 raised to the reciprical of the time (in seconds) for that decay
 will give factor to put in as TCRF.

Use the following only if this is the lsst step of the program run:

End of Data - enter a /* as the last physical
 input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist fo at least one /* card.

MOTOR DATA FOR STEP No. LOP-1, MOTOR No. 1.

Sheet 4

If this sheet is used, do not use a Sheet 3 for the same step.

MOTOR DATA - Alternate Method - KW vs Time Data. See Sht 3 for Primary Method.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	1800 . - - - - -
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	260 . - - - - -
Motor Horsepower	MHP2	21-30	81 . - - - - - (181.)
Motor Load in KW-Running Load	MLKW	31-40	67 . - - - - - (150.)
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	75 . - - - - -

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag	FLG01	01-10	----- 0 .
Cube Curve Motor Load Calculation	FLG03	11-20	----- 0 .
Motor Load in KW vs TIME	FLG02 (Note 8)	21-30	----- 2 . <u>1 .</u> 8.0

NOTES: 8. Use a "2" for defining a "Standard Motor". Data is not required. Omit Time and KW data below. If Motor Definition data is put in (above), it will not be used in any of the calculations.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

	Column	TIME	Column	LOAD - KW
	(Read 8b1)		(Read 9b1)	
1	01-10	-----	01-10	-----
2	11-20	-----	11-20	-----
3	21-30	-----	21-30	-----
4	31-40	-----	31-40	-----
5	41-50	-----	41-50	-----
6	51-60	-----	51-60	-----
7	61-70	-----	61-70	-----
8	71-80	-----	71-80	-----
	(Read 8b2)		(Read 9b2)	
9	01-10	-----	01-10	-----
10	11-20	-----	11-20	-----
11	21-30	-----	21-30	-----
12	31-40	-----	31-40	-----
13	41-50	-----	41-50	-----
14	51-60	-----	51-60	-----
15	61-70	-----	61-70	-----
16	71-80	-----	71-80	-----
	(Read 8b3)		(Read 9b3)	
17	01-10	-----	01-10	-----
18	11-20	-----	11-20	-----
19	21-30	-----	21-30	-----
20	31-40	-----	31-40	-----
21	41-50	-----	41-50	-----

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - /*.

use motor data same as
Step 2 for LOCA/MSLA
Sheet 2

LOAD DATA FOR STEP No. LOP-2.

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Value
Existing Load - KW	EKW	01-10	313 (396)
Added Load - KW See Note 1	AKW	11-20	0
In Rush Load - Motor Starting	SKVA	21-30	4921
Motor Horse Power-See Note 2 & 3	MHP1	31-40	800
New Time, Start of Step - Sec	NTM	41-50	4.5 0A 5.5

- NOTES:
1. For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 5. For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input 0.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is not used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (percent decay as a decimal)
raised to the reciprical of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the lsst step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run,
prior to the /* card (provided as part of the "Execute Job Control")
should consist fo at least one /* card.

LOAD DATA FOR STEP No. LOP-3 .

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	# 2 Value	# 1
Existing Load - KW	EKW	01-10	(1018)	935
Added Load - KW See Note 1	AKW	11-20	0	
In Rush Load - Motor Starting	SKVA	21-30	(2954)	2623
Motor Horse Power-See Note 2 & 3	MHP1	31-40	(500)	450
New Time, Start of Step - Sec	NTM	41-50	15	

- NOTES:
- For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 - Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 - MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 - Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
 If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
 If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 - For Turbocharged engines, for TURBO, input 1.
 For blower scavenged or naturally aspirated engines, input 0.
 For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
 For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
 (For N/A or Blower Scavenged, EXLF is not used)
 For TCRF, input .7 for a decay rate of 50% in 2 seconds,
 or calculate factor as follows: (precent decay as a decimal)
 raised to the reciprical of the time (in seconds) for that decay
 will give factor to put in as TCRF.

Use the following only if this is the last step of the program run:

End of Data - enter a /* as the last physical
 input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run,
 prior to the /* card (provided as part of the "Execute Job Control")
 should consist of at least one /* card.

LOAD DATA FOR STEP No. 200-4/5

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Value
Existing Load - KW	EKW	01-10	1287 (1320)
Added Load - KW See Note 1	AKW	11-20	0
In Rush Load - Motor Starting	SKVA	21-30	536
Motor Horse Power-See Note 2 & 3	MHP1	31-40	105
New Time, Start of Step - Sec	NTM	41-50	50

STEP 4 1 2 | STEP 5
 1 2
 1352 (1435)

use motor data from Loc A/MSL/ STEPS 7 & 8

- NOTES:
1. For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
 If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
 If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 5. For Turbocharged engines, for TURBO, input 1.
 For blower scavenged or naturally aspirated engines, input 0.
 For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
 For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
 (For N/A or Blower Scavenged, EXLF is not used)
 For TCRF, input .7 for a decay rate of 50% in 2 seconds,
 or calculate factor as follows: (precent decay as a decimal)
 raised to the reciprical of the time (in seconds) for that decay
 will give factor to put in as TCRF.

Use the following only if this is the lsst step of the program run:

End of Data - enter a /* as the last physical input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist fo at least one /* card.

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Value
Existing Load - KW	EKW	01-10	1417 (1500)
Added Load - KW See Note 1	AKW	11-20	0
In Rush Load - Motor Starting	SKVA	21-30	243 (527)
Motor Horse Power-See Note 2 & 3	MHP1	31-40	40 (90)
New Time, Start of Step - Sec	NTM	41-50	70

NOTES: 1. For a load rejection (Off-Load) situation, the value should include a minus (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.

2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.

3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.

4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.

5. For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input 0.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is not used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (percent decay as a decimal)
raised to the reciprocal of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the last step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist of at least one /* card.

LOAD DATA FOR STEP No. LOP-7 .

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Value
Existing Load - KW	EKW	01-10	1450 (1575)
Added Load - KW See Note 1	AKW	11-20	0
In Rush Load - Motor Starting	SKVA	21-30	254 (218)
Motor Horse Power-See Note 2 & 3	MHP1	31-40	32 (32)
New Time, Start of Step - Sec	NTM	41-50	80

- NOTES:
1. For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and or 4) for each step.
 4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
 If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
 If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 5. For Turbocharged engines, for TURBO, input 1.
 For blower scavenged or naturally aspirated engines, input 0.
 For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
 For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
 (For N/A or Blower Scavenged, EXLF is not used)
 For TCRF, input .7 for a decay rate of 50% in 2 seconds,
 or calculate factor as follows: (precent decay as a decimal)
 raised to the reciprical of the time (in seconds) for that decay
 will give factor to put in as TCRF.

Use the following only if this is the last step of the program run:

End of Data - enter a /* as the last physical input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist of at least one /* card.

MOTOR DATA FOR STEP No. LOA-7, MOTOR No. 1.
 If this sheet is used, do not use a Sheet 3 for the same step.

MOTOR DATA - Alternate Method - KW vs Time Data. See Sht 3 for Primary Method.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	1800
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	100
Motor Horsepower	MHP2	21-30	30 37
Motor Load in KW-Running Load	MLKW	31-40	30 31
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	75

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag	FLG01	01-10	0
Cube Curve Motor Load Calculation	FLG03	11-20	0
Motor Load in KW vs TIME	FLG02 (Note 8)	21-30	2.1

STW

NOTES: 8. Use a "2" for defining a "Standard Motor". Data is not required. Omit Time and KW data below. If Motor Definition data is put in (above), it will not be used in any of the calculations.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

	Column (Read 8b1)	TIME	Column (Read 9b1)	LOAD - KW
1	01-10	-----	01-10	-----
2	11-20	-----	11-20	-----
3	21-30	-----	21-30	-----
4	31-40	-----	31-40	-----
5	41-50	-----	41-50	-----
6	51-60	-----	51-60	-----
7	61-70	-----	61-70	-----
8	71-80	-----	71-80	-----
	(Read 8b2)		(Read 9b2)	
9	01-10	-----	01-10	-----
10	11-20	-----	11-20	-----
11	21-30	-----	21-30	-----
12	31-40	-----	31-40	-----
13	41-50	-----	41-50	-----
14	51-60	-----	51-60	-----
15	61-70	-----	61-70	-----
16	71-80	-----	71-80	-----
	(Read 8b3)		(Read 9b3)	
17	01-10	-----	01-10	-----
18	11-20	-----	11-20	-----
19	21-30	-----	21-30	-----
20	31-40	-----	31-40	-----
21	41-50	-----	41-50	-----

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - - /*.

LOAD DATA FOR STEP No. LOP-8.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	#1 Value	#2
Existing Load - KW	EKW	01-10	1481	(1602)
Added Load - KW See Note 1	AKW	11-20	0	
In Rush Load - Motor Starting	SKVA	21-30	3583	(67)
Motor Horse Power-See Note 2 & 3	MHP1	31-40	610	(10)
New Time, Start of Step - Sec	NTM	41-50	90	

- NOTES:
1. For a load rejection (Off-Load) situation, the value should include a minus (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
 If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
 If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 5. For Turbocharged engines, for TURBO, input 1.
 For blower scavenged or naturally aspirated engines, input 0.
 For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
 For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
 (For N/A or Blower Scavenged, EXLF is not used)
 For TCRF, input .7 for a decay rate of 50% in 2 seconds,
 or calculate factor as follows: (percent decay as a decimal)
 raised to the reciprocal of the time (in seconds) for that decay
 will give factor to put in as TCRF.

Use the following only if this is the last step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist of at least one /* card.

MOTOR DATA FOR STEP No. LOP-8, MOTOR No. _____.
 If this sheet is used, do not use a Sheet 3 for the same step.

MOTOR DATA - Alternate Method - KW vs Time Data. See Sht 3 for Primary Method.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MSP1	01-10	1800
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	500
Motor Horsepower	MHP2	21-30	610
Motor Load in KW-Running Load	MLKW	31-40	443
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	75

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag	FLG01	01-10	0
Cube Curve Motor Load Calculation	FLG03	11-20	0
Motor Load in KW vs TIME	FLG02 (Note 8)	21-30	2

NOTES: 8. Use a "2" for defining a "Standard Motor". Data is not required. Omit Time and KW data below. If Motor Definition data is put in (above), it will not be used in any of the calculations.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

	Column	TIME	Column	LOAD - KW
1	01-10	---	01-10	---
2	11-20	---	11-20	---
3	21-30	---	21-30	---
4	31-40	---	31-40	---
5	41-50	---	41-50	---
6	51-60	---	51-60	---
7	61-70	---	61-70	---
8	71-80	---	71-80	---
9	01-10	---	01-10	---
10	11-20	---	11-20	---
11	21-30	---	21-30	---
12	31-40	---	31-40	---
13	41-50	---	41-50	---
14	51-60	---	51-60	---
15	61-70	---	61-70	---
16	71-80	---	71-80	---
17	01-10	---	01-10	---
18	11-20	---	11-20	---
19	21-30	---	21-30	---
20	31-40	---	31-40	---
21	41-50	---	41-50	---

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - - /*.

LOAD DATA FOR STEP No. L00-9.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Value	#1	#2
Existing Load - KW	EKW	01-10	192.8		(1610)
Added Load - KW See Note 1	AKW	11-20	207.		
In Rush Load - Motor Starting	SKVA	21-30	702.674-2		
Motor Horse Power-See Note 2 & 3	MHP1	31-40	107.		
New Time, Start of Step - Sec	NTM	41-50	120.		

NOTES: 1. For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.

2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
 If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
 If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
5. For Turbocharged engines, for TURBO, input 1.
 For blower scavenged or naturally aspirated engines, input 0.
 For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
 For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
 (For N/A or Blower Scavenged, EXLF is not used)
 For TCRF, input .7 for a decay rate of 50% in 2 seconds,
 or calculate factor as follows: (percent decay as a decimal)
 raised to the reciprical of the time (in seconds) for that decay
 will give factor to put in as TCRF.

Use the following only if this is the lsst step of the program run:

End of Data - enter a /* as the last physical
 input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist fo at least one /* card.

MOTOR DATA FOR STEP No. LOP-9, MOTOR No. 1.

Sheet 4

If this sheet is used, do not use a Sheet 3 for the same step.

MOTOR DATA - Alternate Method - KW vs Time Data. See Sht 3 for Primary Method.

(Read 6)	Symbol	Columns	Value.
Motor Speed - RPM	MRPM	01-10	<u>1800</u> . - - - - -
Motor Inertia - Lb-Ft-Sqd	MWR2	11-20	<u>200</u> . - - - - -
Motor Horsepower	MHP2	21-30	<u>107</u> . - - - - -
Motor Load in KW-Running Load	MLKW	31-40	<u>60</u> . - - - - -
Motor Slip/Load Constant-Percent	XMRC (75%)	41-50	<u>75</u> . - - - - -

(Read 7)	Symbol	Columns	Value.
Unloaded Motor Flag	FLG01	01-10	- - - - - <u>0</u> .
Cube Curve Motor Load Calculation	FLG03	11-20	- - - - - <u>0</u> .
Motor Load in KW vs TIME	FLG02 (Note 8)	21-30	- - - - - <u>2</u> . - - - - - <u>1</u> . <u>STO</u> .

NOTES: 8. Use a "2" for defining a "Standard Motor". Data is not required. Omit Time and KW data below. If Motor Definition data is put in (above), it will not be used in any of the calculations.

NOTE: Punch (key in) ALL Motor Torque Data before any Load Torque Data.

	Column	TIME	Column	LOAD - KW
	(Read 8b1)		(Read 9b1)	
1	01-10	- - - - -	01-10	- - - - -
2	11-20	- - - - -	11-20	- - - - -
3	21-30	- - - - -	21-30	- - - - -
4	31-40	- - - - -	31-40	- - - - -
5	41-50	- - - - -	41-50	- - - - -
6	51-60	- - - - -	51-60	- - - - -
7	61-70	- - - - -	61-70	- - - - -
8	71-80	- - - - -	71-80	- - - - -
	(Read 8b2)		(Read 9b2)	
9	01-10	- - - - -	01-10	- - - - -
10	11-20	- - - - -	11-20	- - - - -
11	21-30	- - - - -	21-30	- - - - -
12	31-40	- - - - -	31-40	- - - - -
13	41-50	- - - - -	41-50	- - - - -
14	51-60	- - - - -	51-60	- - - - -
15	61-70	- - - - -	61-70	- - - - -
16	71-80	- - - - -	71-80	- - - - -
	(Read 8b3)		(Read 9b3)	
17	01-10	- - - - -	01-10	- - - - -
18	11-20	- - - - -	11-20	- - - - -
19	21-30	- - - - -	21-30	- - - - -
20	31-40	- - - - -	31-40	- - - - -
21	41-50	- - - - -	41-50	- - - - -

End of data for 1 step - enter a /* following the last percent load torque curve card for the last motor for each step. If this is the last step in the Program run, this data should be followed by two (2) cards, /*, /* (then /&). See sheet 2.

Cols 01-02 - /*.

/* END.

EXISTING LOADS -
OVERLAPS

Sheet 1 Summary ARKLOC 4 (E)

FILE # 4-8 ARKLOC.

LOAD DATA FOR STEP No. 1.

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Value
Existing Load - KW	EKW	01-10	<u>1644</u> -----
Added Load - KW See Note 1	AKW	11-20	<u>0</u> -----
In Rush Load - Motor Starting	SKVA	21-30	<u>3729</u> -----
Motor Horse Power-See Note 2 & 3	MHP1	31-40	<u>6056</u> -----
New Time, Start of Step - Sec	NTM	41-50	<u>0</u> -----

Use motors
from LOCA
Steps.
~~586~~
150 HP
~~150 HP~~
+
455HP

- NOTES:
1. For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 5. For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input 0.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is not used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (precent decay as a decimal)
raised to the reciprical of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the lsst step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run,
prior to the /* card (provided as part of the "Execute Job Control")
should consist fo at least one /* card.

LOAD DATA FOR STEP No. 2.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Value
Existing Load - KW	EKW	01-10	2125
Added Load - KW See Note 1	AKW	11-20	Ø
In Rush Load - Motor Starting	SKVA	21-30	4004
Motor Horse Power-See Note 2 & 3	MHP1	31-40	676
New Time, Start of Step - Sec	NTM	41-50	Ø

USE
Std.

MOTOR:

NOTES: 1. For a load rejection (Off-Load) situation, the value should include a minus (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.

2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.

1800 RPM
600 WR2
676 HP
498 LOAD
75

3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.

4. Use FLG2Ø = Ø for the case of no accumulated resistive loading or when no effect is desired.

If FLG2Ø = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.

If FLG2Ø = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.

Ø
Ø
2.

5. For Turbocharged engines, for TURBO, input 1.
For blower scavenged or naturally aspirated engines, input Ø.
For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
(For N/A or Blower Scavenged, EXLF is not used)
For TCRF, input .7 for a decay rate of 50% in 2 seconds,
or calculate factor as follows: (percent decay as a decimal)
raised to the reciprical of the time (in seconds) for that decay
will give factor to put in as TCRF.

Use the following only if this is the lsst step of the program run:

End of Data - enter a /* as the last physical
input card in the input stream - Cols 01-02 - - - - - /*.

NOTE: If input is by punch card, the last two data cards for any run, prior to the /* card (provided as part of the "Execute Job Control") should consist fo at least one /* card.

LOAD DATA FOR STEP No. 3.

Sheet 2

Step Data - Any Number. Terminal Run with a /* card after the last step.

(Read 5)	Symbol	Columns	Value
Existing Load - KW	EKW	01-10	<u>1450</u> -----
Added Load - KW See Note 1	AKW	11-20	<u>0</u> -----
In Rush Load - Motor Starting	SKVA	21-30	<u>3828</u> -----
Motor Horse Power-See Note 2 & 3	MHP1	31-40	<u>646.</u> -----
New Time, Start of Step - Sec	NTM	41-50	<u>0</u> -----

- NOTES:
1. For a load rejection (Off-Load) situation, the value should include a minue (-) sign; ie. -3000. Off loads may be used at any step in the program. If the last step, follow by /* card.
 2. Input motor data using either Sheet 3 or 4. Sheet 3 is for cases where the motor torque vs speed (and load torque vs speed) data is known. Sheet 4 is used when the motor/load KW is in the form of KW vs TIME.
 3. MHP1 should equal the total of the individual motor horsepowers (MHP2's from sheets 3 and/or 4) for each step.
 4. Use FLG20 = 0 for the case of no accumulated resistive loading or when no effect is desired.
 If FLG20 = 1, program will use "existing load" plus "added KW Loading" in correcting for effect of voltage dip and overshoot.
 If FLG20 = 2, program will use "accumulated KW Loads" in correcting for the effect of voltage dip and overshoot.
 5. For Turbocharged engines, for TURBO, input 1.
 For blower scavenged or naturally aspirated engines, input 0.
 For OP Turbo, input EXLF = 1. (Linear) or fit to suit curve.
 For PC Turbo, input EXLF = 2. (Exponential) or fit to suit.
 (For N/A or Blower Scavenged, EXLF is not used)
 For TCRF, input .7 for a decay rate of 50% in 2 seconds,
 or calculate factor as follows: (precent decay as a decimal)
 raised to the reciprical of the time (in seconds) for that decay
 will give factor to put in as TCRF.

use
Std.
motors -
1800RPM.
600 WR2
646 HP
473 KWLo
75.

0
0
2.

Use the following only if this is the lsst step of the program run:

End of Data - enter a /* as the last physical
 input card in the input stream - Cols 01-02 - - - - - (/*)

end ALL

*NOTE: If input is by punch card, the last two data cards for any run,
 prior to the /* card (provided as part of the "Execute Job Control")
 should consist fo at least one /* card.

ENGINE RATED AT 2850 KW AT 900 RPM OF 12 CYLINDERS, STROKES PER CYCLE
WITH CAPABILITY OF 120.0 PERCENT LOAD, AND WITH 34372. LB-FT-SQRD-INERTIA

GENERATOR FIELD AT 4043. KVA-AMM-HAS THE FOLLOWING PROPERTIES:
CONSTANT FIELD CURRENT 13.30 PERCENT
CONSTANT REACTANCE 5.00 PERCENTS
FIELD LOAD CONSTANT 320 VOLTS
NO-LOAD FIELD VOLTAGE 55 VOLTS
MAXIMUM FIELD VOLTAGE - FORCING 455 VOLTS
THE CORRECTED SUB-TRANSIENT REACTANCE IS 21.933 PERCENT

THE POINT FOR DEFINITION OF RECOVERY FOR VOLTAGE IS 90. PERCENT AND FOR FREQUENCY IS 98. PERCENT

THE FOLLOWING CONSTANTS ARE BEING USED FOR THESE COMPUTATIONS:
GENERATOR DIP CONSTANT 1687
EXCITER RECOVERY RATE 5.00
EXCITER CONSTANT 320
FIELD LOAD CONSTANT 0.510
LOADING LOAD FACTOR IS 1.300
LOAD RECOVERY RATE 0.250 PER SECOND
TURBO C I 1.00 TURBO RESPONSE FACTOR IS 0.2500
THE TIME INCREMENT IN THE CALCULATION IS 0.10 SECONDS
VOLTAGE OVERSHOOT CONSTANT IS 0.60
FLAG 20 SET B 2
BACK LEAD-LINE CONSTANT IS 0.0270
GOV FREQUENTIAL FACTOR 1.3500 GOVERNOR DEAD-TIME IS 0.1000
FRECTION HP RATIO = 0.1500

ACCELERATION CONSTANT (C2) = 0.003000366 ENGINE GOV DEAD-TIME = 0.370000136

STEP 224 1 THE STARTING TIME IS 0.0 SECONDS
THE LOADS ARE AS FOLLOWS
LOAD KW HP FC UNIT RATING

ENGINE	0				0.0
ROTOR	246				0.83
MOTORS	118		140		4.07
NET LOAD	362				12.70

THE ACCUMULATED RESISTIVE LOAD IS 246 KW
THE ACCUMULATED SYSTEM INERTIA IS 24572. LB-FT-SQRD -- CEF = 0.0034000361

THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 902.8KVA AND THE CORRECTED THRUSS POWER IS 965.8KVA

VOLTAGE DIP = 4.551
RECOVERY TIME TO 90.0 PERCENT = 0.031
TOTAL RECOVERY TIME = 0.110
0.015 0.035

MOTOR NUMBER 1 MOTOR RATING = 140 HP AT 1800 RPM.
THE MOTOR HAS 150. LB-FT SQUARED INERTIA AND WILL HAVE A 116. KW LOAD WHEN RUNNING.
FIELD LOAD TORQUE IS 118.408 LB-FT
FIELD LOAD KW IS 118.4100
FLAG 1 = 0. FLAG 2 = 2. FLAG 3 = 0.

INPUT-TIME = 0.0 , KW = 135.

TIME = 0.1000, INCREMENTAL KW LOAD = 139.
TIME = 0.2000, INCREMENTAL KW LOAD = 139.
TIME = 0.3000, INCREMENTAL KW LOAD = 139.
TIME = 0.4000, INCREMENTAL KW LOAD = 139.
TIME = 0.5000, INCREMENTAL KW LOAD = 139.

INPUT-TIME = 0.5000, KW = 139.

TIME	INCREMENTAL KW LOAD	INCREMENTAL KW LOAD	NET DEVIATION	NET LOAD KW	AVAILABLE LOAD KW
0.10	0.6000	385.10	0.13024	385.10	0.0
0.20	0.7000	385.25	0.13099	385.25	0.0
0.30	0.8000	385.25	0.13059	385.25	0.0
0.40	0.9000	385.25	0.13099	385.25	0.0
0.50	1.0000	385.25	0.04944	385.25	533.05
0.60	1.1000	387.57	-0.05497	387.57	545.23
0.70	1.2000	389.89	-0.05971	389.89	555.51
0.80	1.3000	392.22	0.06448	392.22	561.71
0.90	1.4000	394.54	-0.06928	394.54	568.11
1.00	1.5000	396.86	-0.07412	396.86	614.52
1.10	1.6000	398.82	-0.07990	398.82	630.51
1.20	1.7000	410.78	0.08581	410.78	643.15
PEAK LOAD KW = 290, AND OCCURS AT 1.20 MAX. OVERVOLTAGE OCCURS AT 2.10 WITH RECOVERY AT 2.30					
TIME	INCREMENTAL KW LOAD	INCREMENTAL KW LOAD	NET DEVIATION	NET LOAD KW	AVAILABLE LOAD KW
1.30	1.8000	290.0	0.13024	290.0	290.0
1.40	1.9000	290.0	0.13099	290.0	290.0
1.50	2.0000	115.0	0.13059	115.0	115.0
PEAK LOAD KW = 290, AT 1.2000 SECONDS WITH PEAK VOLTAGE AT 2.1000					
DEVIATION AT INFLECTION = 0.573 SYSTEM DEAD TIME = 0.438 MAXIMUM DEVIATION = 0.573 TIME TO RECOVERY TO BOTTOM = 0.318 TIME TO RECOVERY TO 90 PERCENT = 0.9 TOTAL RECOVERY TIME = 1.259					

65.00	100.00	40.00	100.00	37.50	2.30	100.00	100.00	67.00	2.01	58.62	669.
70.00	100.00	48.00	100.00	44.00	2.30	100.00	100.00	62.50	2.07	60.63	859.
75.00	107.00	56.00	103.50	52.00	2.30	100.00	100.00	64.50	2.07	61.64	818.
80.00	139.00	63.00	121.00	59.00	2.60	100.00	100.00	76.00	1.95	65.64	839.
85.00	139.00	72.00	152.00	67.00	2.70	100.00	100.00	80.00	1.86	68.51	853.
90.00	190.00	80.00	153.50	76.00	2.80	100.00	103.50	81.50	1.70	70.22	834.
95.00	189.00	90.00	193.50	83.00	2.90	100.00	103.50	81.50	1.70	71.06	876.
100.00	100.00	58.00	141.50	94.00	3.00	100.00	103.50	81.50	1.70	73.43	810.
					3.10	100.00	131.00	83.00	2.05	75.67	873.
					3.20	100.00	131.00	83.00	2.06	77.72	811.
					3.30	100.00	131.00	83.00	2.06	77.72	811.
					3.40	100.00	152.00	85.00	2.81	82.57	1095.
					3.50	100.00	103.50	107.50	3.55	84.13	1024.
					3.60	100.00	103.50	107.50	3.55	84.13	1024.
					3.70	100.00	103.50	108.50	3.59	93.26	1347.
					3.80	100.00	131.00	85.00	1.67	94.81	863.
					3.90	100.00	143.50	85.00	1.67	96.68	895.
					4.00	100.00	143.50	85.00	1.67	98.07	867.
					4.10	100.00	143.50	85.00	1.67	99.54	823.
TOTAL EQUIVALENT ENERGY = 968.32896 DEGREE OF SEVERITY = 146.62814 PEAK GRID LOAD = 1317. AT 3.70994 SECONDS											
PEAK LOAD KW = 1317. AND OCCURS AT 3.70 HV. OVERVOLTAGE OCCURS AT 4.10 WITH RECOVERY AT 5.31											
1.00	INHERENTIAL LOAD-KW	CHANGE IN DEVIATION	PCT DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW						
0.10	224.86	0.31310	0.31310	1284.96	0.0 0.						
0.20	827.76	0.28022	0.59332	1189.76	0.0 0.						
0.30	822.18	0.30263	0.29532	1233.18	0.0 0.						
0.40	976.65	0.32566	1.22101	1330.63	1709.01 1.						
0.50	976.65	0.00189	1.51912	1425.86	1831.38 1.						
0.60	1023.86	0.14787	1.67134	1440.02	1925.00 1.						
0.70	1023.86	0.16175	0.29579	1432.15	1931.22 1.						
0.80	1030.10	0.17014	0.73980	1416.55	1942.03 1.						
0.90	1034.55	0.17820	0.56170	1405.74	1950.06 1.						
1.00	1038.94	0.18590	0.47547	1395.73	1954.77 1.						
1.00	1023.73	0.19331	0.18019								
DEVIATION AT THELECTION = 1.221 CHANGE IN DEVIATION = 0.308 MAXIMUM DEVIATION = 1.521 TIME OF RECOVERY TO 90.0 PERCENT = 0.0 TOTAL RECOVERY TIME = 1.071											

WEL0010 FREQUENCY AND VOLTAGE FLUCTUATION PREDICTIONS PROGRAM PAGE LOGS UNIT 2

STEP NO. 3 THE STARTING TIME IS 10.00 SECONDS

THE LOADS ARE AS FOLLOWS:

LOAD KW HF PCT UNIT RATING

EXISTING 95.4 33.53
 STEADY 0.0
 MOTORS 497.6 600.
 BELT LOAD 1101.51.25

THE ACCUMULATED RESISTIVE LOAD IS 246. KW, 8.63 PERCENT RATING.

THE ACCUMULATED SYSTEM INERTIA IS 39722. LB-FT-SQED -- C2P = 0.0029599176

THE BRUSH POWER FOR THE MOTORS AT THIS STEP IS 3531. 3536 AND THE COLLECTED THROUGH POWER IS 3531. 3536

VOLTAGE DIP = 16.010
 TIME OF MAXIMUM VOLTAGE DIP = 0.100
 RECOVERY TIME TO 90.0 PERCENT = 0.267
 TOTAL RECOVERY TIME = 0.363

MOTOR NUMBER 1 MOTOR RATING = 600. HP AT 3575 RPM.

THE MOTOR HAS 129. LB-FT SQUARED INERTIA AND WILL HAVE A 300. KW LOAD WHEN RUNNING.

FULL LOAD TORQUE IS 881. LB-FT

FULL LOAD KW IS 497. AT AN ASSUMED EFFICIENCY OF 90 PERCENT.

FLAG 1 = 0. FLAG 2 = 0. FLAG 3 = 0.

TRAITS - PERCENT		AVERAGE		OUTPUT		PERCENT COLLECTED		PERCENT INCREMENTAL		ACCUM.	
SPEED	MOTOR TORQUE	LOAD TORQUE	MOTOR TORQUE	LOAD TORQUE	TIME SECONDS	AV. VOLTAGE	MOTOR TORQUE	NET TORQUE	SPEED CHANGE	PERCENT SPEED	KW LOAD
0.0	70.00	15.00	70.50	12.00	0.0					0.0	0.0
5.00	71.00	9.00	70.50	12.00	0.10	22.00	70.50	47.00	3.00	3.00	0.0
10.00	73.00	5.00	72.00	7.00	0.20	86.78	53.09	41.00	1.00	3.08	0.0
15.00	74.00	4.00	73.50	4.50	0.30	92.74	61.24	54.96	2.40	6.28	0.0
20.00	76.00	4.00	75.00	4.00	0.40	97.00	69.12	62.12	3.72	9.00	0.0
25.00	78.00	6.00	77.00	5.00	0.50	100.00	73.50	69.00	3.00	12.00	0.0
30.00	81.00	8.00	79.50	7.00	0.60	100.00	75.00	71.00	3.10	15.10	0.0
35.00	84.00	10.00	82.50	9.00	0.70	100.00	75.00	71.00	3.10	18.20	0.0
40.00	88.00	14.00	86.00	12.00	0.80	100.00	77.00	72.00	3.15	21.35	0.0
45.00	93.00	17.00	90.50	15.50	0.90	100.00	77.00	72.00	3.15	24.50	0.0
50.00	98.00	22.00	95.50	19.50	1.00	100.00	77.00	72.50	3.17	27.67	0.0
55.00	103.00	26.00	100.50	24.00	1.10	100.00	80.50	73.50	3.21	30.88	0.0
60.00	108.00	31.00	105.50	28.50	1.20	100.00	83.50	73.50	3.21	34.09	0.0
65.00	113.00	36.00	110.50	33.00	1.30	100.00	86.00	74.00	3.24	37.33	0.0
70.00	118.00	41.00	115.50	37.50	1.40	100.00	88.50	75.00	3.28	40.61	0.0
75.00	123.00	46.00	120.50	42.00	1.50	100.00	91.00	75.00	3.28	43.89	0.0
80.00	128.00	51.00	125.50	46.50	1.60	100.00	93.50	80.00	3.30	47.19	0.0
85.00	133.00	56.00	130.50	51.00	1.70	100.00	114.50	90.50	3.96	51.36	0.0
90.00	138.00	61.00	135.50	55.50	1.80	100.00	132.00	103.50	1.52	53.00	0.0
95.00	143.00	66.00	140.50	60.00	1.90	100.00	148.50	114.50	5.01	60.00	0.0

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	582.50	0.17444	0.17444	1573.50	0.0
0.20	573.90	0.16983	0.34427	1557.60	0.0
0.30	638.22	0.18884	0.53311	1622.82	0.0
0.40	683.19	0.20217	0.73528	1667.19	0.0
0.50	623.72	0.20283	0.93811	1677.72	2071.66
0.60	659.60	-0.13290	0.80521	1673.60	2122.70
0.70	678.03	0.15166	0.95687	1662.03	2174.23
0.80	676.23	-0.16754	0.78933	1660.23	2226.14
0.90	684.45	-0.18637	0.60296	1648.45	2278.66

TOTAL EQUIVALENT ENERGY = 735.02588
 DEGREE OF SEVERITY = 148.58772
 LOAD UNDER LOAD = 349.01 2.5000000000000000

PEAK LOAD KW = 949.000 OCCURS AT 0.20
 MAX. OVERVOLTAGE OCCURS AT 2.99 WITH RECOVERY AT 3.82

DEVIATION AT THELECTION = 0.476
 SYSTEM RECOVERY TIME = 0.716
 TIME OF MAXIMUM DEVIATION = 0.416
 TIME OF RECOVERY TO 93.0 PERCENT = 0.0
 LOAD RECOVERY TIME = 0.907

STEP NO. 4 THE STARTING TIME IS 15.00 SECONDS
 THE LOADS ARE AS FOLLOWS

EXISTING 1292.
 PEAK 949.
 MOTOR 313.
 NET LOAD 1766.

THE ACCUMULATED RESERVE LOAD IS 246. KW
 THE REGENERATED SYSTEM TRIP IS 3096. LB-FT-SARND -- CFI = 0.60294

0.20	582.11	0.17151	0.34740	1371.11	0.0	0.0
0.30	660.25	0.19453	0.54193	1982.25	0.0	0.0
0.40	878.87	0.19978	0.74128	1976.87	0.0	0.0
0.50	684.13	0.03461	0.77670	1976.13	2354.95	2.0
0.60	695.59	-0.12104	0.56193	1987.59	2401.14	2.0
0.70	765.24	-0.11467	0.44726	2057.24	2446.15	2.0
0.80	902.56	-0.00736	0.30970	2194.56	2451.47	2.0
0.90	896.03	-0.10544	0.25444	2178.03	2535.99	2.0
1.00	767.59	-0.15345	0.10101	2059.59	2580.37	2.0
DEVIATION AT INJECTION = 0.776						
SYSTEM BEAD TIME = 0.417						
MAXIMUM DEVIATION = 0.776						
TIME TO REACH BEAD = 0.417						
TIME OF RECOVERY TO 98.0 PERCENT = 0.0						
TOTAL RECOVERY TIME = 1.046						
SILENCE 14.44						
SPEED 57.60						
ROTORS 0.0						
REF LOAD 1763						
150						
4.36						
63.05						
THE ACCUMULATED RESISTIVE LOAD IS 342 KW @ 0.43 PERCENT RATING						
THE ACCUMULATED SYSTEM INERTIA IS 40205. LB-FT-SQRD -- CAP = 0.0029236313						
THE THROUGHPUTS FOR THE MOTORS AT THIS STEP IS 1014.2866 AND THE CORRECTED THROUGHPUT IS 1011.3846						
VOLTAGE DIP = 5.335						
RECOVERY TIME = 0.033						
TOTAL RECOVERY TIME = 0.110						
2.016						
0.039						
MOTOR NUMBER 1 MOTOR RATING = 150. HP @ 1190. RPM						
THE MOTOR HAS 343. LB-FT CRANKED INERTIA AND WILL HAVE A 124. KW LOSS WHEN RUMBLING.						
FULL LOAD TORQUE IS 124.562 LB-FT						
FULL LOAD KW IS 124.67 ON ASSUMED EFFICIENCY OF 98 PERCENT.						
FLAG 1 = 0. FLAG 2 = 0. FLAG 3 = 1.						
MOTOR PERCENT						
AVERAGE						
OUTPUT						
PERCENT CORRECTED THROUGHPUT						
ACCUM. PERCENT						
KW LOAD						
SPEED MOTOR TORQUE LOAD MOTOR TORQUE LOAD						
INCREMENT TORQUE TORQUE TORQUE TORQUE						
SECONDS TIME						
TORQUE TORQUE						
CHANGE SPEED						
FU						
0.0						
187.60						
0.01						
219.00						
792.50						
0.01						
15.00						
231.00						
0.06						
14.00						
230.00						
0.24						
230.50						
0.22						

00000000 FREQUENCY AND VOLTAGE EXCURSION PREDICTIONS PROGRAM PAGE 7
 AERARONS P 3 L 3/0 205925, 12 DF, 2850 KM @ 500 RPM, LOAD LOADS, UNIT 2

30.00	372.00	0.90	226.00	0.57	0.16	99.62	229.74	229.52	11.42	11.42	367.
35.00	219.00	1.56	229.50	1.18							
40.00	118.00	2.26	213.50	2.13	0.20	97.62	219.82	213.61	16.27	22.22	337.
45.00	215.00	3.59	213.50	3.49	0.30	169.06	213.50	213.01	19.64	32.55	272.
50.00	217.00	6.40	216.50	5.34	0.40	100.00	219.56	202.74	10.13	43.66	315.
55.00	204.00	12.26	204.50	16.81	0.50	100.00	222.70	187.53	9.39	52.11	
60.00	197.00	21.69	199.00	24.12	0.60	100.00	193.50	170.97	8.51	60.92	279.
65.00	194.00	27.46	199.50	24.53	0.70	100.00	191.50	158.62	8.02	69.01	267.
70.00	189.00	34.30	191.50	30.88	0.80	100.00	181.50	141.91	7.08	76.95	
75.00	189.00	42.18	189.00	38.24	0.90	100.00	171.50	133.15	6.90	83.05	229.
80.00	188.00	51.26	188.50	46.69	1.00	100.00	243.50	166.18	8.30	91.39	313.
85.00	201.00	61.41	194.50	56.31	1.10	100.00	180.00	127.13	4.35	95.65	238.
90.00	231.00	72.20	219.00	67.16	1.20	100.00	150.00	87.13	4.35	100.00	279.
95.00	260.00	85.74	245.50	79.32							
100.00	100.00	100.00	180.00	92.87							

TOTAL EQUIVALENT ENERGY = 223.29000000

PERCENT OF SEVERITY = 367.01 @ 0.1000SECONDS

FEAR MOTOR LOAD = 367.000 OCCURS AT 0.10

MAX. SWL VOLTAGE OCCURS AT 1.20 WITH RECOVERY AT 1.51

TYPE	INCREMENTAL LOAD-KM	CHARGE IN DEVIATION	NET DEVIATION	NET LOAD-KM	AVAILABLE LOAD-KM
0.10	363.27	0.10621	0.10621	2067.27	0.0 0.
0.20	345.97	0.10115	0.20735	1989.97	0.0 0.
0.30	334.66	0.09782	0.30517	1928.66	0.0 0.
0.40	319.13	0.09350	0.39867	1863.13	0.0 0.
0.50	304.83	0.08826	0.48693	1803.89	0.0 0.
0.70	286.66	0.08154	0.49820	1719.66	2731.51 2.
0.70	275.66	-0.24891	0.01747	1719.66	2771.02 2.

DEVIATION AT REFLECTION = 2.358

SYSTEM DEAD TIME = 0.514

MAXIMUM DEVIATION = 0.478

TIME OF MAXIMUM DEVIATION = 0.514

TIME OF RECOVERY TO 98.0 PERCENT = 0.718

TOTAL RECOVERY TIME =

STEP 001 - THE STARTING TIME IS 25.00 SECONDS

THE LOADS ARE AS FOLLOWS

LOAD NO	KW	HP	PCT UNIT RATING
1	106.00	143.00	6.53
2	0.00	0.00	0.00
3	377.00	505.00	13.23
4	2134.00	2867.00	75.27

THE ACCUMULATED RESISTIVE LOAD IS 246.00 KW, 3.63 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 49548.00 LB-FT-SQRD -- CEF = 0.0020999003

THE THROUGH POWER FOR THE MOTORS AT THIS STEP IS 2730.00 SEVA AND THE CORRECTED THROUGH POWER IS 2730.00 KWVA

VOLTAGE DIP = 12.034
 TIME OF MAXIMUM VOLTAGE DIP = 0.030
 RECOVERY TIME TO 90 PERCENT = 6.134
 TOTAL RECOVERY TIME = 6.285

MOTOR NUMBER 1 MOTOR RATING = 455.00 HP AT 1780.00 RPM
 THE MOTOR HAS 335.00 LB-FT SQUARE INERTIA AND WILL HAVE A 377.00 KW LOAD UNDER RUNNING
 FULL LOAD TORQUE IS 1343.00 LB-FT
 FULL LOAD KW IS 377.00 AT AN ASSUMED EFFICIENCY OF 90 PERCENT.
 FLAG 1 = 0. FLAG 2 = 0. FLAG 3 = 9.

INPUTS - PERCENT				OUTPUT			
SPEED	MOTOR TORQUE	LOAD TORQUE	MOTOR LOAD	TIME	AV. TERM VOLTAGE	MOTOR NET TORQUE	PERCENT THROUGH POWER
0.00	100.00	15.00	13.00	0.00			
5.00	101.00	11.00	10.00	0.10	97.85	90.30	5.64
10.00	104.00	7.00	6.00	0.20	91.00	81.00	5.62
15.00	106.00	5.00	5.00	0.30	87.00	76.00	5.58
20.00	102.00	5.00	5.00	0.40	83.00	71.00	5.54
25.00	112.00	6.00	5.50	0.50	80.00	66.00	5.50
30.00	115.00	6.00	5.50	0.60	77.00	61.00	5.46
35.00	119.00	12.00	10.50	0.70	74.00	56.00	5.42
40.00	125.00	17.00	14.50	0.80	71.00	51.00	5.38
45.00	130.00	21.00	18.00	0.90	68.00	46.00	5.34
50.00	137.00	26.00	23.50	1.00	65.00	41.00	5.30
55.00	142.00	32.00	29.00	1.10	62.00	36.00	5.26
60.00	147.00	37.00	34.50	1.20	59.00	31.00	5.22
65.00	151.00	44.00	40.50	1.30	56.00	26.00	5.18
70.00	154.00	51.00	47.00	1.40	53.00	21.00	5.14
75.00	158.00	58.00	53.50	1.50	50.00	16.00	5.10
80.00	160.00	66.00	60.00	1.60	47.00	11.00	5.06
85.00	162.00	75.00	67.50	1.70	44.00	6.00	5.02
90.00	162.00	82.00	73.50	1.80	41.00	1.00	5.00
95.00	160.00	93.00	81.50	1.90	38.00	0.00	5.00
100.00	160.00	98.00	85.50	2.00	35.00	0.00	5.00

APPENDIX B1 FREQUENCY AND VOLTAGE EXCURSION PREDICTIONS PROGRAM
 ARMOHEAS F & L, S/O 205925, 12 OP, 2850 KW @ 900 RPM, 100A LOADS, UNIT 2

1.40 100.00 140.00 44.50 3.09 97.56 535.
 1.50 100.00 140.00 44.50 3.09 100.55 574.

JOIGL EQUIVALENT ENERGY = 173.9655, 26589
 LIMIT OF ENERGY = 815.01 1.0000-EC0005
 1.40 MOTOR LOAD = 815.01 1.0000-EC0005

MAX. OVERVOLTAGE OCCURS AT 1.50 WITH RECOVERY AT 2.24

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	551.23	0.15980	0.15980	2319.23	0.0 0.
0.20	552.55	0.16010	0.31997	2320.55	0.0 0.
0.30	614.99	0.17828	0.49825	2302.99	0.0 0.
0.40	632.33	0.18533	0.68359	2307.13	0.0 0.
0.50	631.64	0.04920	0.73279	2399.64	2869.51 2.
0.50	631.64	-0.10631	0.62648		
0.60	649.96	-0.14117	0.48531	2417.96	2904.95 2.
0.70	651.01	-0.15124	0.33407	2419.01	2940.74 2.
0.80	733.49	-0.13772	0.19635	2501.19	2975.57 2.
0.90	807.56	0.12654	0.06980	2575.56	3012.09 2.

DEVIATION AT INFLECTION = 0.724
 SYSTEM DEAD TIME = 0.425
 MAXIMUM DEVIATION = 0.724
 TIME OF MAXIMUM DEVIATION = 0.422
 TIME OF RECOVERY TO 98.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.945

TIME OF THE STARTING TIME IS 50.00 SECONDS
 THE LOADS ARE AS FOLLOWS
 LOAD KW HF FCY UNIT RATING

EXISTING	2145.	75.26		
ADDED	0.	0.6		
TOTAL	2145.	75.86		
ADDED	07.	3.05		
TOTAL	2232.	78.91		

THE ACCUMULATED RESISTIVE LOAD IS 236.88, 8.43 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 30883.18-FT-SQED -- CIP = 0.6625751317

THE THROUGH POWER FOR THE MOTORS AT THIS STEP IS 536.58VA AND THE CORRECTED THROUGH POWER IS 536.58VA

TOTAL DIP = 2.812
 TIME OF MAXIMUM VOLTAGE DIP = 0.018
 RECOVERY TIME TO 98.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.057
 0.009 0.020

MOTOR NUMBER 1 MOTOR RATING = 185 HP AT 1775 RPM
 THE MOTOR HAS 85 LB-FT SQUARED INERTIA AND WILL HAVE A 65 KW LOAD WHEN RUNNING.
 FULL LOAD TORQUE IS 31.1 LB-FT
 FULL LOAD KW IS 97.0 AT AN ASSUMED EFFICIENCY OF 90 PERCENT.
 LOG 2-9, LINE 3-1

INPUTS - PERCENT				OUTPUT -					
TORQUE	MOTOR TORQUE	LOAD TORQUE	NOISE TORQUE	LOAD TORQUE	LINE SECONDS	VOLTAGE TORQUE	PERCENT CORRECTED	PERCENT INCRNTRL	ACCRU. INCRNTL
0.0	258.00	0.0	0.0	258.00	0.01	0.01	0.0	0.0	0.0
5.00	242.00	0.01	256.00	0.01	0.06	0.06			
10.00	227.00	0.10	234.50	0.22	0.22	0.22			
15.00	216.00	0.24	221.50	0.57	0.57	0.57	100.00	271.28	13.03
20.00	207.00	0.40	211.50	1.18	1.18	1.18	100.00	170.87	24.11
25.00	197.00	1.53	193.00	2.13	2.13	2.13	100.00	177.50	37.19
30.00	189.00	2.70	183.00	3.49	3.49	3.49	100.00	170.87	21.6
35.00	183.00	4.29	173.50	5.34	5.34	5.34	100.00	177.50	37.19
40.00	171.00	2.11	173.50	7.76	7.76	7.76	100.00	170.87	21.6
45.00	166.00	12.39	168.50	10.81	10.81	10.81	100.00	177.50	37.19
50.00	162.00	16.64	163.00	13.57	13.57	13.57	100.00	170.87	21.6
55.00	151.00	21.00	161.50	19.17	19.17	19.17	100.00	177.50	37.19
60.00	161.00	27.46	161.00	24.53	24.53	24.53	100.00	170.87	21.6
65.00	144.00	34.32	162.50	30.88	30.88	30.88	100.00	177.50	37.19
70.00	168.00	42.17	163.00	38.23	38.23	38.23	100.00	170.87	21.6
75.00	171.00	51.09	173.50	46.60	46.60	46.60	100.00	177.50	37.19
80.00	193.00	61.41	183.00	56.31	56.31	56.31	100.00	170.87	21.6
85.00	213.00	72.90	203.00	67.16	67.16	67.16	100.00	177.50	37.19
90.00	173.00	85.74	203.00	79.32	79.32	79.32	100.00	170.87	21.6
95.00	213.00	100.00	203.00	92.87	92.87	92.87	100.00	177.50	37.19

TOTAL EQUIVALENT ENERGY = 186.13477
 DEGREE OF SEVERITY = 243.66804
 PZAW MOTOR LOAD = 249. AT 0.1000 SECONDS

LINE LOAD IS 259 AND OCCURS AT 0.10
 HIGHEST OVERVOLTAGE OCCURS AT 1.10 WITH RECOVERY AT 1.26

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
6.10	248.89	0.07156	0.07156	249.89	0.0
6.20	217.02	0.06740	0.13896	249.89	0.0
6.30	198.89	0.05718	0.19614	249.89	0.0
6.40	183.62	0.05279	0.24893	249.89	0.0
6.50	172.47	0.04959	0.29852	249.89	0.0
6.60	167.23	0.04606	0.34458	249.89	0.0
6.70	167.23	-0.07054	0.27404	249.89	0.0

DEVIATION AT INFLECTION = 0.330
 SYSTEM DEAD TIME = 0.578
 MAXIMUM DEVIATION = 0.330
 TIME OF MAXIMUM DEVIATION = 0.578
 TIME OF RECOVERY TO 50.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.686

STEP 002 B THE STARTING TIME IS 60.00 SECONDS
 THE LOADS ARE AS FOLLOWS:
 LOAD KW HP FCT UNIT RATING

EXISTING 2210. 77.54
 ADDED 0. 0.0
 MOTORS 87. 105.
 NET LOAD 2297. 80.60

THE ACCUMULATED RESISTIVE LOAD IS 246. KW 8.63 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 40988. LB-FT-SQRD --- CEP = 0.0028851813

THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 536. SKVA AND THE CORRECTED INRUSH POWER IS 536. SKVA

VOLTAGE DIP = 2.012
 TIME OF MAXIMUM VOLTAGE DIP = 0.018
 RECOVERY TIME TO 90.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.057

MOTOR NUMBER 1 MOTOR RATING = 105. HP AT 1775. RPM
 THE MOTOR HAS 05. LB-FT SQUARED INERTIA AND WILL HAVE A .65 KW LOAD WHEN RUNNING.
 FULL LOAD TORQUE IS 311. LB-FT
 FULL LOAD KW IS 87. AT AN ASSUMED EFFICIENCY OF 90 PERCENT.
 FLAG 1 = 0. FLAG 2 = 0. FLAG 3 = 1.

INPUTS- PERCENT AVERAGE OUTPUT

STEP	MOTOR	LOAD	TORQUE	BOLOS	TORQUE	LOAD	TORQUE	SECONDS	VOLTAGE	PERCENT CORRECTED	PERCENT INRUSH	PERCENT INRUSH	ACCUM. INRUSH	PERCENT INRUSH	PERCENT INRUSH	PERCENT INRUSH
0.0	230.00	0.0	0.0	250.00	0.01	0.0	0.0	0.10	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
5.00	242.00	0.01	0.10	234.50	0.06	0.10	0.10	0.10	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
10.00	222.00	0.10	0.34	221.50	0.22	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
50.00	207.00	0.06	0.06	211.50	0.57	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
50.00	189.00	2.70	2.70	193.00	2.13	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
35.00	103.00	4.20	4.20	186.00	3.42	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
35.00	175.00	6.60	6.60	179.50	5.34	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
50.00	171.00	2.41	2.41	171.50	7.76	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
50.00	166.00	12.50	12.50	168.50	10.81	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
50.00	122.00	16.64	16.64	124.00	14.57	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
50.00	161.00	21.60	21.60	161.50	19.12	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
65.00	161.00	27.46	27.46	161.00	24.53	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
70.00	161.00	34.30	34.30	162.50	30.89	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0
70.00	168.00	42.19	42.19	168.00	38.24	0.20	0.20	0.20	100.00	100.00	14.03	14.03	0.0	0.0	0.0	0.0

APPENDIX B1 FREQUENCY AND VOLTAGE EXCURSION PREDICTIONS PROGRAM
 AREA: 000000 F & L, 5/0 205925, 12 OF, 2850 EB 9 200 FEB, LOCAL 000000 UNIT 2

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	249.89	0.07141	0.07141	249.89	0.00
0.20	217.02	0.06227	0.13368	247.02	0.00
0.30	198.89	0.05786	0.19154	248.89	0.00
0.40	183.62	0.05268	0.24423	237.62	0.00
0.50	172.47	0.04948	0.29371	238.47	0.00
0.58	167.32	0.04668	0.34039	307.22	3488.33
0.63	167.32	0.04562	0.38601		
DEVIATION AT INFLECTION = 0.339					
CYCLE HEAD LINE = 0.576					
TOTAL DEVIATION = 0.339					
TIME OF MAXIMUM DEVIATION = 0.576					
TIME OF RECOVERY TO 98.0 PERCENT = 0.0					
TOTAL RECOVERY TIME = 0.638					
THE INRUSH AT THE STARTING TIME IS 70.00 SECONDS					
THE LOGS ARE AS FOLLOWS					
EXISTING	2275.	79.82			
ADDED	0.	0.0			
REMOVED	83.	100.			
NET LOAD	2358.	59.82			
THE ACCUMULATED RESISTIVE LOAD IS 246.84, 0.65 PERCENT RATIO					
THE OCCURRENCE OF THIS LOAD IS 30.25, I.E. IT OCCURS 30.25 PERCENT OF THE TIME					
THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 592.30VA AND THE CORRECTED THROUGH POWER IS 592.30VA					
VOLTAGE DIP = 3.897					
TIME OF MAXIMUM VOLTAGE DIP = 0.015					
RECOVERY TIME TO 98.0 PERCENT = 0.0					
TOTAL RECOVERY TIME = 0.063					

TOTAL EQUIVALENT ENERGY = 186.13477
 SEVERITY OF SEVERITY = 213.02601
 SEVERITY OF SEVERITY = 539. AT 0.100000000000

THE LOAD IS 249.89 AND OCCURS AT 0.10
 THE OVERLOAD OCCURS AT 1.10 WITH RECOVERY AT 1.24

VOLTAGE DIP = 3.897
 TIME OF MAXIMUM VOLTAGE DIP = 0.015
 RECOVERY TIME TO 98.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.063

40370010 FREQUENCY AND VOLTAGE EXCURSION PREDICTIONS FOR 6000
ASKANSAS P & L, S/D 28525, 12 0P, 2856 PM @ 500 MPH, 1004 10.05, UNIT 2

STEP 10 TO THE STARTING TIME IS 80.63 SECONDS

THE LOADS ARE AS FOLLOWS:

LOAD KW	HP	PCT UNIT RATING
338	457.1	37
0	0	
31	41.68	
2352	3151	

THE ACCUMULATED RESISTIVE LOAD IS 246 KW, B. 63 PERCENT RATING
THE ACCUMULATED SYSTEM INERTIA IS 41103.1 LB-FT-SQRD -- C.F. = 0.0023592989

THE MACH POWER FOR THE MOTORS AT THIS STEP IS 252.2856 MW FOR CUMULATED TORQUE POWER IS 252.2856 MW

VOLTAGE DIP = 1.34%
TIME OF MAXIMUM VOLTAGE DIP = 0.006
RECOVERY TIME TO 20.0 PERCENT = 0.0
TOTAL RECOVERY TIME = 0.027

NETTOR PUSHER 1 MOTOR RATING = 37. HP @ 1800. RPH.
THE MOTOR HAS 50. LB-FT TORQUE INERTIA AND WILL HAVE A 31. KW LOAD WHEN RUNNING.

FULL LOAD TORQUE IS 100 LB-FT

FULL LOAD KW IS 34. AT AN ASSUMED EFFICIENCY OF 70 PERCENT.

FLAG 1 = 0, FLAG 2 = 2, FLAG 3 = 0.

INPUT TIME = 0.0, KW = 37.

TIME	INCREMENTAL KW LOAD	INCREMENTAL KW LOAD
0.1000	0.1000	37
0.2000	0.2000	37
0.3000	0.3000	37
0.4000	0.4000	37
0.5000	0.5000	37

INPUT TIME = 0.5000, KW = 37.

TIME	INCREMENTAL KW LOAD	INCREMENTAL KW LOAD
0.6000	0.6000	37
0.7000	0.7000	37
0.8000	0.8000	37
0.9000	0.9000	37
1.0000	1.0000	37

INPUT TIME = 1.0000, KW = 40.

TIME	INCREMENTAL KW LOAD	INCREMENTAL KW LOAD
1.1000	1.1000	40
1.2000	1.2000	40
1.3000	1.3000	40
1.4000	1.4000	40
1.5000	1.5000	40

INPUT TIME = 1.5000, KW = 40.

TIME	INCREMENTAL KW LOAD	INCREMENTAL KW LOAD
1.6000	1.6000	40
1.7000	1.7000	40
1.8000	1.8000	40
1.9000	1.9000	40
2.0000	2.0000	40

INPUT TIME = 2.0000, KW = 41.

TIME	INCREMENTAL KW LOAD	INCREMENTAL KW LOAD
2.1000	2.1000	41
2.2000	2.2000	41
2.3000	2.3000	41
2.4000	2.4000	41
2.5000	2.5000	41

INPUT TIME = 2.5000, KW = 41.

TIME	INCREMENTAL KW LOAD	INCREMENTAL KW LOAD
2.6000	2.6000	41
2.7000	2.7000	41
2.8000	2.8000	41
2.9000	2.9000	41
3.0000	3.0000	41

INPUT TIME = 3.0000, KW = 41.

TIME	INCREMENTAL KW LOAD	INCREMENTAL KW LOAD
3.1000	3.1000	41
3.2000	3.2000	41
3.3000	3.3000	41
3.4000	3.4000	41
3.5000	3.5000	41

INPUT TIME = 3.5000, KW = 41.

TIME	INCREMENTAL KW LOAD	INCREMENTAL KW LOAD
3.6000	3.6000	41
3.7000	3.7000	41
3.8000	3.8000	41
3.9000	3.9000	41
4.0000	4.0000	41

INPUT TIME = 4.0000, KW = 41.

LOAD OCCURS AT 77 AND OCCURS AT 1.50

LOAD OCCURS AT 2.10 WITH RECOVERY AT 2.10

TIME INCREMENTAL LOAD-KW CHANGE IN DEVIATION NET DEVIATION NET LOAD-KW AVAILABLE LOAD-KW

0.10 34.80 0.21852 0.21852 0.21852 2321.82 2321.82

0.20 36.80 0.01052 0.01052 0.02105 2394.80 2394.80

9.36	36.80	0.01052	0.03157	2394.80	0.0	0.
0.40	36.80	0.01052	0.04210	2394.80	0.0	0.
0.65	36.80	0.01052	0.05332	2394.60	0.0	0.
0.65	37.42	0.01070	0.06332	2395.42	0.0	0.
0.70	38.03	0.01088	0.07426	2396.03	0.0	0.
0.80	30.64	0.01105	0.08523	2396.64	0.0	0.
0.70	39.26	0.01123	0.09618	2397.26	0.0	0.
0.75	39.87	0.00528	0.10176			
DEVIATION AT INJECTION = 0.102						
SYSTEM DEAD TIME = 0.548						
90% RISE TIME = 0.102						
TIME TO MAXIMUM DEVIATION = 0.246						
TIME OF RECOVERY TO 90% PERCENT = 0.9						
90% RECOVERY TIME = 0.565						
STEP NO.11 THE STABILIZING TIME IS 56.00 SECONDS						
THE LOADS ARE AS FOLLOWS						
LOAD	KW	HP	PCT UNIT RATING			
EXCITING	2382					
ADDED	0					
MOTORS	21					
NET LOAD	2410					
THE ACCELERATED RESISTIVE LOAD IS 246 KW, 0.23 PERCENT ROLLING						
THE ACCELERATED SYSTEM INERTIA IS 31153 LB-FT-SQ IN -- L.P. = 0.5025/33.7						
THE TORQUE POWER FOR THE MOTORS AT THIS STEP IS 149.8866 AND THE CORRECTED TORQUE POWER IS 149.8866						
VOLTAGE RISE = 0.798						
TIME TO RECOVER VOLTAGE R.P. = 0.005						
RECOVERY TIME TO 90% PERCENT = 0.0						
TOTAL RECOVERY TIME = 0.016						
0.002						
0.064						
MOTOR NUMBER 1 MOTOR RATING = 25 HP AT 1800 RPM						
THE MOTOR HAS 25 LB-FT SQUARED INERTIA AND WILL HAVE A 21 KW LOAD WHEN RUNNING.						
FULL LOAD TORQUE IS 21 LB-FT						
1800 RPM KW IS 21.0100 @ 90% EFFICIENCY OF 90 PERCENT						
FLAG 1 = 0, FLAG 2 = 2, FLAG 3 = 0						
LOAD TIME = 0.0	KW = 25					
TIME = 0.1000,	INCREMENTAL KW LOAD	25				
TIME = 0.2000,	INCREMENTAL KW LOAD	25				
TIME = 0.3000,	INCREMENTAL KW LOAD	25				
TIME = 0.4000,	INCREMENTAL KW LOAD	25				
TIME = 0.5000,	INCREMENTAL KW LOAD	25				
TIME = 0.6000,	INCREMENTAL KW LOAD	25				
TIME = 0.7000,	INCREMENTAL KW LOAD	25				
TIME = 0.8000,	INCREMENTAL KW LOAD	25				
TIME = 0.9000,	INCREMENTAL KW LOAD	25				
TIME = 1.0000,	INCREMENTAL KW LOAD	25				
TIME = 1.0000,	INCREMENTAL KW LOAD	25				
TIME = 1.2000,	INCREMENTAL KW LOAD	25				
TIME = 1.5000,	INCREMENTAL KW LOAD	25				

APPENDIX B1 FREQUENCY AND VOLTAGE EXCURSION PREDICTIONS LOGSHEET PAGE 11
 6866253 2 L, 5/0 2037.5, 12 OF, 2350 KV R 950 P/B, 1000 LOADS UNIT 2

LINE	TYPE	TIME	KW	INCIDENTAL KW LOAD	INCREMENTAL KW LOAD	NET DEVIATION	AVAILABLE LOAD KW
1	1.5000	73.		1.5000	1.5000	0.0000	2413.87
2	1.7000	41.		1.6000	1.7000	0.0000	2413.87
3	1.8000	42.		1.7000	1.8000	0.0000	2413.87
4	1.9000	52.		1.8000	1.9000	0.0000	2413.87
5	2.0000	21.		1.9000	2.0000	0.0000	2413.87
6	2.1000			2.0000	2.1000	0.0000	2413.87
7	2.2000			2.1000	2.2000	0.0000	2413.87
8	2.3000			2.2000	2.3000	0.0000	2413.87
9	2.4000			2.3000	2.4000	0.0000	2413.87
10	2.5000			2.4000	2.5000	0.0000	2413.87
11	2.6000			2.5000	2.6000	0.0000	2413.87
12	2.7000			2.6000	2.7000	0.0000	2413.87
13	2.8000			2.7000	2.8000	0.0000	2413.87
14	2.9000			2.8000	2.9000	0.0000	2413.87
15	3.0000			2.9000	3.0000	0.0000	2413.87
16	3.1000			3.0000	3.1000	0.0000	2413.87
17	3.2000			3.1000	3.2000	0.0000	2413.87
18	3.3000			3.2000	3.3000	0.0000	2413.87
19	3.4000			3.3000	3.4000	0.0000	2413.87
20	3.5000			3.4000	3.5000	0.0000	2413.87
21	3.6000			3.5000	3.6000	0.0000	2413.87
22	3.7000			3.6000	3.7000	0.0000	2413.87
23	3.8000			3.7000	3.8000	0.0000	2413.87
24	3.9000			3.8000	3.9000	0.0000	2413.87
25	4.0000			3.9000	4.0000	0.0000	2413.87
26	4.1000			4.0000	4.1000	0.0000	2413.87
27	4.2000			4.1000	4.2000	0.0000	2413.87
28	4.3000			4.2000	4.3000	0.0000	2413.87
29	4.4000			4.3000	4.4000	0.0000	2413.87
30	4.5000			4.4000	4.5000	0.0000	2413.87
31	4.6000			4.5000	4.6000	0.0000	2413.87
32	4.7000			4.6000	4.7000	0.0000	2413.87
33	4.8000			4.7000	4.8000	0.0000	2413.87
34	4.9000			4.8000	4.9000	0.0000	2413.87
35	5.0000			4.9000	5.0000	0.0000	2413.87
36	5.1000			5.0000	5.1000	0.0000	2413.87
37	5.2000			5.1000	5.2000	0.0000	2413.87
38	5.3000			5.2000	5.3000	0.0000	2413.87
39	5.4000			5.3000	5.4000	0.0000	2413.87
40	5.5000			5.4000	5.5000	0.0000	2413.87
41	5.6000			5.5000	5.6000	0.0000	2413.87
42	5.7000			5.6000	5.7000	0.0000	2413.87
43	5.8000			5.7000	5.8000	0.0000	2413.87
44	5.9000			5.8000	5.9000	0.0000	2413.87
45	6.0000			5.9000	6.0000	0.0000	2413.87
46	6.1000			6.0000	6.1000	0.0000	2413.87
47	6.2000			6.1000	6.2000	0.0000	2413.87
48	6.3000			6.2000	6.3000	0.0000	2413.87
49	6.4000			6.3000	6.4000	0.0000	2413.87
50	6.5000			6.4000	6.5000	0.0000	2413.87
51	6.6000			6.5000	6.6000	0.0000	2413.87
52	6.7000			6.6000	6.7000	0.0000	2413.87
53	6.8000			6.7000	6.8000	0.0000	2413.87
54	6.9000			6.8000	6.9000	0.0000	2413.87
55	7.0000			6.9000	7.0000	0.0000	2413.87
56	7.1000			7.0000	7.1000	0.0000	2413.87
57	7.2000			7.1000	7.2000	0.0000	2413.87
58	7.3000			7.2000	7.3000	0.0000	2413.87
59	7.4000			7.3000	7.4000	0.0000	2413.87
60	7.5000			7.4000	7.5000	0.0000	2413.87
61	7.6000			7.5000	7.6000	0.0000	2413.87
62	7.7000			7.6000	7.7000	0.0000	2413.87
63	7.8000			7.7000	7.8000	0.0000	2413.87
64	7.9000			7.8000	7.9000	0.0000	2413.87
65	8.0000			7.9000	8.0000	0.0000	2413.87
66	8.1000			8.0000	8.1000	0.0000	2413.87
67	8.2000			8.1000	8.2000	0.0000	2413.87
68	8.3000			8.2000	8.3000	0.0000	2413.87
69	8.4000			8.3000	8.4000	0.0000	2413.87
70	8.5000			8.4000	8.5000	0.0000	2413.87
71	8.6000			8.5000	8.6000	0.0000	2413.87
72	8.7000			8.6000	8.7000	0.0000	2413.87
73	8.8000			8.7000	8.8000	0.0000	2413.87
74	8.9000			8.8000	8.9000	0.0000	2413.87
75	9.0000			8.9000	9.0000	0.0000	2413.87
76	9.1000			9.0000	9.1000	0.0000	2413.87
77	9.2000			9.1000	9.2000	0.0000	2413.87
78	9.3000			9.2000	9.3000	0.0000	2413.87
79	9.4000			9.3000	9.4000	0.0000	2413.87
80	9.5000			9.4000	9.5000	0.0000	2413.87
81	9.6000			9.5000	9.6000	0.0000	2413.87
82	9.7000			9.6000	9.7000	0.0000	2413.87
83	9.8000			9.7000	9.8000	0.0000	2413.87
84	9.9000			9.8000	9.9000	0.0000	2413.87
85	10.0000			9.9000	10.0000	0.0000	2413.87

DEV. OF INFECTION = 0.001
 MAXIMUM DEVIATION = 1.221
 TIME OF MAXIMUM DEVIATION = 0.021
 TIME OF RECOVERY = 1.246

LINE 10112, THE STARTING LINE IS 120.00 SECONDS
 LOAD KW HP PCT UNIT RATING

LINE 2410 92.56
 2410 92.56
 2410 92.56
 2574 90.32

THE REGENERATED RESISTIVE LOAD IS 3.77 KW
 THE REGENERATED SWITCH TORQUE IS 41170. (6-FT-SEC) = 0.17

48320010 FREQUENCY AND VOLTAGE EXCURSION PREDICTIONS PROGRAM PAGE 1
ARKANSAS F & L, S/D 205925, 12 OF, 2850 KW @ 900 RPM, NSLR LOADS, UNIT 1

ENGINE RATED AT 2850.0 KW AT 900.0 RPM, OF 12. CYLINDERS, 2 STROKES PER CYCLE
WITH CAPABILITY OF 120.0 PERCENT LOAD, AND WITH 34572. LB-FT-SQB INERTIA

REGULATOR RATED AT 4043. KVA AND HAS THE FOLLOWING CHARACTERISTICS:

- LOADS LEFT REACTANCE 13.40 PERCENT
- SYSTEM INERTIA REACTANCE 5.00 PERCENT
- TIME CONSTANT 5.00 SECONDS
- FULL LOAD FIELD VOLTAGE 54. VOLTS
- NO-LOAD FIELD VOLTAGE 54. VOLTS
- MAXIMUM FIELD VOLTAGE - FORCING 455. VOLTS
- THE CORRECTED SUB-TRANSIENT REACTANCE IS 21.933 PERCENT

THE POINT FOR DEFINITION OF RECOVERY FOR VOLTAGE IS 90. PERCENT AND FOR FREQUENCY IS 98. PERCENT

THE FOLLOWING CONSTANTS ARE BEING USED FOR THESE COMPUTATIONS:

- GENERATOR DIP CONSTANT 1667.
- EXCITER RECOVERY RATE 25.00
- SYSTEM CONSTANT 320
- MAXIMUM LOAD FACTOR 0.510
- LOAD RECOVERY RATE 0.250 PER SECOND
- LOAD RECOVERY RATE 0.250 PER SECOND
- INERTIA IS 34572. LB-FT-SQB
- THE TIME INCREMENT IN THE CALCULATION IS 0.10 SECONDS
- VOLTAGE OVERSHOOT CONSTANT IS 0.60
- FLAG 20 SET 0
- BACK LEAD TIME CONSTANT IS 0.0270
- GOV. CONTROL FACTOR 1.3500 GOVERNOR DEAD BAND IS 0.1000
- FRICTION HP RATIO = 0.1500

ACCELERATION CONSTANT (C2) = 0.0034000366 ENGINE/GOV. DEAD TIME = 0.3242221334

STEP NO. 1 THE STARTING TIME IS 0.0 SECONDS

THE LOADS ARE AS FOLLOWS

LOAD KW	HP	PER UNIT RATING
EXISTING	0	0.0
GOV	246	8.63
MOTORS	113	3.73
NET LOAD	359	12.50

THE ACCUMULATED RESISTIVE LOAD IS 342 KW @ 0.63 PERCENT RATING
THE ACCUMULATED SYSTEM INERTIA IS 34572. LB-FT-SQB -- C2P = 0.00340003661

THE IMPUSH POWER FOR THE MOTORS AT THIS STEP IS 829. SKVA AND THE CORRECTED THROUGH POWER IS 933. SKVA

VOLTAGE DIP = 4.724

TIME OF POSITIVE VOLTAGE DIP = 0.030

RECOVERY TIME TO 90.0 PERCENT = 0.0

TOTAL RECOVERY TIME = 0.097

2.015

0.034

MOTOR NUMBER 1 MOTOR RATING = 135. HP AT 1800. RPM,
THE MOTOR HAS 150. LB-FT SQUARED INERTIA AND WILL HAVE A 112. KW LOAD WHEN RUNNING.

FOR 1.000 RPM INERTIA IS 324. LB-FT-SQB
FOR 1.000 RPM IS 112. AT AN ASSUMED EFFICIENCY OF 90 PERCENT.

FLAG 1 = 0. FLAG 2 = 2. FLAG 3 = 0.

TRIP TIME = 0.0 , KW = 134.

TRIP TIME = 0.5000, KW = 134.

TIME =	INCREMENTAL KW LOAD =
0.1000	134.
0.2000	134.
0.3000	134.
0.4000	134.
0.5000	134.

STEP NO 2 THE STARTING TIME IS 4.50 SECONDS

THE LOADS ARE AS FOLLOWS

LOAD	KW	HP	PCT UNIT RATING
1	358	525	12.56
2	0	0	0.00
3	663	967	23.57
TOTAL	1021	1492	35.03

THE ACCUMULATED RESISTIVE LOAD IS 246 KW, 8.63 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 34722 LB-FT-SQRD -- C2P = 0.6033853478

THE TORQUE POWER FOR THE MOTORS AT THIS STEP IS 4921.35VA AND THE CORRECTED THROUGH POWER IS 4921.35VA

VOLTAGE DIP = 20.909
 TIME OF MAXIMUM VOLTAGE DIP = 6.131
 RECOVERY TIME TO 90.0 PERCENT = 6.331
 TOTAL RECOVERY TIME = 0.497
 0.664 0.198

MOTOR NUMBER 1 MOTOR RATING = 900 HP AT 835 RPM
 THE MOTOR HAS 5000 LB-FT SQUARED INERTIA AND WILL HAVE 0.622 KW LOAD WHEN RUNNING
 FULL LOAD TORQUE IS 4748 LB-FT
 FULL LOAD KW IS 663 AT AN ASSUMED EFFICIENCY OF 90 PERCENT
 FLAG 1 = 0 FLAG 2 = 0 FLAG 3 = 0

THROTS- PERCENT	AVERAGE			OUTPUT			PERCENT CORRECTED TORQUE	NET TORQUE	SPEED CHANGE	PERCENT SPEED	ACCUH	INCRSHL	KW LOAD
	MOTOR TORQUE	LOAD TORQUE	MOTOR TORQUE	LOAD TORQUE	LOAD TORQUE	AV. TERM TORQUE							
5.00	100.00	15.00	0.00	100.00	11.50	0.00	92.51	50.11	2.77	2.27	0.0	1017	477
5.00	100.00	0.00	0.00	100.00	0.00	0.00	86.57	23.42	1.77	4.03	2.27	1017	960
10.00	100.00	4.00	100.00	100.00	6.00	0.30	85.14	70.47	2.20	6.23	6.23	947	947
15.00	100.00	8.00	100.00	100.00	9.00	0.30	81.15	63.06	2.55	8.78	8.78	1001	1001
20.00	100.00	12.00	100.00	100.00	12.00	0.50	97.00	90.74	3.00	11.78	11.78	1069	1069
25.00	100.00	16.00	100.00	100.00	16.00	0.60	100.00	98.50	3.19	13.96	13.96	1066	1066
30.00	100.00	20.00	100.00	100.00	20.00	0.70	100.00	96.50	3.19	16.15	16.15	1070	1070
35.00	100.00	24.00	100.00	100.00	24.00	0.80	100.00	95.00	3.14	18.29	18.29	1071	1071
40.00	100.00	28.00	100.00	100.00	28.00	0.90	100.00	93.00	3.14	20.43	20.43	1071	1071
45.00	100.00	32.00	100.00	100.00	32.00	1.00	100.00	92.50	3.06	22.57	22.57	1071	1071
50.00	100.00	36.00	100.00	100.00	36.00	1.10	100.00	92.00	2.94	24.71	24.71	1071	1071
55.00	100.00	40.00	100.00	100.00	40.00	1.20	100.00	92.00	2.81	26.85	26.85	1071	1071
60.00	100.00	44.00	100.00	100.00	44.00	1.30	100.00	92.00	2.81	28.99	28.99	1071	1071
65.00	100.00	48.00	100.00	100.00	48.00	1.40	100.00	92.00	2.69	31.13	31.13	1071	1071
70.00	100.00	52.00	100.00	100.00	52.00	1.50	100.00	92.00	2.54	33.27	33.27	1071	1071
75.00	100.00	56.00	100.00	100.00	56.00	1.60	100.00	92.00	2.54	35.41	35.41	1071	1071
80.00	100.00	60.00	100.00	100.00	60.00	1.70	100.00	92.00	2.36	37.55	37.55	1071	1071
85.00	100.00	64.00	100.00	100.00	64.00	1.80	100.00	92.00	2.36	39.69	39.69	1071	1071
90.00	100.00	68.00	100.00	100.00	68.00	1.90	100.00	92.00	2.21	41.83	41.83	1071	1071
95.00	100.00	72.00	100.00	100.00	72.00	2.00	100.00	92.00	2.06	43.97	43.97	1071	1071
100.00	100.00	76.00	100.00	100.00	76.00	2.10	100.00	92.00	2.06	46.11	46.11	1071	1071
105.00	100.00	80.00	100.00	100.00	80.00	2.20	100.00	92.00	1.86	48.25	48.25	1071	1071
110.00	100.00	84.00	100.00	100.00	84.00	2.30	100.00	92.00	1.86	50.39	50.39	1071	1071
115.00	100.00	88.00	100.00	100.00	88.00	2.40	100.00	92.00	1.71	52.53	52.53	1071	1071
120.00	100.00	92.00	100.00	100.00	92.00	2.50	100.00	92.00	1.71	54.67	54.67	1071	1071
125.00	100.00	96.00	100.00	100.00	96.00	2.60	100.00	92.00	1.56	56.81	56.81	1071	1071
130.00	100.00	100.00	100.00	100.00	100.00	2.70	100.00	92.00	1.56	58.95	58.95	1071	1071
135.00	100.00	104.00	100.00	100.00	104.00	2.80	100.00	92.00	1.41	61.09	61.09	1071	1071
140.00	100.00	108.00	100.00	100.00	108.00	2.90	100.00	92.00	1.41	63.23	63.23	1071	1071
145.00	100.00	112.00	100.00	100.00	112.00	3.00	100.00	92.00	1.26	65.37	65.37	1071	1071
150.00	100.00	116.00	100.00	100.00	116.00	3.10	100.00	92.00	1.26	67.51	67.51	1071	1071
155.00	100.00	120.00	100.00	100.00	120.00	3.20	100.00	92.00	1.11	69.65	69.65	1071	1071
160.00	100.00	124.00	100.00	100.00	124.00	3.30	100.00	92.00	1.11	71.79	71.79	1071	1071
165.00	100.00	128.00	100.00	100.00	128.00	3.40	100.00	92.00	0.96	73.93	73.93	1071	1071
170.00	100.00	132.00	100.00	100.00	132.00	3.50	100.00	92.00	0.96	76.07	76.07	1071	1071
175.00	100.00	136.00	100.00	100.00	136.00	3.60	100.00	92.00	0.81	78.21	78.21	1071	1071
180.00	100.00	140.00	100.00	100.00	140.00	3.70	100.00	92.00	0.81	80.35	80.35	1071	1071
185.00	100.00	144.00	100.00	100.00	144.00	3.80	100.00	92.00	0.66	82.49	82.49	1071	1071
190.00	100.00	148.00	100.00	100.00	148.00	3.90	100.00	92.00	0.66	84.63	84.63	1071	1071
195.00	100.00	152.00	100.00	100.00	152.00	4.00	100.00	92.00	0.51	86.77	86.77	1071	1071
200.00	100.00	156.00	100.00	100.00	156.00	4.10	100.00	92.00	0.51	88.91	88.91	1071	1071
205.00	100.00	160.00	100.00	100.00	160.00	4.20	100.00	92.00	0.36	91.05	91.05	1071	1071
210.00	100.00	164.00	100.00	100.00	164.00	4.30	100.00	92.00	0.36	93.19	93.19	1071	1071
215.00	100.00	168.00	100.00	100.00	168.00	4.40	100.00	92.00	0.21	95.33	95.33	1071	1071
220.00	100.00	172.00	100.00	100.00	172.00	4.50	100.00	92.00	0.21	97.47	97.47	1071	1071
225.00	100.00	176.00	100.00	100.00	176.00	4.60	100.00	92.00	0.06	99.61	99.61	1071	1071
230.00	100.00	180.00	100.00	100.00	180.00	4.70	100.00	92.00	0.06	101.75	101.75	1071	1071
235.00	100.00	184.00	100.00	100.00	184.00	4.80	100.00	92.00	0.00	103.89	103.89	1071	1071
240.00	100.00	188.00	100.00	100.00	188.00	4.90	100.00	92.00	0.00	106.03	106.03	1071	1071
245.00	100.00	192.00	100.00	100.00	192.00	5.00	100.00	92.00	0.00	108.17	108.17	1071	1071
250.00	100.00	196.00	100.00	100.00	196.00	5.10	100.00	92.00	0.00	110.31	110.31	1071	1071
255.00	100.00	200.00	100.00	100.00	200.00	5.20	100.00	92.00	0.00	112.45	112.45	1071	1071
260.00	100.00	204.00	100.00	100.00	204.00	5.30	100.00	92.00	0.00	114.59	114.59	1071	1071
265.00	100.00	208.00	100.00	100.00	208.00	5.40	100.00	92.00	0.00	116.73	116.73	1071	1071
270.00	100.00	212.00	100.00	100.00	212.00	5.50	100.00	92.00	0.00	118.87	118.87	1071	1071
275.00	100.00	216.00	100.00	100.00	216.00	5.60	100.00	92.00	0.00	121.01	121.01	1071	1071
280.00	100.00	220.00	100.00	100.00	220.00	5.70	100.00	92.00	0.00	123.15	123.15	1071	1071
285.00	100.00	224.00	100.00	100.00	224.00	5.80	100.00	92.00	0.00	125.29	125.29	1071	1071
290.00	100.00	228.00	100.00	100.00	228.00	5.90	100.00	92.00	0.00	127.43	127.43	1071	1071
295.00	100.00	232.00	100.00	100.00	232.00	6.00	100.00	92.00	0.00	129.57	129.57	1071	1071
300.00	100.00	236.00	100.00	100.00	236.00	6.10	100.00	92.00	0.00	131.71	131.71	1071	1071
305.00	100.00	240.00	100.00	100.00	240.00	6.20	100.00	92.00	0.00	133.85	133.85	1071	1071
310.00	100.00	244.00	100.00	100.00	244.00	6.30	100.00	92.00	0.00	135.99	135.99	1071	1071
315.00	100.00	248.00	100.00	100.00	248.00	6.40	100.00	92.00	0.00	138.13	138.13	1071	1071
320.00	100.00	252.00	100.00	100.00	252.00	6.50	100.00	92.00	0.00	140.27	140.27	1071	1071
325.00	100.00	256.00	100.00	100.00	256.00	6.60	100.00	92.00	0.00	142.41	142.41	1071	1071
330.00	100.00	260.00	100.00	100.00	260.00	6.70	100.00	92.00	0.00	144.55	144.55	1071	1071
335.00	100.00	264.00	100.00	100.00	264.00	6.80	100.00	92.00	0.00	146.69	146.69	1071	1071
340.00	100.00	268.00											

45.00	100.00	40.00	100.00	37.50	2.20	100.00	100.00	67.00	2.21	50.62	889.
					2.30	100.00	100.00	67.50	2.07	60.58	850.
					2.40	100.00	100.00	62.50	2.07	62.77	818.
					2.50	100.00	100.00	59.50	2.07	64.81	808.
50.00	100.00	40.00	100.00	41.00	2.60	100.00	100.00	56.00	1.85	66.60	828.
					2.70	100.00	100.00	54.00	1.85	68.51	820.
55.00	107.00	53.00	103.50	52.00	2.80	109.00	103.50	51.50	1.70	70.22	811.
					2.90	100.00	103.50	51.50	1.70	71.62	827.
					3.00	100.00	103.50	51.50	1.70	73.62	813.
					3.10	100.00	121.00	62.00	2.05	75.67	823.
					3.20	100.00	121.00	62.00	2.05	77.22	818.
					3.30	100.00	121.00	62.00	2.05	79.77	803.
65.00	169.00	72.00	152.00	67.00	3.40	100.00	152.00	85.00	2.81	82.57	1075.
50.00	198.00	80.00	183.50	76.00	3.50	100.00	183.50	107.50	3.53	86.13	1206.
					3.60	100.00	183.50	107.50	3.53	89.68	1268.
95.00	189.00	90.00	193.50	85.00	3.70	100.00	193.50	108.50	3.59	93.26	1317.
100.00	100.00	98.00	144.50	54.00	3.80	100.00	144.50	50.50	1.67	94.93	993.
					3.90	100.00	144.50	50.50	1.67	97.40	978.
					4.00	100.00	144.50	50.50	1.67	98.57	967.
					4.10	100.00	144.50	50.50	1.67	99.54	950.

TOTAL EQUIVALENT ENERGY = 268.32886
 DEGREE OF SEVERITY = 146.00814
 PEAK HOLLOW LOAD = 1317.61 3.0000SLDMS

PEAK LOAD KM = 1317. AND OCCURS AT 3.70
 PEZ. OVERVOLTAGE OCCURS AT 4.10 WITH RECOVERY AT 5.31

TIME	INCREMENTAL LOAD-KM	CHARGE IN DEVIATION	NET DEVIATION	NET 1060-KM	AVAILABLE LOAD-KM
0.10	821.94	0.31310	0.31310	1202.86	0.0 0.
0.20	827.76	0.28023	0.59332	1185.76	0.0 0.
0.30	892.12	0.30204	0.89536	1256.17	0.0 0.
0.40	976.67	0.32565	1.22102	1334.67	1705.78 1.
0.50	976.67	-0.00189	1.21913	1421.37	1857.97 1.
0.60	1063.67	-0.14770	1.07143	1414.02	1921.63 1.
0.70	1086.02	-0.16179	0.90964	1480.16	1933.80 1.
0.80	1070.16	-0.17019	0.73944	1412.55	1935.14 1.
0.90	1054.55	-0.17827	0.56117	1396.94	1946.31 1.
1.00	1038.94	-0.18598	0.37519	1381.73	1953.95 1.

OSCILLATION AC REFLECTION = 1.294
 SYSTEM DEAD TIME = 0.398
 MAXIMUM REVISION = 1.398
 TIME OF RECOVERY TO 98.0 PERCENT = 0.8
 TOTAL RECOVERY TIME = 1.691

APR520046 FREQUENCY AND VOLTAGE EXCURSION PREDICTION PROGRAM PAGE 5
 DEPARTMENT P & L, 570 2000 A, 13 OF, 2850 FM P 500 EFB, BURLINGAME, UNIT 1

75.00	172.00	59.00	169.00	46.50	5.00	100.00	161.00	121.00	5.27	66.18	727.
80.00	175.00	57.00	173.50	53.50	2.10	100.00	169.00	122.50	5.36	71.54	917.
85.00	173.00	64.00	174.00	60.50	2.20	100.00	172.00	120.00	5.25	70.37	917.
90.00	160.00	72.00	170.50	68.00	2.30	100.00	174.00	113.50	4.96	81.75	913.
95.00	157.00	80.00	162.50	76.00	2.40	100.00	170.50	102.50	4.48	86.23	899.
100.00	106.00	88.00	128.50	84.00	2.50	100.00	162.50	86.50	3.78	90.91	843.
					2.60	100.00	162.50	84.50	3.78	93.77	831.
					2.70	100.00	170.50	44.50	1.95	75.74	653.
					2.80	100.00	162.50	44.50	1.95	57.68	613.
					2.90	100.00	162.50	44.50	1.95	59.63	640.

TOTAL EQUIVALENT ENERGY = 739.02612
 PERCENT SEVERITY = 149.59781
 CLEAR HOLD LOAD = 242.41 AT 2.2000 SECONDS

EXCESS LOAD KW = 542.000 OCCURS AT 3.20
 MAX. OVERVOLTAGE OCCURS AT 2.70 WITH RECOVERY AT 3.82

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	582.50	0.17444	0.17444	1562.50	0.0 0.
0.20	573.90	0.16983	0.34427	1553.90	0.0 0.
0.30	638.23	0.18826	0.53253	1613.23	0.0 0.
0.40	683.20	0.20217	0.73470	1663.20	0.0 0.
0.41	623.72	0.02023	0.75493	1673.72	2667.62 2.
0.50	673.72	0.10468	0.85961	1669.69	2119.35 2.
0.60	689.60	-0.13309	0.72652	1658.02	2171.26 2.
0.70	878.02	-0.15188	0.57464	1656.23	2223.22 2.
0.80	676.23	-0.16779	0.40685	1633.49	2573.23 2.
0.90	663.49	0.18664	0.59349		

MAXIMUM DEVIATION OF THE REACTION = 0.756
 SYSTEM BEAT TIME = 0.316
 MAXIMUM DEVIATION = 0.756
 TIME OF MAXIMUM DEVIATION = 0.410
 TIME OF RECOVERY TO 50.0 PERCENT = 0.6
 TOTAL RECOVERY TIME = 0.655

STEP NO. 4 THE STARTING TIME IS 15.00 SECONDS
 THE LOADS ARE AS FOLLOWS:

LOAD KW	HP	PER UNIT RATING
1287.		45.16
506.		13.54
1701.		59.70

THE ACCUMULATED RESISTIVE LOAD IS 246.40 KW, 0.43 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 3089.6 LB-FT-SQ IN, 1.21 PERCENT RATING

THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 2954. SKVA AND THE CORRECTED INRUSH POWER IS 2954. SKVA

VOLTAGE DUE TO INRUSH = 11.754
 TIME OF MAXIMUM VOLTAGE DUE TO INRUSH = 0.603
 DECELERATION TIME TO 90 PERCENT = 0.154
 TOTAL RECOVERY TIME = 0.306

MOTOR NUMBER 1 MOTOR RATING = 500 HP AT 1780 RPM.
 THE MOTOR HAS 310 LB-FT SQUARED INERTIA AND WILL HAVE A 166. KG LOAD WHEN RUNNING.
 FULL LOAD TORQUE IS 1175 LB-FT
 FULL LOAD RPM IS 1780
 FLAG 1 = 0. FLAG 2 = 0. FLAG 3 = 0.
 ASSUMED EFFICIENCY OF 96 PERCENT.

INPUTS - PERCENT		AVERAGE		OUTPUT		PERCENT CORRECTED		PERCENT INCRNTL		ACCUR.		INCRNTL	
SPEED	MOTOR TORQUE	LOAD TORQUE	BOUR TORQUE	LOAD TORQUE	SECONDS	AV. TERM VOLTAGE	TORQUE	TORQUE	NET TORQUE	STEEP	PERCENT STEEP	PERCENT	KW LOAD
0.0	100.00	15.00	101.00	12.00	0.0	23.22	92.00	91.50	6.72	6.72	0.0	0.0	311.
5.0	102.00	9.00	102.50	7.50	0.10	89.73	83.34	78.34	6.46	13.18	6.72	6.72	615.
10.00	103.00	6.00	103.50	5.00	0.30	96.30	100.63	96.13	7.92	21.10	6.72	6.72	662.
15.00	113.00	8.00	111.50	6.50	0.40	99.79	111.04	104.54	8.61	29.71	6.72	6.72	679.
20.00	117.00	10.00	115.00	8.00	0.50	100.00	117.00	107.50	8.86	30.57	6.72	6.72	684.
25.00	125.00	17.00	123.00	15.00	0.60	100.00	128.50	109.00	8.98	47.55	6.72	6.72	696.
30.00	132.00	22.00	120.50	19.50	0.70	100.00	123.50	124.50	10.26	57.81	6.72	6.72	705.
35.00	182.00	37.00	173.00	34.00	0.80	100.00	125.50	150.00	12.36	70.17	6.72	6.72	723.
40.00	193.00	42.00	167.50	39.50	0.90	100.00	120.00	138.50	11.41	81.70	6.72	6.72	731.
45.00	198.00	49.00	195.50	45.50	1.00	100.00	173.50	78.50	8.12	89.70	6.72	6.72	751.
50.00	200.00	58.00	198.00	52.50	1.10	100.00	141.00	42.00	3.76	23.65	6.72	6.72	762.
55.00	196.00	63.00	198.00	59.50	1.20	100.00	131.00	48.00	3.96	27.61	6.72	6.72	780.
60.00	195.00	71.00	190.50	67.00	1.30	100.00	121.00	48.00	3.96	101.56	6.72	6.72	788.
65.00	182.00	79.00	173.50	75.00	1.40	100.00	173.50	78.50	8.12	89.70	6.72	6.72	751.
70.00	100.00	87.00	131.00	83.00	1.50	100.00	121.00	48.00	3.96	101.56	6.72	6.72	780.

TOTAL EQUIVALENT ENERGY = 6875.24287
 PERCENT EFFICIENCY = 903.01 @ 0.2000 SECONDS
 LOAD RECOVERY OCCURS AT 1.30 WITH RECOVERY AT 2.00

TIME INCREMENTAL LOAD-KW CHANGE IN DEVIATION NET DEVIATION NET LOAD-KW AVAILABLE LOAD-KW
 0.10 596.97 0.17589 1882.97 0.0 0.

EXERCISE 1010 FREQUENCY AND VOLTAGE EXCESSION PREDICTIONS PROGRAM PAGE 11
 ADDRESS F & L, S.D. 266725, 12 OF, 28350 EW @ 966 FPH, BSLE 106605, UNIT 1

20.00	272.00	0.20	226.00	6.57	228.56	11.42	267.
25.00	249.00	1.50	226.50	1.18	217.68	19.07	345
30.00	218.00	3.00	213.50	2.12	213.01	19.64	332.
35.00	213.00	4.50	210.50	3.31	202.74	10.13	315.
40.00	209.00	6.40	202.50	7.76	187.93	9.39	296.
50.00	204.00	12.50	195.50	19.21	170.97	8.54	277.
55.00	201.00	18.50	192.50	14.57	160.62	8.02	267.
60.00	197.00	21.60	189.00	12.12	151.50	7.66	257.
65.00	194.00	27.40	185.50	14.53	141.01	7.06	238.
70.00	189.00	34.30	181.50	30.88	138.19	6.90	228.
75.00	182.00	42.10	178.00	39.24	125.50	6.90	218.
80.00	188.00	51.20	183.50	46.57	113.01	7.06	208.
85.00	201.00	61.31	174.50	56.31	100.00	7.06	198.
90.00	231.00	72.50	215.00	67.16	87.18	8.30	188.
95.00	260.00	85.70	245.50	79.32	74.13	4.35	178.
100.00	100.00	100.00	100.00	92.87	61.13	5.35	168.

0.10	99.63	228.78	228.56	11.42	267.
0.20	72.63	212.50	217.68	19.07	345
0.30	100.00	216.50	213.01	19.64	332.
0.40	100.00	210.50	202.74	10.13	315.
0.50	100.00	202.50	187.93	9.39	296.
0.60	100.00	195.50	170.97	8.54	277.
0.70	100.00	191.50	160.62	8.02	267.
0.80	100.00	185.50	151.50	7.66	257.
0.90	100.00	191.50	138.19	6.90	228.
1.00	100.00	245.50	166.18	8.30	313.
1.10	100.00	150.00	87.18	4.35	228.
1.20	100.00	180.00	87.18	5.35	168.

0.10	363.39	0.10624	1816.39	0.0
0.20	346.01	0.10116	1729.01	0.0
0.30	324.59	0.09782	1787.59	0.0
0.40	319.13	0.09330	1772.13	0.0
0.50	301.86	0.08876	1753.86	0.0
0.51	284.66	0.01154	1739.66	2521.37.24
0.52	286.66	0.12783	1739.66	2567.75.2.
0.70	275.66	0.24532	1739.66	

TOTAL FORMALIN ENERGY = 220.00154
 FORMALIN ENERGY = 233.23265
 FLOW MOTOR LOAD = 367. AT 0.1000SECONDS
 PEAK LOAD KW = 367. AND OCCURS AT 0.10
 LOAD OVERSAMPLING GROUPS AT 1.20 WITH RECOVERY AT 1.51
 TIME INTERVAL LOAD-KW CHANGE IN DEVIATION
 TIME DEVIATION = 0.10624
 TIME DEVIATION = 0.10116
 TIME DEVIATION = 0.09782
 TIME DEVIATION = 0.09330
 TIME DEVIATION = 0.08876
 TIME DEVIATION = 0.01154
 TIME DEVIATION = 0.12783
 TIME DEVIATION = 0.24532
 DEVIATION AT INJECTION = 0.268
 STEADY STATE TIME = 0.214
 TIME DEVIATION = 0.498
 TIME DEVIATION = 0.513
 TIME DEVIATION TO 50 PERCENT = 0.721
 TIME DEVIATION TO 100 PERCENT = 0.721

66122019 FREQUENCY AND VIBRATION EXCURSION PREDICTIONS PROGRAM PAGE 10
 BRKANSAS P & L, S-0 205225, 12 OF, 2850 KW @ 900 RPM, HELIX L0005, UNIT 1

STEP 01: 6 THE STARTING TIME IS 25.60 SECONDS
 THE LOADS ARE AS FOLLOWS:

LOAD	KW	HP	PCT	UNIT	RATING
1	157.6	212.5	75		
2	157.6	212.5	75		
3	157.6	212.5	75		
4	157.6	212.5	75		
5	157.6	212.5	75		
6	157.6	212.5	75		
7	157.6	212.5	75		
8	157.6	212.5	75		
9	157.6	212.5	75		
10	157.6	212.5	75		
11	157.6	212.5	75		
12	157.6	212.5	75		
13	157.6	212.5	75		
14	157.6	212.5	75		
15	157.6	212.5	75		
16	157.6	212.5	75		
17	157.6	212.5	75		
18	157.6	212.5	75		
19	157.6	212.5	75		
20	157.6	212.5	75		
21	157.6	212.5	75		
22	157.6	212.5	75		
23	157.6	212.5	75		
24	157.6	212.5	75		
25	157.6	212.5	75		
26	157.6	212.5	75		
27	157.6	212.5	75		
28	157.6	212.5	75		
29	157.6	212.5	75		
30	157.6	212.5	75		
31	157.6	212.5	75		
32	157.6	212.5	75		
33	157.6	212.5	75		
34	157.6	212.5	75		
35	157.6	212.5	75		
36	157.6	212.5	75		
37	157.6	212.5	75		
38	157.6	212.5	75		
39	157.6	212.5	75		
40	157.6	212.5	75		
41	157.6	212.5	75		
42	157.6	212.5	75		
43	157.6	212.5	75		
44	157.6	212.5	75		
45	157.6	212.5	75		
46	157.6	212.5	75		
47	157.6	212.5	75		
48	157.6	212.5	75		
49	157.6	212.5	75		
50	157.6	212.5	75		
51	157.6	212.5	75		
52	157.6	212.5	75		
53	157.6	212.5	75		
54	157.6	212.5	75		
55	157.6	212.5	75		
56	157.6	212.5	75		
57	157.6	212.5	75		
58	157.6	212.5	75		
59	157.6	212.5	75		
60	157.6	212.5	75		
61	157.6	212.5	75		
62	157.6	212.5	75		
63	157.6	212.5	75		
64	157.6	212.5	75		
65	157.6	212.5	75		
66	157.6	212.5	75		
67	157.6	212.5	75		
68	157.6	212.5	75		
69	157.6	212.5	75		
70	157.6	212.5	75		
71	157.6	212.5	75		
72	157.6	212.5	75		
73	157.6	212.5	75		
74	157.6	212.5	75		
75	157.6	212.5	75		
76	157.6	212.5	75		
77	157.6	212.5	75		
78	157.6	212.5	75		
79	157.6	212.5	75		
80	157.6	212.5	75		
81	157.6	212.5	75		
82	157.6	212.5	75		
83	157.6	212.5	75		
84	157.6	212.5	75		
85	157.6	212.5	75		
86	157.6	212.5	75		
87	157.6	212.5	75		
88	157.6	212.5	75		
89	157.6	212.5	75		
90	157.6	212.5	75		
91	157.6	212.5	75		
92	157.6	212.5	75		
93	157.6	212.5	75		
94	157.6	212.5	75		
95	157.6	212.5	75		
96	157.6	212.5	75		
97	157.6	212.5	75		
98	157.6	212.5	75		
99	157.6	212.5	75		
100	157.6	212.5	75		

THE ACCUMULATED RESISTIVE LOAD IS 246. KW, 8.63 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 40548. LB-FT-SEC² -- CIP = 0.6929785003

FOR THROUGH POWER FOR THE MOTORS AT THIS STEP IS 2730. 38VA AND THE CORRECTED THROUGH POWER IS 2730. 38VA

VOLTAGE DIP = 12.644
 FACT OF MAXIMUM VOLTAGE DIP = 0.080
 RECOVERY TIME TO 90.0 PERCENT = 0.134
 TOTAL RECOVERY TIME = 0.285
 0.035 0.091

MOTOR NUMBER 1 MOTOR RATING = 455. HP @ 1780. RPM.
 THE MOTOR RATING IS 335. LB-FT SQUARED INERTIA AND WILL HAVE A 377. KW LOAD WHEN RUNNING.
 FULL LOAD TORQUE IS 1343. LB-FT
 FULL LOAD KW IS 377. AT AN ASSUMED EFFICIENCY OF 90 PERCENT.
 FLAG 1 = 0. FLAG 2 = 0. FLAG 3 = 0.

INCREASING	MOTOR TORQUE	LOAD TORQUE	MOTOR TORQUE	LOAD TORQUE	TIME SECONDS	AV. TERM VOLTAGE	MOTOR TORQUE	NET TORQUE	SPEED CHANGE	PERCENT SPEED	ACCUM. INCREASING	MOTOR TORQUE	LOAD TORQUE	MOTOR TORQUE	LOAD TORQUE	PERCENT SPEED	ACCUM. INCREASING
0.0	100.00	15.00	100.00	15.00	0.0					0.0							
5.00	101.00	11.00	100.50	13.00	0.10	93.89	93.36	81.36	5.64	5.74	658.						
10.00	102.00	7.00	100.20	9.00	0.20	91.09	87.13	81.13	5.63	11.27	509.						
15.00	103.00	5.00	100.00	7.00	0.30	87.20	86.56	86.56	0.70	17.98	617.						
20.00	104.00	5.00	100.00	10.50	0.40	100.00	117.70	106.00	7.37	25.31	832.						
25.00	105.00	5.00	100.00	14.50	0.50	100.00	117.00	106.50	7.30	32.70	632.						
30.00	106.00	5.00	100.00	19.00	0.60	100.00	117.00	106.50	7.30	40.00	432.						
35.00	107.00	5.00	100.00	23.50	0.70	100.00	117.00	106.50	7.63	47.98	651.						
40.00	108.00	5.00	100.00	28.00	0.80	100.00	117.00	106.50	8.04	56.69	733.						
45.00	109.00	5.00	100.00	32.50	0.90	100.00	117.00	106.50	8.51	66.00	800.						
50.00	110.00	5.00	100.00	37.00	1.00	100.00	117.00	106.50	9.04	75.82	867.						
55.00	111.00	5.00	100.00	41.50	1.10	100.00	117.00	106.50	9.63	84.37	777.						
60.00	112.00	5.00	100.00	46.00	1.20	100.00	117.00	106.50	10.28	93.00	726.						
65.00	113.00	5.00	100.00	50.50	1.30	100.00	117.00	106.50	11.00	101.43	675.						
70.00	114.00	5.00	100.00	55.00	1.40	100.00	117.00	106.50	11.80	110.00	624.						
75.00	115.00	5.00	100.00	59.50	1.50	100.00	117.00	106.50	12.70	119.00	573.						
80.00	116.00	5.00	100.00	64.00	1.60	100.00	117.00	106.50	13.70	128.00	522.						
85.00	117.00	5.00	100.00	68.50	1.70	100.00	117.00	106.50	14.80	137.00	471.						
90.00	118.00	5.00	100.00	73.00	1.80	100.00	117.00	106.50	16.00	146.00	420.						
95.00	119.00	5.00	100.00	77.50	1.90	100.00	117.00	106.50	17.30	155.00	369.						
100.00	120.00	5.00	100.00	82.00	2.00	100.00	117.00	106.50	18.70	164.00	318.						

TOTAL EQUIVALENT ENERGY = 655.97437

LEVEL OF SEVERITY = 173.93180

PER MOTOR LOAD = 815.61 1.0000SECONDS

PEAK LOAD KW = 915 AND OCCURS AT 1.69

MAX. OVERVOLTAGE OCCURS AT 1.50 WITH RECOVERY AT 2.24

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	551.25	0.15980	0.15980	44.50	0.0 0.
0.20	552.79	0.16025	0.32005	44.50	0.0 0.
0.30	615.09	0.17931	0.49936	2192.09	0.0 0.
0.40	632.32	0.18333	0.68269	2216.32	0.0 0.
0.50	631.63	0.04020	0.72289	2208.63	2654.05 2.
0.56	631.63	-0.10078	0.62212	2208.63	2693.36 2.
0.60	649.95	-0.13521	0.48791	2228.00	2772.70 2.
0.70	651.00	-0.14640	0.34150	2384.55	2912.04 2.
0.80	733.48	-0.13399	0.20751		
0.90	807.55	-0.12393	0.08359		

DEVIATION AT INFLECTION = 0.724

SYSTEM DEAD TIME = 0.422

MINIMUM DEVIATION = 0.724

TIME OF MAXIMUM DEVIATION = 0.122

TIME OF RECOVERY TO 99.0 PERCENT = 0.0

TOTAL RECOVERY TIME = 0.963

THE MOTOR STARTING TIME IS 36.66 SECONDS

THE LOADS ARE AS FOLLOWS

LOAD KW HP PER UNIT RATING

EXISTING 1954 68.56

ADDED 0.0

TOTALS 87. 105. 3.05

NET LOAD 2091. 71.62

THE AGGRAVATED PERSISTIVE LOAD IS 246. KW, 8.63 PERCENT RATING

THE AGGRAVATED SYSTEM INERTIA IS 46883. LB-FT-SQRD -- C2P = 0.6628751367

THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 536. SEVA AND THE CORRECTED THROUGH POWER IS 536. SEVA

VOLTAGE DIP = 2.012

TIME OF MAXIMUM VOLTAGE DIP = 0.018

RECOVERY TIME TO 90.0 PERCENT = 0.0

TOTAL RECOVERY TIME = 0.057

0.009 0.620

DEVIATION AT INJECTION = 0.330
 SYSTEM BEAR TIME = 0.576
 DIVISION = 0.130
 TIME OF OSCILLATION DEVIATION = 0.376
 TIME OF RECOVERY TO 90.0 PERCENT = 0.9
 TOTAL RECOVERY TIME = 0.691

THE 100% OF THE STARTING TIME IS 30.00 SECONDS
 THE LOSSES ARE AS FOLLOWS
 LOAD KW HF PCI UNIT RATING

EXISTING 2012: 70.84
 AMPL 0.0
 MOTORS 87. 105.
 REL LOAD 2106. 73.20

THE ACCUMULATED RESISTIVE LOAD IS 246. KW
 THE ACCUMULATED SYSTEM INERTIA IS 40269. LB-FT-SQRD -- CIP = 0.0628671313

THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 536. SKVA AND THE CORRECTED INRUSH POWER IS 536. SKVA

VOLTAGE DIP = 2.812
 TIME OF HAVTHORN VOLTAGE DIP = 0.018
 RECOVERY TIME TO 90.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.057
 0.009 0.020

MOTOR NUMBER 1 MOTOR RATING = 105. HP AT 1775 RPM
 THE MOTOR HGS = 85. LB-FT SQUARED INERTIA AND WILL HAVE A .65 KW LOAD WHEN FURRING.
 FULL LOAD TORQUE IS 311. LB-FT
 FULL LOAD KW IS 87. AT AN ASSUMED EFFICIENCY OF 90 PERCENT.
 FLAG 1 = 0. FLAG 2 = 0. FLAG 3 = 1.

INPUTS	PERCENT	AVERAGE	OUTPUT	PERCENT CORRECTED	PERCENT INCRUSHL	ACCUM.	INCRUSHL		
STEP	MOTOF	LOAD	MOTOF	AV. TORQ	MOTOR	NET	SPEED	PERCENT	FW LOAD
INJECTION	TORQUE	TORQUE	TORQUE	VOLTAGE	TORQUE	TORQUE	CHARGE	SPEED	KW
0.0	235.00	0.0	235.00	0.0	0.0	0.0	0.0	0.0	0.0
2.00	232.00	0.01	232.00	0.01	0.01	0.01	0.01	0.01	0.01
10.00	216.00	0.10	216.00	0.10	0.10	0.10	0.10	0.10	0.10
20.00	207.00	0.80	211.50	0.80	221.50	221.28	14.03	14.03	216.
30.00	187.00	1.56	203.00	1.18	191.00	190.87	12.11	26.14	216.
40.00	163.00	2.70	193.00	2.13	173.50	173.16	11.03	38.17	187.
50.00	135.00	4.29	176.00	3.49	168.50	168.56	10.00	47.19	151.
60.00	105.00	6.40	166.00	5.24	161.50	161.50	9.03	56.22	105.
70.00	73.00	9.11	151.00	7.76	151.00	151.00	8.66	64.56	73.
80.00	42.19	12.50	141.00	10.81	146.00	146.00	8.10	72.00	42.19
90.00	30.88	16.24	131.00	14.57	142.50	142.50	7.66	80.66	30.88
100.00	168.00	21.66	124.00	19.12	136.47	136.47	6.56	87.11	168.00
110.00	168.00	27.46	116.00	24.53	127.76	127.76	5.66	92.77	168.00
120.00	168.00	34.70	107.50	30.88	122.00	122.00	4.80	97.97	168.00
130.00	168.00	42.19	100.00	38.24	117.00	117.00	4.00	103.97	168.00

DEVIATION AT INFECTION = 0.115
 SYSTEM DEAD TIME = 0.798
 MAXIMUM DEVIATION = 0.115
 TIME OF DEAD TIME DEVIATION = 0.798
 TIME OF RECOVERY TO 90.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.832

WITH 20110 THE STARTUP TIME IS 60.60 SECONDS
 THE LOADS ARE AS FOLLOWS

EXISTING	2125.	74.53
ADDED	0.	0.0
TOTAL	2125.	74.53
PERCENT	42.	
NET LOAD	2125.	74.53

THE ACCUMULATED RESISTIVE LOAD IS 216. KW @ 8.63 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 41163. LB-FT-SEC² -- CIP = 0.9928597590

THE BRUSH POWER FOR THE MOTORS AT THIS STEP IS 280. SKVA AND THE CORRECTED THROUGH POWER IS 280. SKVA

VOLTAGE DIP = 1.531
 TIME OF HAZARDOUS VOLTAGE DIP = 0.010
 RECOVERY TIME TO 90.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.031
 CIP = 0.995

MOTOR NUMBER 1 MOTOR RATING = 42. HP AT 1800. RPM.
 THE HOLDER HAS 20. LB-FT² SCRAPPED INERTIA AND WILL HAVE A 35. KW LOAD WHEN RUNNING.
 THE LOAD IS 35. HP AT 90 ASSUMED EFFICIENCY OF 90 PERCENT.
 FLAG 1 = 9. FLAG 2 = 2. FLAG 3 = 0.

INPUT TIME = 0.0 , KW = 42.

TIME = 0.1000.	INCREMENTAL KW LOAD =	42.
TIME = 0.2000.	INCREMENTAL KW LOAD =	42.
TIME = 0.3000.	INCREMENTAL KW LOAD =	42.
TIME = 0.4000.	INCREMENTAL KW LOAD =	42.
TIME = 0.5000.	INCREMENTAL KW LOAD =	42.

INPUT TIME = 0.5000, KW = 42.

TIME = 0.6000.	INCREMENTAL KW LOAD =	42.
TIME = 0.7000.	INCREMENTAL KW LOAD =	42.
TIME = 0.8000.	INCREMENTAL KW LOAD =	44.
TIME = 0.9000.	INCREMENTAL KW LOAD =	45.
TIME = 1.0000.	INCREMENTAL KW LOAD =	45.

INPUT TIME = 1.0000, KW = 45.

TIME = 1.1000.	INCREMENTAL KW LOAD =	47.
TIME = 1.2000.	INCREMENTAL KW LOAD =	47.
TIME = 1.3000.	INCREMENTAL KW LOAD =	47.
TIME = 1.4000.	INCREMENTAL KW LOAD =	47.
TIME = 1.5000.	INCREMENTAL KW LOAD =	47.

INPUT TIME = 1.5000, KW = 50.

TIME = 1.6000.	INCREMENTAL KW LOAD =	50.
TIME = 1.7000.	INCREMENTAL KW LOAD =	50.
TIME = 1.8000.	INCREMENTAL KW LOAD =	57.
TIME = 1.9000.	INCREMENTAL KW LOAD =	57.
TIME = 2.0000.	INCREMENTAL KW LOAD =	57.

INPUT TIME = 1.7000, KW = 70.

TIME = 2.1000.	INCREMENTAL KW LOAD =	87.
TIME = 2.2000.	INCREMENTAL KW LOAD =	87.
TIME = 2.3000.	INCREMENTAL KW LOAD =	87.
TIME = 2.4000.	INCREMENTAL KW LOAD =	87.
TIME = 2.5000.	INCREMENTAL KW LOAD =	87.

INPUT TIME = 1.9000, KW = 87.

TIME = 2.6000.	INCREMENTAL KW LOAD =	87.
TIME = 2.7000.	INCREMENTAL KW LOAD =	87.
TIME = 2.8000.	INCREMENTAL KW LOAD =	87.
TIME = 2.9000.	INCREMENTAL KW LOAD =	87.
TIME = 3.0000.	INCREMENTAL KW LOAD =	87.

INPUT TIME = 2.0000, KW = 87.

TIME = 3.1000.	INCREMENTAL KW LOAD =	87.
TIME = 3.2000.	INCREMENTAL KW LOAD =	87.
TIME = 3.3000.	INCREMENTAL KW LOAD =	87.
TIME = 3.4000.	INCREMENTAL KW LOAD =	87.
TIME = 3.5000.	INCREMENTAL KW LOAD =	87.

INPUT TIME = 2.0000, KW = 87.

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	41.78	0.01195	0.01195	2166.78	0.0 0.
0.20	41.78	0.01195	0.02392	2166.78	0.0 0.
0.30	41.78	0.01195	0.03584	2166.78	0.0 0.
0.40	41.78	0.01195	0.04779	2166.78	0.0 0.
0.50	41.78	0.01195	0.05973	2166.78	0.0 0.
0.60	42.47	0.01215	0.07188	2167.47	0.0 0.
0.70	43.17	0.01235	0.08423	2168.17	0.0 0.
0.80	43.86	0.01254	0.09677	2168.86	0.0 0.
0.88	44.56	0.01600	0.10677		
0.90	44.56	0.07054	0.07054	2169.56	333.76.2.
DEVIATION AT REFLECTION = 0.107 STEADY DEAD TIME = 0.828 MAXIMUM DEVIATION = 0.107 TIME OF MAXIMUM DEVIATION = 0.078 TIME OF RECOVERY TO 98.0 PERCENT = 0.0 TOTAL RECOVERY TIME = 0.911					
STEP NO.11 THE STARTING TIME IS 90.60 SECONDS THE LOADS ARE AS FOLLOWS: LOAD KW HP ICL WPLI RATING EXISTING 2161 75.80 COMED 0 0.0 MOTOR 524 635 NET LOAD 2887 94.29					
THE ACCUMULATED RESISTIVE LOAD IS 246 KW, 8.63 PERCENT RATING. THE ACCUMULATED SYNCH INERTIA IS 21153 LB-EL-SQRD = 0.021 = 0.002552234					
THE BRUSH POWER FOR THE MOTORS AT THIS STEP IS 3732. SEVA AND THE CORRECTED THROUGH POWER IS 3732. SEVA					
VOLTAGE DIP = 16.768 TIME OF MAXIMUM VOLTAGE DIP = 0.165 RECOVERY TIME TO 98.0 PERCENT = 0.248 TOTAL RECOVERY TIME = 0.591					
MOTOR JUNE 1.1 MOTOR FAILING 635. THE AT 1800 RPM THE MOTOR HAS 25 LB-FT SQUARED INERTIA AND WILL HAVE A 464. KW LOAD WHEN RUNNING. FULL LOAD TORQUE IS 1953 LB-FT FULL LOAD KW IS 526. AT AN ASSUMED EFFICIENCY OF 90 PERCENT. FLAG 1 = 0. FLAG 2 = 2. FLAG 3 = 0.					
EFFECT TIME = 0.0 , KW = 632. TIME = 0.1020. INCREMENTAL KW LOAD = 632.					

TIME	INCREMENTAL KW LOAD	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.0000	0.0000	0.0000	0.0000	0.0000
0.1000	0.3000	0.3000	0.3000	0.3000
0.2000	0.4000	0.7000	0.7000	0.7000
0.3000	0.5000	1.2000	1.2000	1.2000
0.4000	0.6000	1.8000	1.8000	1.8000
0.5000	0.7000	2.5000	2.5000	2.5000
0.6000	0.8000	3.3000	3.3000	3.3000
0.7000	0.9000	4.2000	4.2000	4.2000
0.8000	1.0000	5.2000	5.2000	5.2000
0.9000	1.1000	6.3000	6.3000	6.3000
1.0000	1.2000	7.5000	7.5000	7.5000
1.1000	1.3000	8.8000	8.8000	8.8000
1.2000	1.4000	10.2000	10.2000	10.2000
1.3000	1.5000	11.7000	11.7000	11.7000
1.4000	1.6000	13.3000	13.3000	13.3000
1.5000	1.7000	15.0000	15.0000	15.0000
1.6000	1.8000	16.8000	16.8000	16.8000
1.7000	1.9000	18.7000	18.7000	18.7000
1.8000	2.0000	20.7000	20.7000	20.7000
1.9000	2.1000	22.8000	22.8000	22.8000
2.0000	2.2000	25.0000	25.0000	25.0000
2.1000	2.3000	27.3000	27.3000	27.3000
2.2000	2.4000	29.7000	29.7000	29.7000
2.3000	2.5000	32.2000	32.2000	32.2000
2.4000	2.6000	34.8000	34.8000	34.8000
2.5000	2.7000	37.5000	37.5000	37.5000
2.6000	2.8000	40.3000	40.3000	40.3000
2.7000	2.9000	43.2000	43.2000	43.2000
2.8000	3.0000	46.2000	46.2000	46.2000
2.9000	3.1000	49.3000	49.3000	49.3000
3.0000	3.2000	52.5000	52.5000	52.5000
3.1000	3.3000	55.8000	55.8000	55.8000
3.2000	3.4000	59.2000	59.2000	59.2000
3.3000	3.5000	62.7000	62.7000	62.7000
3.4000	3.6000	66.3000	66.3000	66.3000
3.5000	3.7000	70.0000	70.0000	70.0000
3.6000	3.8000	73.8000	73.8000	73.8000
3.7000	3.9000	77.7000	77.7000	77.7000
3.8000	4.0000	81.7000	81.7000	81.7000
3.9000	4.1000	85.8000	85.8000	85.8000
4.0000	4.2000	90.0000	90.0000	90.0000
4.1000	4.3000	94.3000	94.3000	94.3000
4.2000	4.4000	98.7000	98.7000	98.7000
4.3000	4.5000	103.2000	103.2000	103.2000
4.4000	4.6000	107.8000	107.8000	107.8000
4.5000	4.7000	112.5000	112.5000	112.5000
4.6000	4.8000	117.3000	117.3000	117.3000
4.7000	4.9000	122.2000	122.2000	122.2000
4.8000	5.0000	127.2000	127.2000	127.2000
4.9000	5.1000	132.3000	132.3000	132.3000
5.0000	5.2000	137.5000	137.5000	137.5000
5.1000	5.3000	142.8000	142.8000	142.8000
5.2000	5.4000	148.2000	148.2000	148.2000
5.3000	5.5000	153.7000	153.7000	153.7000
5.4000	5.6000	159.3000	159.3000	159.3000
5.5000	5.7000	165.0000	165.0000	165.0000
5.6000	5.8000	170.8000	170.8000	170.8000
5.7000	5.9000	176.7000	176.7000	176.7000
5.8000	6.0000	182.7000	182.7000	182.7000
5.9000	6.1000	188.8000	188.8000	188.8000
6.0000	6.2000	195.0000	195.0000	195.0000
6.1000	6.3000	201.3000	201.3000	201.3000
6.2000	6.4000	207.7000	207.7000	207.7000
6.3000	6.5000	214.2000	214.2000	214.2000
6.4000	6.6000	220.8000	220.8000	220.8000
6.5000	6.7000	227.5000	227.5000	227.5000
6.6000	6.8000	234.3000	234.3000	234.3000
6.7000	6.9000	241.2000	241.2000	241.2000
6.8000	7.0000	248.2000	248.2000	248.2000
6.9000	7.1000	255.3000	255.3000	255.3000
7.0000	7.2000	262.5000	262.5000	262.5000
7.1000	7.3000	269.8000	269.8000	269.8000
7.2000	7.4000	277.2000	277.2000	277.2000
7.3000	7.5000	284.7000	284.7000	284.7000
7.4000	7.6000	292.3000	292.3000	292.3000
7.5000	7.7000	300.0000	300.0000	300.0000
7.6000	7.9000	307.8000	307.8000	307.8000
7.7000	8.1000	315.7000	315.7000	315.7000
7.8000	8.3000	323.7000	323.7000	323.7000
7.9000	8.5000	331.8000	331.8000	331.8000
8.0000	8.7000	340.0000	340.0000	340.0000
8.1000	8.9000	348.3000	348.3000	348.3000
8.2000	9.1000	356.7000	356.7000	356.7000
8.3000	9.3000	365.2000	365.2000	365.2000
8.4000	9.5000	373.8000	373.8000	373.8000
8.5000	9.7000	382.5000	382.5000	382.5000
8.6000	9.9000	391.3000	391.3000	391.3000
8.7000	10.1000	400.2000	400.2000	400.2000
8.8000	10.3000	409.2000	409.2000	409.2000
8.9000	10.5000	418.3000	418.3000	418.3000
9.0000	10.7000	427.5000	427.5000	427.5000
9.1000	10.9000	436.8000	436.8000	436.8000
9.2000	11.1000	446.2000	446.2000	446.2000
9.3000	11.3000	455.7000	455.7000	455.7000
9.4000	11.5000	465.3000	465.3000	465.3000
9.5000	11.7000	475.0000	475.0000	475.0000
9.6000	11.9000	484.8000	484.8000	484.8000
9.7000	12.1000	494.7000	494.7000	494.7000
9.8000	12.3000	504.7000	504.7000	504.7000
9.9000	12.5000	514.8000	514.8000	514.8000
10.0000	12.7000	525.0000	525.0000	525.0000

DEVIATION AT INFLECTION = 0.674
 MAXIMUM DEAD TIME = 0.300
 MAXIMUM DEVIATION = 0.674
 TIME OF MAXIMUM DEVIATION = 0.409
 TIME OF RECOVERY TO 98.0 PERCENT = 0
 TOTAL RECOVERY TIME = 0.300

PEAK LOAD KW = 1316. AND OCCURS AT 1.00
 MAX. OVERVOLTAGE OCCURS AT 2.10 WITH RECOVERY AT 3.07

INPUT - TIME = 1.0000, KW = 684.
 INPUT - TIME = 1.5000, KW = 842.
 INPUT - TIME = 1.7000, KW = 1053.
 INPUT - TIME = 1.8000, KW = 1316.
 INPUT - TIME = 1.5000, KW = 1316.
 INPUT - TIME = 2.0000, KW = 526.
 PEAK LOAD 1316. AT 1.0000 SECONDS
 WITH PEAK VOLTAGE AT 2.1000

STEP NO: 12 THE STARTING TIME IS 120.00 SECONDS
THE LOADS ARE AS FOLLOWS:

LOAD KW HP PCT UNIT RATING
 2850 0.0 97.0
 2850 0.0 97.0
 2850 0.0 97.0

THE ACCUMULATED RESISTIVE LOAD IS 246. KW 8.63 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 1178. LB-FT-SQRD -- CAP = 0.0028345493

THE BRUSH POWER FOR THE MOTORS AT THIS STEP IS 612. SKVA AND THE COLLECTED THROUGH POWER IS 612. SKVA

VOLTAGE DIP = 3.128
 TIME OF MAXIMUM VOLTAGE DIP = 0.020
 RECOVERY TIME TO 95.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.026

GRADE NUMBER 1 MOTOR RATING = 97. HP AT 1800. RPM
 THE MOTOR HAS 100. LB-FT SQUARED INERTIA AND WILL HAVE A 90. KW LOAD WHEN RUNNING.
 FRI LOAD TORQUE IS 283. LB-FT
 FRI LOAD KW IS 99. AT 60 ASSUMED EFFICIENCY OF 90 PERCENT.
 FLAG 1 = 0. FLAG 2 = 2. FLAG 3 = 0.

INPUT TIME = 0.0 KW = 26.

TIME = 0.1000, INCREMENTAL KW LOAD = 26.
 TIME = 0.2000, INCREMENTAL KW LOAD = 26.
 TIME = 0.3000, INCREMENTAL KW LOAD = 26.
 TIME = 0.4000, INCREMENTAL KW LOAD = 26.
 TIME = 0.5000, INCREMENTAL KW LOAD = 26.

INPUT TIME = 0.5000, KW = 26.

TIME = 0.6000, INCREMENTAL KW LOAD = 26.
 TIME = 0.7000, INCREMENTAL KW LOAD = 26.
 TIME = 0.8000, INCREMENTAL KW LOAD = 26.
 TIME = 0.9000, INCREMENTAL KW LOAD = 26.
 TIME = 1.0000, INCREMENTAL KW LOAD = 26.

INPUT TIME = 1.0000, KW = 105.

TIME = 1.1000, INCREMENTAL KW LOAD = 105.
 TIME = 1.2000, INCREMENTAL KW LOAD = 105.
 TIME = 1.3000, INCREMENTAL KW LOAD = 105.
 TIME = 1.4000, INCREMENTAL KW LOAD = 105.
 TIME = 1.5000, INCREMENTAL KW LOAD = 105.

INPUT TIME = 1.5000, KW = 129.

TIME = 1.6000, INCREMENTAL KW LOAD = 105.
 TIME = 1.7000, INCREMENTAL KW LOAD = 105.
 TIME = 1.8000, INCREMENTAL KW LOAD = 201.
 TIME = 1.9000, INCREMENTAL KW LOAD = 201.
 TIME = 2.0000, INCREMENTAL KW LOAD = 80.

INPUT TIME = 1.7000, KW = 161.

TIME = 1.8000, INCREMENTAL KW LOAD = 201.
 TIME = 1.9000, INCREMENTAL KW LOAD = 201.
 TIME = 2.0000, INCREMENTAL KW LOAD = 80.

INPUT TIME = 1.8000, KW = 261.

TIME = 1.9000, INCREMENTAL KW LOAD = 201.
 TIME = 2.0000, INCREMENTAL KW LOAD = 80.

INPUT TIME = 1.9000, KW = 201.

TIME = 2.0000, INCREMENTAL KW LOAD = 80.

INPUT TIME = 2.0000, KW = 80.

TIME = 2.1000, INCREMENTAL KW LOAD = 80.

INPUT TIME = 2.1000, KW = 80.

TIME = 2.2000, INCREMENTAL KW LOAD = 80.

PEAK LOAD KW = 201. AND OCCURS AT 1.70
 60% OVERVOLTAGE OCCURS AT 2.10 WITH RECOVERY AT 2.20

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	26.48	0.02754	0.02754	2721.42	612.00
0.20	96.48	0.02754	0.05508	2721.40	612.00

1	ENGINE RATED AT 2850.0 KW AT 700.0 RPM, OF 12 CYLINDERS. 3 STROKES PER CYCLE
2	WITH CAPABILITY OF 120.0 PERCENT LOAD, AND WITH 34572. LB-FT SQD INERTIA
3	GENERATOR RATED AT 4063. KVA AND HAS THE FOLLOWING PROPERTIES:
4	EFFICIENCY PERCENT = 88.00
5	PERCENT
6	TIME CONSTANT = 1.30 SECONDS
7	PERCENT
8	TIME CONSTANT = 2.08 SECONDS
9	PERCENT
10	FULL LOAD FIELD VOLTAGE = 52. VOLTS
11	NO-LOAD FIELD VOLTAGE = 45. VOLTS
12	MAXIMUM FIELD VOLTAGE = 45. VOLTS
13	THE CORRECTED SUB-TRANSIENT REACTANCE IS 21.933 PERCENT
14	THE POINT FOR INITIATION OF RECOVERY FOR VOLTAGE IS 90. PERCENT AND FOR FREQUENCY IS 98. PERCENT
15	THE FOLLOWING CONSTANTS ARE BEING USED FOR THESE COMPUTATIONS:
16	GENERATOR DIP CONSTANT = 1667
17	POSTER RECOVERY RATE = 5.00
18	BASE LOAD CONSTANT = 1.20
19	EXISTING LOAD FACTOR IS 0.516
20	LOAD RECOVERY RATE = 0.250 PER SECOND
21	THEBO IS 1.00
22	THEBO RESPONSE FACTOR IS 0.10 SECONDS
23	THE TIME INCREMENT IN THE CALCULATION IS 0.80
24	VOLTAGE OVERSHOOT CONSTANT IS 0.9270
25	FLAG TO SET @ 2
26	GOV LEAD TIME CONSTANT IS 0.1000
27	GOV FEEDBACK FACTOR = 0.1500
28	FEEDBACK HP RATIO = 0.1500
29	ACCELERATION CORRSIAHJ (C2) = 0.0034200366
30	LINE LEADV. DEAD TIME = 0.1232221336
31	THE NO. 1 THE STARTING TIME IS 9.0 SECONDS
32	THE LOADS ARE AS FOLLOWS
33	LOAD KW HP PCT UNIT RATING
34	EXISTING 0.0
35	ADDED 248. 8.63
36	MOTORS 67. 2.36
37	NET LOAD 313. 10.99
38	THE ACCUMULATED RESERVE LOAD IS 248. KW
39	THE ACCUMULATED SYSTEM INERTIA IS 34572. LB-FT SQD -- LCI = 0.0034090364
40	THE THRUST POWER FOR THE MOTORS AT THIS STEP IS 541. SRVA AND THE CORRECTED THRUST POWER IS 621. SRVA
41	VOLTAGE DIP = 3.246
42	TIME OF RESTORATION VOLTAGE DIP = 0.020
43	RECOVERY TIME TO 90.0 PERCENT = 0.0
44	TOTAL RECOVERY TIME = 0.065
45	PERCENT = 0.010
46	PERCENT = 0.023
47	MOTOR NUMBER 1 MOTOR RATING = 81. HP AT 1800. RPM.
48	THE MOTOR HAS 150. LB-FT SQUARED INERTIA AND WILL HAVE A 67. KW LOAD WHEN RUNNING.
49	FULL LOAD TORQUE IS 234. LB-FT
50	FULL LOAD KW IS 67. AT AN ASSURED EFFICIENCY OF 90 PERCENT.
51	FLAG 1 = 0. FLAG 2 = 2. FLAG 3 = 0.
52	INPUT TIME = 0.0 , KW = 81.
53	TIME = 0.1000, INCREMENTAL KW LOAD = 81.
54	TIME = 0.2000, INCREMENTAL KW LOAD = 81.
55	TIME = 0.3000, INCREMENTAL KW LOAD = 81.
56	TIME = 0.4000, INCREMENTAL KW LOAD = 81.
57	TIME = 0.5000, INCREMENTAL KW LOAD = 81.
58	INPUT TIME = 0.5000, KW = 81.
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F.1. 04320010 FREQUENCY AND VOLTAGE EXCURSION PREDICTIONS PROGRAM PAGE 2
 ADDRESS P & L, S/O 205925, 12 OF, 2850 KW @ 900 RPM, LOOP LOADS, UNIT 1

TIME	INCREMENTAL KW LOAD =	INCREMENTAL KW LOAD =	NET LOAD KW	AVAILABLE LOAD KW
0.0000	0.0000	0.0000	0.00	0.00
0.1000	0.7000	0.7000	326.57	0.00
0.2000	0.8000	0.8000	326.57	0.00
0.3000	0.9000	0.9000	326.57	0.00
0.4000	1.0000	1.0000	326.57	0.00
0.5000	1.1000	1.1000	326.57	0.00
0.6000	1.2000	1.2000	326.57	0.00
0.7000	1.3000	1.3000	326.57	451.86
0.8000	1.4000	1.4000	327.91	464.70
0.9000	1.5000	1.5000	329.25	477.55
1.0000	1.6000	1.6000	330.60	490.49
1.1000	1.7000	1.7000	331.94	503.43
1.2000	1.8000	1.8000	333.28	516.40
1.3000	1.9000	1.9000	337.31	533.66
1.4000	2.0000	2.0000	341.34	551.12

TIME	INCREMENTAL KW LOAD =	CHANGE IN DEVIATION	NET DEVIATION
0.10	0.7000	0.11103	0.11103
0.20	0.8000	0.11103	0.22207
0.30	0.9000	0.11103	0.33310
0.40	1.0000	0.11103	0.44414
0.50	1.1000	0.05927	0.50341
0.60	1.2000	-0.01978	0.48363
0.70	1.3000	-0.04651	0.43712
0.80	1.4000	-0.05943	0.37769
0.90	1.5000	-0.05436	0.32333
1.00	1.6000	-0.05831	0.26502
1.10	1.7000	-0.06226	0.20276
1.20	1.8000	-0.06676	0.13600
1.30	1.9000	-0.07133	0.06467

DEVIATION AT INFLECTION =	0.504
SYSTEM DEAD TIME =	0.454
MAXIMUM DEVIATION =	0.504
TIME OF MAXIMUM DEVIATION =	0.454
TIME OF RECOVERY TO 98.0 PERCENT =	0.00
TOTAL RECOVERY TIME =	1.297

PEAK LOAD KW = 168, AND OCCURS AT 1.90
 MAX. OVERVOLTAGE OCCURS AT 2.10 WITH RECOVERY AT 2.29

STEP NO. 2 THE STARTING TIME IS 4.50 SECONDS

THE LOADS ARE AS FOLLOWS:

LOAD NO.	HP	PCY	UNIT	RATING
1	375			10.78
2	0			0.0
3	663			23.87
4	974			33.55

THE ACCUMULATED RESISTIVE LOAD IS 246 KW, 8.63 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 34922, LB-FT-SQRD -- GPF = 0.0633853473

THE THROUGH POWER FOR THE MOTORS AT THIS STEP IS 4924, 31V6 AND THE CORRECTED THROUGH POWER IS 4924, 31V6

VOLTAGE DIF = 20.989
 TIME OF MAXIMUM VOLTAGE DIF = 0.131
 RECOVERY TIME TO 90.0 PERCENT = 0.331
 TOTAL RECOVERY TIME = 0.497

MOTOR NUMBER 1 MOTOR RATING = 800, HP AT 885 RPM,
 THE MOTOR HAS 2000, LB-FT SQUARED INERTIA AND WILL HAVE A 622, LB-FT LOAD WHEN RUNNING.
 FULL LOAD TORQUE IS 2000, LB-FT
 FULL LOAD KW IS 663, AT AN ASSURED EFFICIENCY OF 90 PERCENT.
 FLAG 1 = 0, FLAG 2 = 0, FLAG 3 = 0.

THROTS	PERCENT	AVERAGE		OUTPUT		PERCENT CORRECTED	PERCENT	INERTIA	ACCUM.	PERCENT	INERTIA
		MOTOR TORQUE	LOAD TORQUE	MOTOR TORQUE	LOAD TORQUE						
0.0	100.00	15.00	100.00	11.50	0.0	89.51	89.51	0.00	0.00	0.00	0.00
5.00	100.00	8.00	100.00	11.50	0.16	88.50	89.66	0.16	0.16	2.27	1.17
10.00	100.00	4.00	100.00	6.00	0.30	85.15	72.50	0.30	0.30	2.20	2.17
15.00	100.00	3.00	100.00	3.50	0.40	81.16	66.50	0.40	0.40	2.55	2.78
20.00	100.00	4.00	100.00	3.50	0.50	97.98	90.75	0.50	0.50	3.09	3.04
25.00	100.00	6.00	100.00	3.50	0.60	100.00	98.50	0.60	0.60	3.19	3.09
30.00	100.00	9.00	100.00	3.50	0.70	100.00	98.50	0.70	0.70	3.19	3.16
35.00	100.00	13.00	100.00	11.00	0.80	100.00	93.00	0.80	0.80	3.14	3.28
40.00	100.00	17.00	100.00	15.00	0.90	100.00	95.00	0.90	0.90	3.14	3.33
45.00	100.00	20.00	100.00	15.50	1.00	100.00	92.50	1.00	1.00	3.06	27.32
50.00	100.00	26.00	100.00	23.00	1.10	100.00	89.00	1.10	1.10	2.94	30.37
55.00	100.00	31.00	100.00	28.50	1.30	100.00	85.00	1.30	1.30	2.81	36.10
60.00	100.00	35.00	100.00	33.00	1.40	100.00	85.00	1.40	1.40	2.81	38.73
65.00	100.00	26.00	100.00	23.00	1.50	100.00	81.50	1.50	1.50	2.89	41.88
70.00	100.00	31.00	100.00	28.50	1.60	100.00	81.50	1.60	1.60	2.89	44.38
75.00	100.00	35.00	100.00	33.00	1.70	100.00	77.00	1.70	1.70	2.54	45.92
80.00	100.00	35.00	100.00	33.00	1.80	100.00	77.00	1.80	1.80	2.54	47.47
85.00	100.00	35.00	100.00	33.00	1.90	100.00	71.50	1.90	1.90	2.36	51.93
90.00	100.00	35.00	100.00	33.00	2.00	100.00	71.50	2.00	2.00	2.36	54.47
95.00	100.00	35.00	100.00	33.00	2.10	100.00	67.00	2.10	2.10	2.21	50.40

60329016 FREQUENCY AND VOLTAGE EXCURSION FREQUENCIES (PERCENT) FACE A
 60368503 P & L, 270 265925, 12 OF, 2830 KW @ 966 RPM, LOOP LOADS, UNIT 1

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	RET LOAD-KW	AVAILABLE LOAD-KW						
65.00	100.00	40.00	100.00	37.50	2.20	100.00	100.00	67.00	2.21	58.62	869.
70.00	100.00	48.00	100.00	44.00	2.30	100.00	100.00	62.50	2.07	60.68	859.
75.00	107.00	56.00	103.50	52.00	2.40	100.00	60.00	62.50	2.07	62.75	848.
80.00	135.00	62.00	121.00	59.00	2.50	100.00	100.00	62.50	2.07	64.81	838.
85.00	169.00	72.00	152.00	67.00	2.60	100.00	100.00	56.00	1.85	66.87	829.
90.00	198.00	80.00	183.50	76.00	2.70	100.00	103.50	56.00	1.85	69.93	820.
95.00	189.00	90.00	193.50	85.00	3.10	100.00	121.00	62.00	2.05	72.99	811.
100.00	100.00	98.00	111.50	91.00	3.30	100.00	111.00	59.00	2.05	75.05	802.
105.00	169.00	72.00	152.00	67.00	3.40	100.00	152.00	85.00	2.81	82.58	793.
110.00	198.00	80.00	183.50	76.00	3.50	100.00	183.50	97.50	3.55	89.13	784.
115.00	189.00	90.00	193.50	85.00	3.60	100.00	183.50	107.50	3.55	90.58	775.
120.00	100.00	98.00	111.50	91.00	3.70	100.00	153.50	100.50	3.59	93.27	766.
125.00	169.00	72.00	152.00	67.00	3.80	100.00	144.50	50.50	1.67	94.74	757.
130.00	198.00	80.00	183.50	76.00	3.90	100.00	141.50	50.50	1.67	96.20	748.
135.00	189.00	90.00	193.50	85.00	4.00	100.00	141.50	50.50	1.67	97.67	739.
140.00	100.00	98.00	111.50	91.00	4.10	100.00	111.50	50.50	1.67	99.14	730.

TOTAL EQUIVALENT ENERGY = 948.32895
 DEGREE OF SEVERITY = 146.02823
 PEAK MOTOR LOAD = 1317.64 AT 3.7066 SECONDS

PEAK LOAD KW = 1317.64 AND OCCURS AT 3.70
 MAX. OVERVOLTAGE OCCURS AT 4.10 WITH RECOVERY AT 5.31

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	RET LOAD-KW	AVAILABLE LOAD-KW
0.10	923.86	0.31310	0.31310	1237.54	0.0 0.
0.20	627.79	0.28024	0.59333	1140.79	0.0 0.
0.30	822.30	0.30207	0.89541	1205.30	0.0 0.
0.40	976.90	0.32574	1.22114	1289.96	1661.72 1.
0.46	976.90	-0.00189	1.21925	1376.76	1814.66 1.
0.50	1063.76	-0.14004	1.07921	1399.01	1878.37 1.
0.60	1086.01	-0.16220	0.90893	1383.15	1897.79 1.
0.70	1070.15	-0.17084	0.73809	1367.54	1896.47 1.
0.80	1054.54	-0.17906	0.55903	1351.93	1904.05 1.
0.90	1038.93	-0.18691	0.37212	1336.73	1911.20 1.
1.00	1023.73	-0.19448	0.17764		

DEVIATION AT INJECTION = 1.221
 SYSTEM DEAD TIME = 0.398
 SYSTEM DEVIATION = 1.371
 PERCENT OF MAXIMUM DEVIATION = 0.398
 TIME OF RECOVERY TO 98.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 1.688

STEP NO: 3 THE STARTING TIME IS 13.00 SECONDS
 THE LOADS ARE AS FOLLOWS:

LOAD KU HP PCT UNIT RATING
 TYPE 1 255 37.51
 2 500 0.0
 3 500 14.24
 4 500 14.32

THE ACCUMULATED RESISTIVE LOAD IS 246. KU, 6.63 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 59722. LB-FT-SQRD -- CIP = 0.6029592176

THE THROUGH POWER FOR THE MOTORS AT THIS STEP IS 2951.2556 AND THE CORRECTED THROUGH POWER IS 2951.5840

VOLTAGE DIP = 13.753
 TIME OF MAXIMUM VOLTAGE DIP = 0.088
 RECOVERY TIME TO 90.0 PERCENT = 0.134
 TOTAL RECOVERY TIME = 0.222

MOTOR NUMBER 1 MOTOR RATING = 500. HP @ 1780. RPM
 THE MOTOR IS 310. LB-FT SQUARED INERTIA AND WILL HAVE A 352. KU LOAD -- R-RUNNING
 FULL LOAD TORQUE IS 414. @ 14.75 LB-FT
 FULL LOAD KU IS 414. @ 1.60 ASSUMED EFFICIENCY OF 90 PERCENT.
 FLAG 1 = 0. FLAG 2 = 0. FLAG 3 = 0.

INPUTS - PERCENT		AVERAGE		OUTPUT		PERCENT CORRECTED		PERCENT		ACCUM.	
SPEED	MOTOR TORQUE	LOAD TORQUE	MOTOR TORQUE	LOAD TORQUE	TIME SECONDS	AV. TERM VOLTAGE	NET TORQUE	SPEED CHANGE	PERCENT SPEED	KU LOAD	INCHES
0.0	100.00	15.00	101.00	12.00	0.0				0.0	311.	
5.00	102.00	9.00	102.50	7.50	0.10	97.23	87.68	8.72	8.72	859.	
10.00	103.00	6.00	103.50	5.00	0.20	89.78	83.39	8.46	13.18	615.	
15.00	104.00	4.00	103.50	5.00	0.30	96.30	100.70	7.93	21.12	493.	
20.00	107.00	4.00	105.50	4.00	0.30	99.81	111.15	8.42	29.74	472.	
25.00	110.00	5.00	108.50	4.50	0.50	100.00	117.00	8.86	38.60	484.	
30.00	113.00	8.00	111.50	6.50	0.60	100.00	128.50	8.98	47.56	596.	
35.00	117.00	10.00	115.00	9.00	0.70	100.00	133.00	10.26	57.84	765.	
40.00	121.00	13.00	119.00	11.50	0.80	100.00	139.50	11.41	68.25	878.	
45.00	125.00	17.00	123.00	15.00	1.00	100.00	147.00	12.58	79.73	1000.	
50.00	130.00	22.00	128.50	19.50	1.20	100.00	155.50	13.76	92.20	1133.	
55.00	142.00	26.00	137.00	24.00	1.40	100.00	165.00	14.94	105.67	1276.	
60.00	154.00	31.00	153.00	28.50	1.60	100.00	175.50	16.12	120.14	1429.	
65.00	182.00	37.00	173.00	34.00	1.80	100.00	187.00	17.30	135.61	1592.	
70.00	193.00	42.00	187.50	39.50	2.00	100.00	199.00	18.48	152.09	1765.	
75.00	198.00	47.00	193.50	45.50	2.20	100.00	211.50	19.66	168.57	1948.	
80.00	200.00	56.00	199.00	52.50	2.40	100.00	224.00	20.84	185.05	2141.	
85.00	198.00	63.00	198.00	59.50	2.60	100.00	236.50	22.02	201.53	2344.	
90.00	185.00	71.00	190.50	67.00	2.80	100.00	249.00	23.20	218.01	2557.	
95.00	162.00	79.00	173.50	75.00	3.00	100.00	261.50	24.38	234.49	2780.	
100.00	100.00	87.00	131.00	83.00	3.20	100.00	274.00	25.56	250.97	3013.	

TOTAL EQUIVALENT ENERGY = 687.97681
DEGREE OF SEVERITY = 165.99988
PEAK MOTOR LOAD = 503.01 @ 0.86005 SECONDS

FCW LOAD IS 293.0 AMP OCCURS AT 0.80
MAX. OVERVOLTAGE OCCURS AT 1.30 WITH RECOVERY AT 2.07

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	596.90	0.17666	0.17666	1531.93	0.0 0.
0.20	582.54	0.17239	0.34905	1517.54	0.0 0.
0.30	441.36	0.19571	0.54476	1524.36	0.0 0.
0.40	679.06	0.26095	0.80571	1614.06	0.0 0.
0.42	684.05	0.03439	0.84010	1619.05	2929.10 2.
0.50	684.65	-0.10673	0.73337	1630.51	2091.72 2.
0.60	695.51	-0.13572	0.59765	1700.16	2134.58 2.
0.70	765.16	-0.12856	0.46909	1837.88	2187.13 2.
0.80	902.88	-0.16335	0.30574	1820.95	2229.08 2.
0.90	885.95	-0.12375	0.18199	1762.51	2291.09 2.
1.00	767.51	-0.17417	0.00782		

DEVIATION AT INFLECTION = 0.780
SYSTEM PEAK TIME = 0.419
MAXIMUM DEVIATION = 0.780
TIME OF MAXIMUM DEVIATION = 0.417
TIME OF RECOVERY TO 20.0 PERCENT = 0.0
TOTAL RECOVERY TIME = 1.007

STEP 003 & THE VARIATION TIME IS 55.60 SECONDS
THE LOADS ARE AS FOLLOWS
LOAD KW HP PCI UNIT RATING

EXISTING 1287. 45.16
ADDED 0. 0.0
MOTORS 87. 105.
NET LOAD 1374. 48.21

THE ACCUMULATED RESISTIVE LOAD IS 246. KW 8.63 PERCENT FATIGUE
THE ACCUMULATED SYSTEM INERTIA IS 49932. LB-FT-3GRD -- GEP = 0.0029363171

THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 536. SKVA AND THE CORRECTED INRUSH POWER IS 536. SKVA

VOLTAGE DIP = 2.812
TIME OF MAXIMUM VOLTAGE DIP = 0.618
RECOVERY TIME TO 90.0 PERCENT = 0.0
TOTAL RECOVERY TIME = 0.657

APR26016 FREQUENCY AND VOLTAGE EXCURSION PREDICTIONS FROM 5000 PAGES 7 UNIT 1

MOTOR NUMBER 1 MOTOR RATING 105 HP AT 1775 RPM.
 THE MOTOR HAS 85 LB-FT SQUARED INERTIA AND WILL HAVE A 65 KW LOAD WHEN RUNNING.
 FULL LOAD TORQUE IS 311 LB-FT
 FULL LOAD KW IS 97.61 OR ASSUMED EFFICIENCY OF 90 PERCENT

INPUTS - PERCENT		AVERAGE		OUTPUT		PERCENT CORRECTED		PERCENT INCREMENTAL		ACCUM. INCREMENTAL	
SPEED	NOISE	LOAD	TORQUE	MOTOR TORQUE	LOAD TORQUE	TIME SECONDS	VOLTAG	TORQUE	NET TORQUE	NET SPEED CHANGE	FERENCE SPEED
INCREASMENT	TORQUE	TORQUE	TORQUE	TORQUE	TORQUE	SECONDS					KW LOAD
0.0	238.00	0.0	0.0	0.0	0.0	0.0					0.0
5.00	342.00	0.01	0.00	0.00	0.01						
10.00	227.00	0.10	234.50	0.00	0.06						
15.00	213.00	0.34	221.50	0.00	0.22						
20.00	207.00	0.60	211.50	0.00	0.57						
25.00	197.00	1.56	202.00	0.00	1.10						
30.00	189.00	2.70	193.00	0.00	2.13						
35.00	183.00	4.29	186.00	0.00	3.49						
40.00	178.00	6.40	179.50	0.00	5.34						
45.00	171.00	9.11	173.50	0.00	7.76						
50.00	166.00	12.50	168.50	0.00	10.01						
55.00	162.00	16.64	164.00	0.00	14.57						
60.00	141.00	21.20	161.50	0.00	19.12						
65.00	161.00	27.46	161.00	0.00	24.53						
70.00	143.00	31.70	162.50	0.00	30.88						
75.00	138.00	33.19	166.00	0.00	38.29						
80.00	127.00	51.20	172.50	0.00	46.69						
85.00	123.00	61.31	182.00	0.00	56.21						
90.00	213.00	72.90	203.00	0.00	67.16						
95.00	123.00	85.74	203.00	0.00	79.72						
100.00	213.00	100.00	203.00	0.00	82.87						

TOTAL EQUIVALENT ENERGY = 186,134.77
 DEGREE OF SEVERITY = 213,866.04
 FLAR MOTOR LOAD = 249.61 OR 0.1000 SECONDS

FEAR LOAD KW = 349 AND OCCURS AT 5.10
 MAX. OVERVOLTAGE OCCURS AT 1.10 WITH RECOVERY AT 1.26

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	248.89	0.07308	0.07308	1535.89	0.0 0.
0.20	217.02	0.06372	0.13680	1504.02	0.0 0.
0.30	198.89	0.05810	0.19521	1485.89	0.0 0.
0.40	183.62	0.05352	0.24912	1470.62	0.0 0.
0.50	172.47	0.05064	0.29977	1459.47	0.0 0.
0.57	167.22	0.04829	0.34806		
0.60	167.22	-0.07882	0.26924	1454.22	2357.77 0.

46320910 FIELD ENERGY AND VOLTAGE EXHAUSTION PREDICTION PROGRAM PAGE 9
 ARKANSAS P & L, S/D 205925, 12 OF 2050 KW @ 900 RPM, 100% EFFICIENCY, UNIT 1

60.00	177.00	51.20	172.50	46.20					
85.00	193.00	61.41	185.00	56.31					
50.00	213.00	72.90	203.00	67.16					
95.00	193.00	85.74	203.00	72.37					
100.00	213.00	100.00	203.00	92.87					

TOTAL EQUIVALENT ENERGY = 186.13477
 PERCENT OF SEVERITY = 243.86294
 FLOOR MOTOR LOAD = 249.01 @ 0.10000000000000000

PEAK LOAD KW = 242, AND OCCURS AT 0.10
 50% VOLTAGE OCCURS AT 1.10 WITH RECOVERY AT 1.24

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	248.89	0.07293	0.07293	1500.89	0.0 0.
0.20	217.02	0.06359	0.13652	1509.02	0.0 0.
0.30	198.89	0.05828	0.19479	1550.89	0.0 0.
0.40	183.62	0.05380	0.24859	1535.62	0.0 0.
0.50	172.47	0.05054	0.29913	1524.47	0.0 0.
0.57	167.22	0.05442	0.35355	1519.22	212.76 0.
0.50	167.55	0.07337	0.42692		

DEVIATION AT INFLECTION = 0.335
 SYSTEM DEAD TIME = 0.572
 EXISTING DEVIATION = 0.335
 TIME OF MAXIMUM DEVIATION = 0.572
 TIME OF RECOVERY TO 98.0 PERCENT = 0.894
 TOTAL RECOVERY TIME = 0.894

STEP NO: 6 THE STARTING TIME IS 70.00 SECONDS
 THE LOGS ARE AS FOLLOWS:

LOAD KW BY FCL UNIT RATING
 EXISTING 1417. 49.72
 ADDED 0. 0.0
 MOTORS 33. 1.16
 NET LOAD 1450. 50.88

THE ACCUMULATED RESISTIVE LOAD IS 246. KW, 8.63 PERCENT RATING
 THE RECOMMENDED SYSTEM RATING IS 2050. LB-FI-5000 - LFP = 9.000000000000000

THE AMRUSH POWER FOR THE MOTORS AT THIS STEP IS 243. SKVA AND THE CORRECTED THRUSH POWER IS 213. SEVA

VOLTAGE DIF = 1.275
 TIME OF MAXIMUM VOLTAGE DIF = 0.568
 RECOVERY TIME TO 90.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.568
 0.004

60220010 FREQUENCY AND VOLTAGE EXCURSION PROTECTION LOGS FOR 2059:5. 12 OF, 2050 KW @ 200 RPM, 1000 LBS, UNIT 1

DEVIATION AT IMPLECTON = 0.106
 SYSTEM DEAD TIME = 0.892
 MAXIMUM DEVIATION = 0.192
 TIME OF MAXIMUM DEVIATION = 0.0
 TIME OF RECOVERY TO 90.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.926

STEP 007 THE STARTING TIME IS 05.00 SECONDS
 THE LOADS ARE AS FOLLOWS
 LOAD KW HP FCY UNIT RATING

EXISTING 1350. 50.83
 ADDED 0. 0.0
 REDUCED 31. 37.
 NET LOAD 1351. 51.23

THE ACCUMULATED RESISTIVE LOAD IS 286 KW, 0.63 PERCENT RATING
 THE ACCUMULATED SYSTEM THERMIA IS 40362. LB-FT-30RD - C.F. = 0.9029166453

THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 254. SKVA AND THE CORRECTED INRUSH POWER IS 254. SKVA

VOLTAGE DIP = 1.353
 TIME OF NEXT 400V VOLTAGE DIP = 9.000
 RECOVERY TIME TO 90.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.027

MOTOR NUMBER 1 MOTOR RATING = 37. HP @ 1800 RPM
 THE MOTOR IS 100.0% OF THE SOURCE THERMIA AND WILL HAVE A 31. KW LOAD WHEN RUNNING.
 THE LOAD IS 31. KW AT 100% EFFICIENCY OF 90 PERCENT.
 FLAG 1 = 0. FLAG 2 = 2. FLAG 3 = 0.

INPUT TIME = 0.0 KW = 37.

INPUT TIME = 0.5000, KW = 37.

INPUT TIME = 1.0000, KW = 40.

INPUT TIME = 1.5000, KW = 49.

INPUT TIME = 1.7000, KW = 61.

INPUT TIME = 1.9000, KW = 77.

INPUT TIME = 2.0000, KW = 31.

TIME = 0.1000, INCREMENTAL KW LOAD = 37.

TIME = 0.3000, INCREMENTAL KW LOAD = 37.

TIME = 0.5000, INCREMENTAL KW LOAD = 37.

TIME = 0.7000, INCREMENTAL KW LOAD = 37.

TIME = 0.9000, INCREMENTAL KW LOAD = 37.

TIME = 1.0000, INCREMENTAL KW LOAD = 40.

TIME = 1.1000, INCREMENTAL KW LOAD = 42.

TIME = 1.2000, INCREMENTAL KW LOAD = 43.

TIME = 1.3000, INCREMENTAL KW LOAD = 47.

TIME = 1.4000, INCREMENTAL KW LOAD = 49.

TIME = 1.5000, INCREMENTAL KW LOAD = 49.

TIME = 1.6000, INCREMENTAL KW LOAD = 61.

TIME = 1.7000, INCREMENTAL KW LOAD = 61.

TIME = 1.8000, INCREMENTAL KW LOAD = 77.

TIME = 1.9000, INCREMENTAL KW LOAD = 77.

TIME = 2.0000, INCREMENTAL KW LOAD = 31.

TIME	INCREMENTAL LOAD KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	36.80	0.01073	0.01073	1486.80	0.0 0.
0.20	36.80	0.01073	0.02147	1486.80	0.0 0.
0.30	36.80	0.01073	0.03220	1486.80	0.0 0.
0.40	36.80	0.01073	0.04294	1486.80	0.0 0.
0.50	36.80	0.01073	0.05367	1486.80	0.0 0.
0.60	37.42	0.01073	0.06440	1487.26	0.0 0.
0.70	38.93	0.01109	0.07549	1488.03	0.0 0.
0.80	38.64	0.01127	0.08676	1488.64	0.0 0.
0.90	39.26	0.01145	0.09821	1489.26	0.0 0.
0.94	39.87	0.00959	0.10780		

PEAK LOAD = 77. AT 1.9000 SECONDS
 WITH PEAK VOLTAGE AT 2.1000 SECONDS
 TIME LOAD FU = 77.600 SECONDS AT 1.90
 AGG. OVERVOLTAGE OCCURS AT 2.10 WITH RECOVERY AT 2.13

DEVIATION AT REFLECTION = 0.102
 WHICH LEAD LINE = 0.935
 MAXIMUM DEVIATION = 0.102
 TIME OF MAXIMUM DEVIATION = 0.935
 TIME OF RECOVERY TO 98.0 PERCENT = 0.0
 TOTAL RECOVERY TIME = 0.952

STEP NO: 8 THE STARTING TIME IS 90.00 SECONDS
 THE LOADS ARE AS FOLLOWS:
 LOAD KW HP FCU BRUSH RATING
 EXISTING 1480. 51.96
 ADDED 50. 0.0
 TOTAL 1530. 51.96
 NET LOAD 1487. 51.96

THE ACCUMULATED RESISTIVE LOAD IS 246. KW, 8.63 PERCENT RATING
 THE ACCUMULATED SYSTEM INERTIA IS 30402 LB-FT-SEC² = 0.0022663254

THE THRUSH POWER FOR THE MOTORS AT THIS STEP IS 3583. KW AND THE CORRECTED THRUSH POWER IS 3583. KW

VOLTAGE DIP = 16.207
 TIME OF MAXIMUM VOLTAGE DIP = 0.104
 RECOVERY TIME TO 95.0 PERCENT = 0.213
 TOTAL RECOVERY TIME = 0.317

90.00 SECONDS - 1 MOTOR BRUSH RATING SOURCED - THE DATA ARE NOT HAVE A 443. KW LOAD WHEN RUNNING.
 THE MOTOR HAS 500. LB-FT TORQUE IS 1700. LB-FT
 FULL LOAD TORQUE IS 506. LB-FT
 FULL LOAD KW IS 506. AT AN ASSUMED EFFICIENCY OF 90 PERCENT.
 ELONG. 1 = 0. PLUG 2 = 2. PLUG 3 = 0.

TOTAL TIME = 0.0 , KW = 697. TIME = 0.1000, INCREMENTAL KW LOAD = 607.

TIME	INCREMENTAL KW LOAD	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	533.47	0.15524	2014.47	0.0 0.
0.20	556.49	0.16191	2037.49	0.0 0.
0.30	585.14	0.17624	2066.14	0.0 0.
0.40	606.75	0.17653	2087.75	0.0 0.
0.50	606.75	0.01807	2087.75	2531.19 2.
0.59	606.75	-0.12107	2087.75	2531.19 2.
0.60	614.84	0.34329	2097.84	2531.19 2.
0.70	626.97	-0.15320	2107.97	2531.19 2.
0.80	637.00	-0.16231	2118.00	2531.19 2.
DEVIATION AT INFLECTION = 0.682 SYSTEM LEAD TIME = 0.410 MAXIMUM DEVIATION = 0.682 TIME OF MAXIMUM DEVIATION = 0.410 TIME OF RECOVERY TO 98.0 PERCENT = 0.0 TOTAL RECOVERY TIME = 0.859				

TIME	INCREMENTAL KW LOAD	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	533.47	0.15524	2014.47	0.0 0.
0.20	556.49	0.16191	2037.49	0.0 0.
0.30	585.14	0.17624	2066.14	0.0 0.
0.40	606.75	0.17653	2087.75	0.0 0.
0.50	606.75	0.01807	2087.75	2531.19 2.
0.59	606.75	-0.12107	2087.75	2531.19 2.
0.60	614.84	0.34329	2097.84	2531.19 2.
0.70	626.97	-0.15320	2107.97	2531.19 2.
0.80	637.00	-0.16231	2118.00	2531.19 2.

TIME	INCREMENTAL KW LOAD	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	533.47	0.15524	2014.47	0.0 0.
0.20	556.49	0.16191	2037.49	0.0 0.
0.30	585.14	0.17624	2066.14	0.0 0.
0.40	606.75	0.17653	2087.75	0.0 0.
0.50	606.75	0.01807	2087.75	2531.19 2.
0.59	606.75	-0.12107	2087.75	2531.19 2.
0.60	614.84	0.34329	2097.84	2531.19 2.
0.70	626.97	-0.15320	2107.97	2531.19 2.
0.80	637.00	-0.16231	2118.00	2531.19 2.

PEAK LOAD KW = 1264. AND OCCURS AT 1.20
 60% OVERVOLTAGE OCCURS AT 2.10 WITH RECOVERY AT 3.04

INPUT TIME = 1.0000, KW = 657.
 INPUT TIME = 1.5000, KW = 809.
 INPUT TIME = 1.7000, KW = 1011.
 INPUT TIME = 1.8000, KW = 1264.
 INPUT TIME = 1.5000, KW = 1264.

INPUT TIME = 2.0000, KW = 506.
 PEAK LOAD = 1264. AT 1.9000 SECONDS
 WITH 10% VOLTAGE AT 2.1000

STEP NO: 9 THE STARTING TIME IS 120.00 SECONDS
THE LOADS ARE AS FOLLOWS

LOAD KW HP 1-FCY UNIT RATING

THE ACCUMULATED RESISTIVE LOAD IS 453. KW, 15.89 PERCENT RATING
THE ACCUMULATED SYSTEM INERTIA IS 40902. LB-FT-SQD --- CIP = 6.0028736603

THE BRUSH POWER FOR THE MOTORS AT THIS STEP IS 674. SEVA 648 THE CORRECTED THROUGH POWER IS 731. SEVA

VOLTAGE DIP = 3.795
TIME OF MAXIMUM VOLTAGE DIP = 0.024
RECOVERY TIME TO 95.0 PERCENT = 0.0
TOTAL RECOVERY TIME = 0.079

COLOR REDDER 1 MOTOR RATING = 167. HP AT 1800. RPM
THE MOTOR HAS 100. LB-FT SQUARED INERTIA AND WILL HAVE 0. KW LOAD WHEN RUNNING.
FULL LOAD TORQUE IS 312. LB-FT
FULL LOAD KW IS 69. AT AN ASSUMED EFFICIENCY OF 90 PERCENT.
FLAG 1 = 0. FLAG 2 = 1. FLAG 3 = 0.

TR-01 TIME = 0.0 , KW = 106.

INPUT TIME = 0.5000, KW = 196.

INPUT TIME = 1.0000, KW = 115.

INPUT TIME = 1.5000, KW = 132.

INPUT TIME = 1.7000, KW = 177.

INPUT TIME = 1.8000, KW = 222.

INPUT TIME = 1.9000, KW = 222.

INPUT TIME = 2.0000, KW = 89.

PEAK LOAD = 222. AND OCCURS AT 1.20
MAX. OVERVOLTAGE OCCURS AT 2.10 WITH RECOVERY AT 2.32

TIME INCREMENTAL LOAD-KW CHANGE IN DEVIATION NET DEVIATION NET LOAD-KW AVAILABLE LOAD-KW

0.10 313.43 0.02608 0.02608 222.43 0.0 0.

0.20 313.43 0.09000 0.18215 236.43 0.0 0.

0.30 313.43 0.09000 0.18215 236.43 0.0 0.

0.40 313.43 0.09000 0.18215 236.43 0.0 0.

0.50 313.43 0.09000 0.18215 236.43 0.0 0.

0.60 313.43 0.09000 0.18215 236.43 0.0 0.

0.70 313.43 0.09000 0.18215 236.43 0.0 0.

0.80 313.43 0.09000 0.18215 236.43 0.0 0.

ENGINE RATED AT 2050.0 KW AT 900.0 RPM, OF 12. CYLINDERS 2. STROKES PER CYCLE
WITH CAPABILITY OF 120.0 PERCENT LOAD, AND WITH 34572. LB-FT-SQD INERTIA

GENERATOR RATED AT 4063. KVA AND HAS THE FOLLOWING PROPERTIES:

TRANSIENT REACTANCE 26.20 PERCENT
SUBTRANSIENT REACTANCE 13.40 PERCENT
TIME CONSTANT 5.00 SECONDS
FULL LOAD FIELD VOLTAGE 72. VOLTS
NO-LOAD FIELD VOLTAGE 52. VOLTS
MAXIMUM FIELD VOLTAGE - FORCING 455. VOLTS
THE CORRECTED SUB-TRANSIENT REACTANCE IS 21.933 PERCENT

THE POINT FOR DEFINITION OF RECOVERY FOR VOLTAGE IS 90. PERCENT AND FOR FREQUENCY IS 98. PERCENT

THE FOLLOWING CONSTANTS ARE BEING USED FOR THESE COMPUTATIONS:

GENERATOR DIP CONSTANT 1667
EXCITER RECOVERY RATE 5.00
SYSTEM CONSTANT 420
BASE LOAD CONSTANT 0.510
EXISTING LOAD FACTOR IS 1.500
LOAD RECOVERY RATE 0.250 PER SECOND
TURBO C IS 1.00 TURBO RESPONSE FACTOR IS 0.9500
THE TIME INCREMENT IN THE CALCULATION IS 0.10 SECONDS
VOLTAGE OVERTHOOT CONSTANT IS 0.60
FLAG 20 SET @ 2
RACK DEAD TIME CONSTANT IS 0.0270
GOV PROPTNL FACTOR 1.3500 GOVERNOR DEAD BAND IS 0.1000
FRICTION HP RATIO = 0.1500

ACCELERATION CONSTANT (C2) = 0.0034000366 ENGINE/GOV. DEAD TIME = 0.3762221336

STEP NO: 1 THE STARTING TIME IS 0.0 SECONDS

THE LOADS ARE AS FOLLOWS:

LOAD KW	HP	PCT	UNIT RATING
EXISTING 1644.			57.68
ADDED 0.			0.0
MOTORS 501.	605.		17.60
NET LOAD 2145.			75.28

THE ACCUMULATED RESISTIVE LOAD IS 0. KW, 0.0 PERCENT RATING
THE ACCUMULATED SYSTEM INERTIA IS 34572. LB-FT-SQD -- C2P = 0.0034000361

THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 3729. SKVA AND THE CORRECTED INRUSH POWER IS 3729. SKVA

VOLTAGE DIP = 16.757
TIME OF MAXIMUM VOLTAGE DIP = 0.105
RECOVERY TIME TO 90.0 PERCENT = 0.226
TOTAL RECOVERY TIME = 0.387
0.051 0.118

MOTOR NUMBER 1 MOTOR RATING = 455. HP AT 1780. RPM.
THE MOTOR HAS 335. LB-FT SQUARED INERTIA AND WILL HAVE A 377. KW LOAD WHEN RUNNING.
FULL LOAD TORQUE IS 1343. LB-FT
FULL LOAD KW IS 377. AT AN ASSUMED EFFICIENCY OF 90 PERCENT.
FLAG 1 = 0. FLAG 2 = 0. FLAG 3 = 0.

25.00	219.00	1.56	220.50	1.18	0.20	85.80	166.36	165.79	8.36	17.85	283.
30.00	218.00	2.70	218.50	2.15							
35.00	215.00	4.29	216.50	3.49	0.30	91.47	182.80	180.67	9.10	26.95	295.
40.00	212.00	6.40	213.50	5.34							
45.00	209.00	9.11	210.50	7.76	0.40	97.29	202.09	196.75	9.92	36.87	310.
50.00	204.00	12.50	206.50	10.81							
55.00	201.00	16.64	202.50	14.57	0.50	100.00	206.50	195.69	9.86	46.73	306.
60.00	197.00	21.60	199.00	19.12							
65.00	194.00	27.46	195.50	24.53	0.60	100.00	199.00	179.88	9.07	55.80	289.
70.00	189.00	34.30	191.50	30.88	0.70	100.00	195.50	170.97	8.62	64.41	276.
75.00	189.00	42.19	189.00	38.24							
80.00	188.00	51.20	188.50	46.69	0.80	100.00	189.00	150.76	7.60	72.01	261.
85.00	201.00	61.41	194.50	56.31	0.90	100.00	188.50	141.81	7.15	79.16	254.
90.00	231.00	72.90	216.00	67.16							
95.00	260.00	85.74	245.50	79.32	1.00	100.00	216.00	148.84	7.50	86.66	281.
100.00	100.00	100.00	180.00	92.87							
					1.10	100.00	180.00	87.13	4.39	91.05	232.
					1.20	100.00	180.00	87.13	4.39	95.44	228.
					1.30	100.00	180.00	87.13	4.39	99.83	224.

TOTAL EQUIVALENT ENERGY = 273.77295

DEGREE OF SEVERITY = 220.19272

PEAK MOTOR LOAD = 319. AT 0.1000SECONDS

PEAK LOAD KW = 1099. AND OCCURS AT 1.00

MAX. OVERVOLTAGE OCCURS AT 1.60 WITH RECOVERY AT 2.57

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	905.75	0.30796	0.30796	2549.75	0.0 0.
0.20	823.82	0.28010	0.58806	2467.82	0.0 0.
0.30	873.74	0.29708	0.88514	2517.74	0.0 0.
0.40	924.34	0.31428	1.19941	2568.34	0.0 0.
0.41	933.42	0.01760	1.21702		
0.50	933.42	-0.04606	1.17096	2577.42	2720.83 2.
0.60	926.61	-0.06362	1.10734	2570.61	2757.73 2.
0.70	913.69	-0.08059	1.02675	2557.69	2794.72 2.
0.80	939.98	-0.08426	0.94249	2583.98	2831.81 2.
0.90	1032.07	-0.06552	0.87696	2676.07	2868.78 2.
1.00	1099.40	-0.05506	0.82191	2743.40	2905.33 2.
1.10	1022.35	-0.09357	0.72833	2666.35	2941.56 2.
1.20	984.68	-0.11884	0.60950	2628.68	2978.20 2.
1.30	775.74	-0.20241	0.40708	2419.74	3015.07 2.
1.40	667.06	-0.25228	0.15481	2311.06	3053.04 2.

DEVIATION AT INFLECTION = 1.217
SYSTEM DEAD TIME = 0.406
MAXIMUM DEVIATION = 0.406
TIME OF MAXIMUM DEVIATION = 0.0
TIME OF RECOVERY TO 90.0 PERCENT = 0.0
TOTAL RECOVERY TIME = 1.458

STEP NO: 2 THE STARTING TIME IS 80.00 SECONDS
THE LOADS ARE AS FOLLOWS:

LOAD KW HP FCT UNIT RATING
EXISTING 2125 74.56
ADDED 0.0
MOTORS 560. 19.66
NET LOAD 2685. 94.22

THE ACCUMULATED RESISTIVE LOAD IS 0 KW, 0.0 PERCENT RATING
THE ACCUMULATED SYSTEM INERTIA IS 35247. LB-FT-SQRD -- C2F = 0.0033349234

THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 4004. SKVA AND THE CORRECTED INRUSH POWER IS 4004. SKVA

VOLTAGE DIP = 17.773
TIME OF MAXIMUM VOLTAGE DIP = 0.111
RECOVERY TIME TO 90.0 PERCENT = 0.253
TOTAL RECOVERY TIME = 0.418
0.054

MOTOR NUMBER 1 MOTOR RATING = 676. HP AT 1800 RPM.
THE MOTOR HAS 600. LB-FT SQUARED INERTIA AND WILL HAVE A 498. KW LOAD WHEN RUNNING.
FULL LOAD TORQUE IS 1972. LB-FT
FULL LOAD KW IS 560. AT AN ASSUMED EFFICIENCY OF 90 PERCENT.
FLAG 1 = 0. FLAG 2 = 2. FLAG 3 = 0.

INFUT- TIME = 0.0 , KW = 672.	TIME = 0.1000,	INCREMENTAL KW LOAD = 672.
	TIME = 0.2000,	INCREMENTAL KW LOAD = 672.
	TIME = 0.3000,	INCREMENTAL KW LOAD = 672.
	TIME = 0.4000,	INCREMENTAL KW LOAD = 672.
	TIME = 0.5000,	INCREMENTAL KW LOAD = 672.
INFUT- TIME = 0.5000, KW = 672.	TIME = 0.6000,	INCREMENTAL KW LOAD = 684.
	TIME = 0.7000,	INCREMENTAL KW LOAD = 695.
	TIME = 0.8000,	INCREMENTAL KW LOAD = 706.
	TIME = 0.9000,	INCREMENTAL KW LOAD = 717.
	TIME = 1.0000,	INCREMENTAL KW LOAD = 728.
INFUT- TIME = 1.0000, KW = 728.	TIME = 1.1000,	INCREMENTAL KW LOAD = 762.
	TIME = 1.2000,	INCREMENTAL KW LOAD = 796.
	TIME = 1.3000,	INCREMENTAL KW LOAD = 829.
	TIME = 1.4000,	INCREMENTAL KW LOAD = 863.
	TIME = 1.5000,	INCREMENTAL KW LOAD = 897.
INFUT- TIME = 1.5000, KW = 897.	TIME = 1.6000,	INCREMENTAL KW LOAD = 1009.
	TIME = 1.7000,	INCREMENTAL KW LOAD = 1121.
INFUT- TIME = 1.7000, KW = 1121.	TIME = 1.8000,	INCREMENTAL KW LOAD = 1401.
INFUT- TIME = 1.8000, KW = 1401.	TIME = 1.9000,	INCREMENTAL KW LOAD = 1401.
INFUT- TIME = 1.9000, KW = 1401.	TIME = 2.0000,	INCREMENTAL KW LOAD = 560.
INFUT- TIME = 2.0000, KW = 560.		

PEAK LOAD = 1401. AT 1.9000 SECONDS
WITH PEAK VOLTAGE AT 2.1000

PEAK LOAD KW = 1401. AND OCCURS AT 1.90
MAX. OVERTVOLTAGE OCCURS AT 2.10 WITH RECOVERY AT 3.13

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	672.39	0.22424	0.22424	2797.39	0.0 0.
0.20	672.39	0.22424	0.44848	2797.39	0.0 0.
0.30	672.39	0.22424	0.67271	2797.39	0.0 0.
0.40	672.39	0.22424	0.89695	2797.39	0.0 0.
0.40	672.39	0.00668	0.90363		
0.50	672.39	-0.16318	0.74046	2797.39	3301.72 2.
0.60	683.60	-0.17404	0.56641	2908.60	3330.47 2.
0.70	694.81	-0.17993	0.38649	2819.81	3359.33 2.
0.80	706.01	-0.18582	0.20067	2831.01	3388.21 2.
0.90	717.22	-0.19040	0.01027	2842.22	3413.14 3.

DEVIATION AT INFLECTION = 0.904
SYSTEM DEAD TIME = 0.403
MAXIMUM DEVIATION = 0.904
TIME OF MAXIMUM DEVIATION = 0.403
TIME OF RECOVERY TO 98.0 PERCENT = 0.0
TOTAL RECOVERY TIME = 0.905

STEP NO: 3 THE STARTING TIME IS 90.00 SECONDS
THE LOADS ARE AS FOLLOWS:

	LOAD KW	HP	PCT	UNIT RATING
EXISTING	1450.			50.00
ADDED	0.			0.0
MOTORS	535.	646.		18.79
NET LOAD	1985.			69.67

THE ACCUMULATED RESISTIVE LOAD IS 0. KW, 0.0 PERCENT RATING
THE ACCUMULATED SYSTEM INERTIA IS 35847. LB-FT-SQRD -- C2P = 0.0032791041

THE INRUSH POWER FOR THE MOTORS AT THIS STEP IS 3828. SKVA AND THE CORRECTED INRUSH POWER IS 3828. SKVA

VOLTAGE DIP = 17.126
TIME OF MAXIMUM VOLTAGE DIP = 0.107
RECOVERY TIME TO 90.0 PERCENT = 0.235
TOTAL RECOVERY TIME = 0.396
0.052 0.121

MOTOR NUMBER 1 MOTOR RATING = 646. HP AT 1800. RPM.
THE MOTOR HAS 600. LB-FT SQUARED INERTIA AND WILL HAVE A 473. KW LOAD WHEN RUNNING.
FULL LOAD TORQUE IS 1885. LB-FT
FULL LOAD KW IS 535. AT AN ASSUMED EFFICIENCY OF 90 PERCENT.
FLAG 1 = 0. FLAG 2 = 2. FLAG 3 = 0.

INPUT- TIME = 0.0 , KW = 643. TIME = 0.1000, INCREMENTAL KW LOAD = 643.

AN320010 FREQUENCY AND VOLTAGE EXCURSION PREDICTIONS PROGRAM PAGE 6
 ARKANSAS P & L, S/O 205925, 12 OF, 2050 KW @ 900 RPM, SPECIAL LOADS/OL

INPUT-TIME = 0.2000, KW = 643.	INCREMENTAL KW LOAD = 643.	TIME = 0.2000, INCREMENTAL KW LOAD = 643.
INPUT-TIME = 0.3000, KW = 643.	INCREMENTAL KW LOAD = 643.	TIME = 0.3000, INCREMENTAL KW LOAD = 643.
INPUT-TIME = 0.4000, KW = 643.	INCREMENTAL KW LOAD = 643.	TIME = 0.4000, INCREMENTAL KW LOAD = 643.
INPUT-TIME = 0.5000, KW = 643.	INCREMENTAL KW LOAD = 643.	TIME = 0.5000, INCREMENTAL KW LOAD = 643.
INPUT-TIME = 0.6000, KW = 696.	INCREMENTAL KW LOAD = 653.	TIME = 0.6000, INCREMENTAL KW LOAD = 653.
INPUT-TIME = 0.7000, KW = 696.	INCREMENTAL KW LOAD = 664.	TIME = 0.7000, INCREMENTAL KW LOAD = 664.
INPUT-TIME = 0.8000, KW = 696.	INCREMENTAL KW LOAD = 675.	TIME = 0.8000, INCREMENTAL KW LOAD = 675.
INPUT-TIME = 0.9000, KW = 696.	INCREMENTAL KW LOAD = 685.	TIME = 0.9000, INCREMENTAL KW LOAD = 685.
INPUT-TIME = 1.0000, KW = 696.	INCREMENTAL KW LOAD = 696.	TIME = 1.0000, INCREMENTAL KW LOAD = 696.
INPUT-TIME = 1.1000, KW = 857.	INCREMENTAL KW LOAD = 728.	TIME = 1.1000, INCREMENTAL KW LOAD = 728.
INPUT-TIME = 1.2000, KW = 857.	INCREMENTAL KW LOAD = 760.	TIME = 1.2000, INCREMENTAL KW LOAD = 760.
INPUT-TIME = 1.3000, KW = 857.	INCREMENTAL KW LOAD = 792.	TIME = 1.3000, INCREMENTAL KW LOAD = 792.
INPUT-TIME = 1.4000, KW = 857.	INCREMENTAL KW LOAD = 825.	TIME = 1.4000, INCREMENTAL KW LOAD = 825.
INPUT-TIME = 1.5000, KW = 857.	INCREMENTAL KW LOAD = 857.	TIME = 1.5000, INCREMENTAL KW LOAD = 857.
INPUT-TIME = 1.6000, KW = 964.	INCREMENTAL KW LOAD = 964.	TIME = 1.6000, INCREMENTAL KW LOAD = 964.
INPUT-TIME = 1.7000, KW = 1071.	INCREMENTAL KW LOAD = 1071.	TIME = 1.7000, INCREMENTAL KW LOAD = 1071.
INPUT-TIME = 1.8000, KW = 1339.	INCREMENTAL KW LOAD = 1339.	TIME = 1.8000, INCREMENTAL KW LOAD = 1339.
INPUT-TIME = 1.9000, KW = 1339.	INCREMENTAL KW LOAD = 1339.	TIME = 1.9000, INCREMENTAL KW LOAD = 1339.
INPUT-TIME = 2.0000, KW = 535.	INCREMENTAL KW LOAD = 535.	TIME = 2.0000, INCREMENTAL KW LOAD = 535.

FEAK LOAD KW = 1339. AND OCCURS AT 1.90
 MAX. OVERVOLTAGE OCCURS AT 2.10 WITH RECOVERY AT 3.09

TIME	INCREMENTAL LOAD-KW	CHANGE IN DEVIATION	NET DEVIATION	NET LOAD-KW	AVAILABLE LOAD-KW
0.10	642.55	0.21070	0.21070	2092.55	0.0 0.
0.20	642.55	0.21070	0.42140	2092.55	0.0 0.
0.30	642.55	0.21070	0.63210	2092.55	0.0 0.
0.40	642.55	0.21070	0.84280	2092.55	0.0 0.
0.40	642.55	-0.00920	0.85270	2092.55	2515.95 2.
0.50	642.55	-0.13231	0.72039	2092.55	2558.29 2.
0.60	653.26	-0.14921	0.57118	2103.26	2600.71 2.
0.70	663.97	-0.15961	0.41157	2113.97	2643.13 2.
0.80	674.68	-0.17000	0.24157	2124.68	2685.54 2.
0.90	685.39	-0.18040	0.06117	2135.39	

DEVIATION AT INFLECTION = 0.853
 SYSTEM DEAD TIME = 0.405
 MAXIMUM DEVIATION = 0.853
 TIME OF MAXIMUM DEVIATION = 0.405
 TIME OF RECOVERY TO 98.0 PERCENT = 0.932
 TOTAL RECOVERY TIME = 0.932