ATTACHMENT 3

CALCULATION FOR COORDINATION BETWEEN UNDERVOLTAGE
AND OVERCURRENT PROTECTION

CALCULATION COVER SHEET

PROJECT	JOB NO.	CALC NO.	SHEET
Turkey Point Unit 3	21701-523	21701-523-E-02	1
SUBJECT: Verification of Degraded Voltage Relay Protection for Safety Related		TOTAL NO. OF SHEETS: 12	LAST SHEET NO.: 12
Equipment (Coordination between U/V and Overcurrent Protection)		DISCIPLINE: Electrical	

CALCULATION STATUS DESIGNATION ▸	PRELIMINARY	COMMITTED	CONFIRMED	SUPERSEDED	CANCELED
	[ ]	[ ]	[X]	[ ]	[ ]

COMPUTER PROGRAM ▸	SCP	MAP	NCP	NONE	PROGRAM NO.(S)	VERSION/RELEASE NO.
	[ ]	[ ]	[ ]	[X]	Not Applicable	Not Applicable

Attachments

1. Figures 1 - 28 associated with this calculations verification of degraded voltage relay protection. (28 pages)
2. PC/M 91-036, Input Data Ref. No. 8 (excerpt), Motor Data and Safe Heating curves. (9 pages)
3. Miscellaneous Motor Data Sheets and Safe Heating curves. (10 pages)
4. ITE G30 Heater Selection Tables and Overload Tripping Characteristics. (4 pages)
5. Westinghouse F-Series Heater Selection and Trip Curve. (2 pages)
6. Asea Brown Boveri (ABB) 0D61 Breaker Information. (3 pages)
7. ITE Circuit Breaker Curve for HF frame breaker (1 page)
8. Asea Brown Boveri Breaker Characteristics of SS-3 device (1 page)
9. Asea Brown Boveri Overcurrent Relay Characteristics of ITE-51IM relay. (1 page)
10. General Electric Overcurrent Relay Characteristics for IAC66 relay. (1 page)
11. Square D Overload Relay Time Current Characteristics. (1 page)
12. General Electric Motor Starter Heater Time Current Curves. (2 pages)
13. Qualified Air Corp/General Electric Motor Data. (4 pages)
14. General Electric Time-Voltage curves for IAV Relays. (2 pages)
15. Copeland Letter Dated 3/25/92 for compressor motor data. (2 pages)
16. REA No. 91-289 with ABB Test Report Data for trip device settings. (6 pages)

No.	Reason for Revision	By	Date	Checked	Date	Approved	Date	Accepted	Date
0	ISSUED FOR USE	[signature]	3/27/92	RRL	3/27/92	FJG	3/27/92		

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	2

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Swink	03/27/92	Robert R. Larsen	3/27/92

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1.0 PURPOSE:

The purpose of this calculation is to demonstrate that the settings of undervoltage relays, 327I (ITE) and 327T (IAV) are adequate to protect and ensure the operability of safety related equipment connected to the AC distribution system. Specifically this calculation will demonstrate that the undervoltage relays will trip and separate the distribution system from offsite power before either equipment is damaged from the effects of low voltage or rendered inoperable due to the operation of other protective devices.

2.0 SCOPE:

The scope of this calculation includes all safety related loads on the 4.16kV vital switchgear, 480V Load Centers and 480V Motor Control centers except as noted below. Loads which are not susceptible to either damage or tripping through overcurrent devices due to undervoltage have been excluded for the following reasons;

- Motor operated valves and dampers, being intermittent loads will likely not be operating during a degraded voltage transient. The design, application, and overcurrent protection for motor operated valves also allows for extended overload or stalled conditions.
- Battery chargers and resistive loads may become inoperable during exposure to lower than rated voltage but these effects will only last as long as the voltage transient. These loads are not subject to overheating at low voltages nor will they draw current to the extent that overcurrent device actuation is a concern.

The remaining safety related loads consist of 4kV and 480 Volt motors supplied at the switchgear, load center and motor control center levels.

3.0 ASSUMPTIONS/ BASES:

The following assumptions and bases were used in the performance of this calculation;

3.1 Motor breakdown torques were assumed equal to the NEMA Standard MG 1 (Ref. 4.2), section MG 1-12.39, minimum values unless motor specific values were available.

3.2 Thermal damage curves or safe time curves are not available for motors supplied from Motor Control Centers. Thermal overloads on MCC motors were assumed sized to adequately protect the motors. Motors in this range follow standard designs and overload relays settings are generally based on a percentage of motor full load current. As noted in ANSI Standard C37.96 (Ref. 4.8), overload relays are normally adequate to protect motors in this horsepower range. The NEC, (Ref. 4.3), indicates that overload relays with trip currents up to 140% of motor full load current are adequate to prevent overheating for motors with a 1.15 service factor. Motors applied at the MCC level have a service factor of 1.15 or greater per NEMA MG-1 (Ref. 4.2) and Specification 5610-E-6B (Ref. 4.5). This service factor increases the allowable current which a motor can withstand without damage. The ratios between motor full load amps and overload pickup were reviewed to confirm this assumption.

3.3 The voltage drops across individual feeders were calculated neglecting the relative phase between the current and feeder impedance. This simplifying assumption introduces a small conservatism since voltage drops calculated in this manner will be greater than those derived in a more rigorous fashion.

3.4 Motor power factor and efficiency were assumed equal to 0.85 and 0.92 (Ref. 4.1) respectively in the absence of specific motor data, except for motors at and below 2 HP where the following values will be used;

2 HP .85 pf .65 eff.
1 HP .85 pf .61 eff.
3/4 HP .85 pf .59 eff.

The use of these factors provide motor full load currents which are close to typical values provided in the NEC Table 430-150, Reference 4.3. Since the phase angle of the motor current is not being used in this calculation, the adjustment of the efficiency to obtain the target full load amps rather than the power factor is of no concern.

3.5 The voltage seen on the 4.16kV buses was assumed equal to that registered by the undervoltage relays on the 480V loads centers adjusted by the LC transformer turns ratio (including 2.5% boost). By neglecting the voltage drop across the LC transformer, the voltage used for the 4.16kV bus at a given load center voltage is lower than would actually exist. This assumption adds a slight conservatism in the evaluation of the effects of undervoltage on the 4kV motors.

3.6 Disturbances in the offsite power network are considered to be either prolonged undervoltage at levels slightly below the design minimum values, short term voltage excursions (<1 second) caused by system faults, or total system collapse. The setpoint of the ITE relay is selected to prevent motor stalls at prolonged degraded voltages. The second case, short term dips caused by external faults, are of such a limited duration that operating motors will remain at near full speed. System undervoltages of the third type, severe drops which persist for more than a few seconds, are considered to be indicative of a system collapse and the fact that motors may stall under these conditions is not a concern since undervoltage relaying will eventually trip the buses. This calculation is intended only to show that no motor damage will occur in the period before the buses are tripped, not that the distribution system can experience severe undervoltages for several seconds and return to normal operation.

4.0 REFERENCES:

4.1 Calculation EC-145, Rev. 5, "PSB-1, Voltage Analysis for Electrical Auxiliary System". This calculation was used as a source for motor data, cable impedances, and load center to MCC voltage drops. Where more specific motor data was available, such data was used in lieu of the EC-145 information.

4.2 NEMA Standard MG 1-1987, Rev. 1, "Motors and Generators", Section MG 1-12.39, "Breakdown Torque of Single Speed Polyphase Squirrel Cage Medium Motors with Continuous Ratings", Table 12-2, "Service Factor"

4.3 National Electrical Code, 1990, Table 430-150, "Full Load Current Three-Phase Alternating-Current Motors", Section 430-34, "Selection of Overload Relay"

4.4 Project drawings as referenced throughout the calculation.

4.5 Specification 5610-E-6B, "Specifications for Station Auxiliary Motors", Rev. 6.

4.6 Motor Data Sheets, Attachments 2, 3, 13, 15.

4.7 Calculation 21701-523-E-01, Rev. 0, "Unit 3 Load Center's Undervoltage Relay Setpoints".

4.8 ANSI Standard C37.96-1988, "IEEE Guide for AC Motor Protection".

4.9 Electric Power Research Institute Power Plant Electrical Reference Series, Volume 6, "Motors".

4.10 Relay Coordination Study, FLO 53-20.5004, Rev. 11.

4.11 PC/M 90-211, "Replacement of Control RM. HVAC Condensing Sections" Rev. 1.

5.0 METHODOLOGY:

5.1 General Methodology

The methodology employed to demonstrate that the undervoltage relays adequately protect the safety related motors consists of determining the motor current corresponding to various voltages on the undervoltage relay characteristic curves and plotting that current as a function of the undervoltage relay trip time for the specific voltage. A typical current vs. voltage plot for an undervoltage condition is shown in Figure A. Since the voltage seen at the motor terminals will vary from the bus voltage sensed by the undervoltage relays (relays are located at the Load Center level), the calculation takes the voltage drop across bus to bus and individual motor feeder circuits into account. The exact treatment of feeder voltage differs between voltage classes and is addressed in detail later in this calculation.

Once the motor currents are calculated and correlated to undervoltage relay operating times, these values are plotted on a time vs. current scale along with the motor overcurrent device characteristics and motor safe heating curves where available.

Motors at the 480V level, particularly smaller horsepower rating are not typically furnished with safe heating curves. Since motors applied at the motor control center level generally follow standard frame size and designs, overcurrent protection for these motors is selected using standard pickup to FLA ratios between 115 and 140%. For motors where safe heating

curves are not available the undervoltage induced current curves will be plotted against thermal overload curves only with the assumption that thermal overloads are sized adequately to protect the motors.

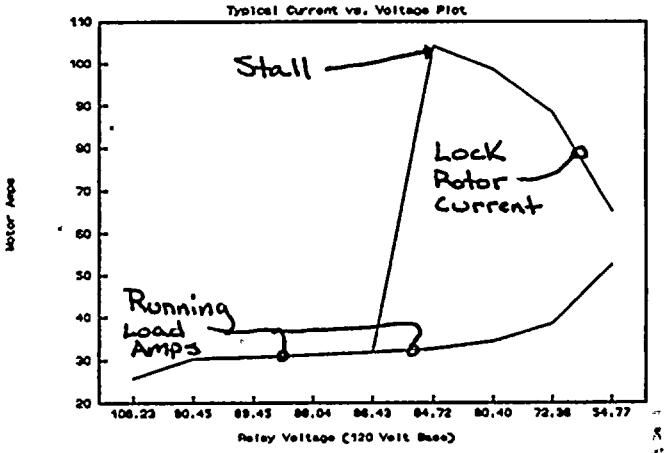

FIGURE A

The calculation of motor overcurrent induced by undervoltage is based on the motor acting as a constant power device, ie. the motor current increases inversely to the decrease in motor terminal voltage. This treatment is valid until the voltage reaches a point where the motor can no longer develop sufficient torque to drive the attached load, at which point the motor begins to stall. The voltage at which stall occurs, referred to as "Stall Voltage" in the calculation is related to the breakdown torque of the motor. The motor torque developed varies as the square of the applied voltage, therefore for a reduction in applied voltage of 20%, the developed torque is 0.8^2 or 0.64 per unit. The maximum torque developed by a motor at rated voltage, the breakdown torque, is similarly reduced with voltage. The stall voltage, that voltage where the breakdown torque equals the rated torque, can then be calculated given the breakdown torque. This stall voltage represents the highest voltage at which a motor may stall, however the motor may continue to run at lower voltages.

Breakdown torque information specific to individual motors has been used where available. For other cases the minimum breakdown torque for the motor frame size from NEMA Standard MG 1, (Ref. 4.2), Section MG 1-12.39, (200% for NEMA Design A & B, 190% for NEMA Design C) will be used. This approach has added conservatism in that it ignores the margin between motor rated horsepower and load brake horsepower.

Once the voltage at the motor terminals falls below the stall voltage discussed above, one of two things happen, the motor may stall, drawing locked rotor current, or may continue to spin due to the combined effects of inertia, motor vs. load torque margin. Since a motor under locked rotor conditions is essentially a fixed impedance, the current drawn at low voltages will decrease proportionally with the voltage. In order to address either possibility, both the stall point and operating points will be plotted below the stall voltage.

The motor will be deemed adequately protected by the bus undervoltage protection if the undervoltage induced overcurrent is shown to persist for less time than the motor protection takes to trip. In other terms, if the motor overcurrent due to undervoltage curve does not intersect the overcurrent protection or thermal damage curves the motor is considered adequately protected.

5.2 Calculations Equations

The calculation of motor currents for selected undervoltage relay setpoint was calculated using a spreadsheet. The calculation inputs required are as follows;

Per Switchgear Bus, Load Center or MCC

- U/V Relay Setpoints for Connected Load Center
- Cable Drop data for MCCs only

Per Motor Load

- Horsepower
- Power Factor
- Efficiency
- Feeder Cable Resistance
- Feeder Cable Reactance
- Locked Rotor/Full Load Amps ratio
- Percent Stall Torque (Breakdown Torque)

The results and intermediate values were derived as follows;

Switchgear, Load Center or MCC values

Relay Voltage = ITE Relay Setpoint for Dropout at 60 Seconds
= IAV Relay Setpoint · Time Dial 5 Curve (Ref. 4.7 and Attachment 14)

Attachment 1 figures are plotted to the ITE dropout value of 60 secs in addition to a 6.5 sec relay tolerance and a 1 sec sequencer time delay per drawing 5610-T-L1, Sh. 13 Rev. 9.

The IAV relay tolerances will not be accounted for in the actual data. However, this margin will be addressed in section 8.0, the conclusion section of this calculation.

Voltage at Load Center = V_{LC} = Relay Voltage · 480/120

Voltage at Switchgear = $V_{SG} = V_{LC} * 4160/(480 \cdot 1.025)$

Voltage at MCC = V_{MCC} = V_{LC}-MCC Feeder Drop

MCC Feeder Drop = $VD_{MCC} = V_{LC} - V_{MCC} = V_{LC} - I_{MCC} \cdot Zc_{MCC}$

I_{MCC} = MCC Load Current = Pm_{MCC}/V_{MCC}
Zc_{MCC} = MCC Feeder Cable Impedance
Pm_{MCC} = MCC Load (KVA)

$V_{LC} = V_{mcc} + Pm_{mcc} / V_{mcc} \cdot Zc_{mcc}$

$$V_{MCC}^2 - V_{MCC} \cdot V_{LC} + Pm_{MCC} \cdot Zc_{MCC} = 0$$

This equation is a quadratic of the form $ax^2+bx+c=0$ whose solution is

$$\frac{-b \pm \sqrt{(b^2-4 \cdot a \cdot c)}}{2 \cdot a}$$

For this application the proper solution is

$$V_{MCC} = \frac{V_{LC} + \sqrt{(V_{LC}^2 - 4 \cdot Pm_{MCC} \cdot Zc_{MCC})}}{2}$$

The value $Pm_{MCC} \cdot Zc_{MCC}$ is derived from values of V_{LC} and V_{MCC} obtained from Calculation EC-145, (Ref. 4.1), which resulted in the lowest voltage for a particular MCC bus.

$$Pm_{MCC} \cdot Zc_{MCC} = V_{LC} \cdot V_{MCC} - V_{MCC}^2$$

The Bus Per Unit Voltage is expressed on a motor voltage base,

$V_{PU} = V_B$ / 4000 for 4kV motors
$= V_B$ / 460 for MCC and LC motors

Motor Values

Motor KVA = HP ·.746 /(Power Factor · Efficiency)

Motor Base Amps = Motor KVA / ($\sqrt{3}$ · Motor Base Volts)

Cable Impedance = $\sqrt{(\text{Cable Resistance}^2 + \text{Cable Reactance}^2)}$

PU Impedance = Cable Impedance · Motor KVA/Motor Base Volts^2

Full Load Torque = Breakdown Torque · $V_{\text{P.U. Stall Voltage}}^2$

% Breakdown Torq = Breakdown Torq/Full Load Torq

Therefore,

PU Stall Voltage = $\sqrt{(}$ 1 / (Percent Stall Torque/100))

Motor Amps (pu) = $I_M = P_M/V_M = (V_B - V_M)/Zc_M$

$V_B = V_M + I_M \cdot Zc_M = P_M/I_M + I_M \cdot Zc_M$

I_M = Motor Amps(pu)
P_M = Motor KVA(pu) = 1
V_M = Motor Voltage(pu)
V_B = Bus Voltage(pu) Swgr, LC, or MCC
Zc_M = Motor Cable Impedance(pu)

All per unit values are determined on a motor KVA base

$I_M^2 - V_B/Zc_M \cdot I_M + P_M/Zc_M = 0$

Solving the quadratic equation:

$$I_M = \frac{V_B/Zc_M + \sqrt{(V_B^2/Zc_M^2 - 4 \cdot P_M/Zc_M)}}{2}$$

Running Amps = $I_M \cdot$ Motor Base Amps

Motor Volts = $V_M = V_B - I_M \cdot Zc_M$

Cable Drop = $V_B - V_M$

Locked Rotor Amps are calculated when the motor voltage falls below the calculated stall voltage. The locked rotor current is calculated using the combined impedance of the motor feeder cable and the motor locked rotor impedance.

In Per Unit

$I_{LRC} = V_B$ / (1/LRC Ratio + Cable Impedance)

In Amps

Locked Rotor Current = $I_{LRC} \cdot$ Motor Base Amps

Since the stall voltage calculated represents the maximum voltage at which the motor may stall, both the running amps and locked rotor amps will be plotted for voltages below the calculated stall voltage.

6.0 CALCULATION

Appendix A provides a listing of the tag numbers for the loads examined, relay settings and overload heater sizes, as well as references for this data.

6.1 4.16 kV Buses 3A, 3B, and 3D

The safety related loads examined for these buses consisted of the following motors;

		Figures
• RHR Pump	3P210A & B	3
• SI Pump	3P215A & B	1
• ICW Pump	3P9A,B & C	2 & 6
• CCW Pump	3P211A,B & C	4 & 5

Since the A & B pumps have identical protective device settings, they have been combined on one plot with the highest motor currents for each case.

The motor currents on bus 3D were examined for two cases, supply from 3A and supply from 3B.

Overcurrent plots for these motors include the motor overcurrent caused by varying levels of undervoltage, the motor protective relay curves and the motor safe heating curves.

6.2 480 V Load Centers 3B01, 3B02, 3B50

The following loads were examined at the load center level;

	Figures
• Charging Pump 3P201A,B & C	7 & 8
• Cont. Spray Pump 3P214A & B	9

The motor current on LC 3H (3B50) was examined for two cases, supply from 3A (3B01) and 3B (3B02).

Since the A & B pumps have identical protective device settings, they have been combined on one plot with the highest motor currents for each case.

Settings for 3P214A & B and 3P201A & B are based on ABB Test Reports (Attachment 16). Where different settings for like equipment is used, the most conservative settings (ie. lowest) were utilized.

Overcurrent plots for these motors include the motor overcurrent caused by varying levels of undervoltage, the trip device curves and the motor safe heating curves (where available).

6.3 480 V Motor Control Centers 3B05, 3B06, 3B07, 3B08, 3B52

The following loads were examined at the MCC level;

			Figures
•	EMERG CONT CLR FAN	3V30A,B & C	10
•	EMERG CONT FILTER FAN	3V3A,B & C	11
•	EDG FO XFER PUMP	3P10A & B	14 & 15
•	EDG ROOM VENT FAN	3V34A & B	16 & 17
•	CONTROL ROOM A/C AHU	E16A & C	12 & 13
•	SWGR 3D ROOM SUPPLY FAN	3V65A & B	18
•	COMPUTER ROOM CHILLER	S74B	21 & 22
•	COMPUTER ROOM CHILLER	S75B	19
•	COMPUTER ROOM A/C AHU	S77B	19
•	COMPUTER ROOM A/C AHU	S78B	19
•	CNTRL RM EMERG FLTR FAN	V29B	20
•	ELECT EQPT ROOM AHU	V77/E231	24, 25, 26
•	AIR,PART & GAS MONITOR	3V36	23

The motor currents for MCC 3B08 (3D) were examined both for the case of supply from Load Center 3B03 and Load Center 3B04 via Load Center 3H.

Plots for motors at the MCC level include only the voltage induced motor overcurrent and the thermal overload characteristics. Safe heating or thermal damage curves are not generally available for these motors. Plots obtained from vendors for the Emergency Containment Filter Fans and the Emergency Containment Cooler Fans were included.

The Control Room HVAC units E16/E17 include several motors fed from a common molded case breaker. These motors are individually thermally protected by internal devices. The effect on the feeder breaker of overloading all motors simultaneously is examined for this case.

7.0 RESULTS

As shown by the individual time vs. current plots, the motor current induced by degraded system will not persist long enough to cause spurious tripping of motors due to overcurrent devices, nor will any of the established safe heating times be exceeded for those motors which safe heating curves have been supplied by the manufacturer.

The motor overload curves overlap the safe heating curves for the Emergency Containment Cooler and Emergency Containment Filter Fans. Although this is not a concern for the purposes of this calculation, the juxtaposition of these two curves suggests that a problems exists with the overcurrent protection for these motors. Further review of the overload heater selection indicates that each is applied within the guidelines for their application. The motor vendor (Reliance) was contacted concerning the application of the thermal damage curves. Reliance indicated that these curves represented the time and current which would cause the motor to reach

215°C, a temperature indicative of accelerated thermal aging rather than catastrophic failure. Furthermore these curves were calculated assuming no heat transfer from the motor, and neglects the additional cooling effects of the vane-axial fan installation. Given the degree of conservatism which was used in the generation of the thermal damage curve and the importance of continued operation of these motors in accident conditions the present overload settings for these fans is prudent.

Likewise, the Containment Spray Pump safe heating curve is shown to underlay its breaker tripping protection (OD61 trip device). However, there is an alarm which will notify the operator of an overload.

8.0 CONCLUSIONS

On review of Attachment 1, the margin between U/V protection and overload protection is substantial in relation to the IAV operating margin. Therefore, the degraded voltage relaying provided on the 480V load center buses will operate and trip the 4.16kV and 480V distribution buses in adequate time to preclude damage to safety related motors and to prevent spurious tripping of those motors.

The adequacy of the 480V motor control center overload relays was reviewed by comparison of the OL relay pickup to the motor full load currents. The ratio between OL trip setting and motor full load amps was below 140% for all MCC motors except for the 3/4 HP EDG Fuel Oil Transfer Pumps and the Electrical Equipment Room AHU. Since the service factor for these motors are 1.15 or higher, all overload relays in this range should provide adequate motor protection. The full load current for motors in the 3/4 HP range may vary widely and the higher ratio for these pumps may be necessary. The undervoltage/overcurrent curve for the EDG F.O. Transfer Pumps was also reviewed against an overload curve sized for a lower motor FLA and was shown to coordinate with that curve as well (Figure 27 & 28), indicating that the U/V protection would protect these motors. The AHU unit overloads are sized according to vendor specifications and are considered reasonable for this application.

CALCULATION SHEET

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Paul Johnson	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
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MOTOR CONTROL CENTER LOADS

*Note: Also Ref. 5613-E-10 Sh. 1 & 2 Rev. 0

	TAG	RATED HP	MCC	OL HTR SIZE	# OF HTRS	STARTER SIZE	OL MIN FLA	OL TRIP SETTING	LOAD FLA	OL TO FLA RATIO	REFERENCE
*EMERG CONT CLR FAN	3V30A	30	3B06	G30T52	2	3	40	50	38.46	1.30	5613-E-25/SH. 11B Rev. 2
	3V30B	30	3B08	G30T52	2	3	40	50	38.46	1.30	5613-E-25/SH. 11D Rev. 2
	3V30C	30	3B07	G30T52	2	3	40	50	38.46	1.30	5613-E-25/SH. 11F Rev. 2
*EMERG CONT FILTER FAN	3V3A	75	3B06	G30T60	2	4	90	112.5	87.69	1.28	5613-E-25/SH. 11A Rev. 2
	3V3B	75	3B08	G30T59	3	4	80	100.0	87.69	1.14	5613-E-25/SH. 11C Rev. 2
	3V3C	75	3B07	G30T60	2	4	90	112.5	87.69	1.28	5613-E-25/SH. 11E Rev. 2
*EDG FO XFER PUMP	3P10A	0.75	3B05	G30T23	2	1	1.65	2.0625	1.4	1.47	5613-E-27/SH. 11B Rev. 1
	3P10B	0.75	3B52	FH22	2	2	1.63	2.0375	1.4	1.46	5613-E-27/SH. 11A Rev. 1
*EDG ROOM VENT FAN	3V34A	5	3B05	G30T36	2	1	6.07	7.5875	5.99	1.27	5613-E-27/SH. 8A Rev. 0
	3V34B	5	3B52	FH37	3	2	6.5	8.125	5.99	1.36	5613-E-27/SH. 8B Rev. 0
CONTROL ROOM A/C AHU	E16A/E17A	34	3B06	50A bkr (HF3-B050)					38.3		5610-E-1433 Rev. 4 and
	E16C/E17C	34	3B08	50A bkr (HF3-B050)					38.3		5613-E-8-8 Rev.1 & PC/M 90-211 (Ref. 4.11)
*SWGR 3D ROOM SUPPLY FAN	3V65A	2	3B07	FH27	3	2	2.59	3.2375	2.68	1.21	5613-E-27/SH. 8C Rev. 0
	3V65B	2	3B52	FH27	3	2	2.59	3.2375	2.68	1.21	5613-E-27/SH. 8D Rev. 0
COMPUTER ROOM CHILLER	S74B	65	3B08								5613-E-27/SH. 31B Rev. 1
COMPRESSOR		50		CR123F772B	3	3	63.3	79.125	62	1.28	5177-206-M724-31-3 &
FAN 1		5		CR123C778A	3	1	7.2	9	6.8	1.32	5177-206-M724-27-4 &
FAN 2		5		CR123C778A	3	1	7.2	9	6.8	1.32	5177-206-M724-43-1
CHILLER PUMP		5		CR123C778A	3	1	7.2	9	6.8	1.32	
*COMPUTER ROOM CHILLER	S75B	5	3B08	FH37	3	2	6.5	8.125	6.8	1.20	5610-E-27/SH. 32D Rev.0 & 5177-206-M711-34-1
*COMPUTER ROOM A/C AHU	S77B	5	3B08	FH37	3	2	6.5	8.125	6.8	1.20	5610-E-27/SH. 32E Rev. 0 & 5177-206-M711-34-1
*COMPUTER ROOM A/C AHU	S78B	5	3B08	FH37	3	2	6.5	8.125	6.8	1.20	5610-E-27/SH. 32F Rev. 0 & 5177-206-M711-34-1
*CNTRL RM EMERG FLTR FAN	V29B	5	3B08	G30T37	3	1	6.3	7.875	6.8	1.16	5610-E-27/SH. 45F Rev. 5 & 5177-349-M713-10-1
ELECT EQPT ROOM AHU	V77/E231	36	3B08								5613-E-27/SH. 95A Rev. 0
AHU				B15.5	3	0	11.1	13.875	9.3	1.49	Vendor Man. V000475 & Attachment 13
COMP				B32.	3	1	23.0	28.75	17.3	1.66	V000475 & 5610-M-38-24 Sh.1 Rev. 0
FAN				B10.2	3	0	7.32	9.15	6.3	1.45	V000475 & Attachment 13
*AIR PART. & GAS MONITOR	3V36	2	3B06	G30T26	2	1	2.27	2.8375	2.7	1.05	5613-E-25/SH. 26A Rev. 0 & Attach. 3

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Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
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SHT 2 OF 20

4.16 KV SWITCHGEAR LOADS

	TAG	RATED HP	RELAY MODEL	TAP	TIME DIAL	NORMAL DROPOUT PU AMPS	REFERENCE	
COMPONENT COOLING WATER PP	3P211A	450	IAC66K	4.5	4	40	5613-E-315/91-036	SH. 21 Rev. 0 & Attachment 2
	3P211B	450	IAC66K	4.5	4	40		SH. 46 Rev. 0 & Attachment 2
	3P211C	450	ITE-51IM	5	3	45.6		SH. 75 Rev. 0 & Attachment 2
INTAKE COOLING WATER PUMP	3P9A	325	IAC66K	3.5	2.5	40		SH. 28 Rev. 0 & Attachment 2
	3P9B	325	IAC66K	3.5	2.5	40		SH. 50 Rev. 0 & Attachment 2
	3P9C	325	ITE-51IM	3.75	2	39.2		SH. 76 Rev. 0 & Attachmnet 2
SAFETY INJECTION PUMP	3P215A	350	IAC66K	4	2.5	40		SH. 22 Rev. 0 & Attachment 2
	3P215B	350	IAC66K	4	2.5	40		SH. 45 Rev. 0 & Attachment 2
RESIDUAL HEAT REMOVAL PUM	3P210A	300	IAC66K	3.1	3.5	30		SH. 24 Rev. 0 & Attachment 2
	3P210B	300	IAC66K	3.1	3.5	30		SH. 48 Rev. 0 & Attachment 2

LOAD CENTER LOADS

	TAG	RATED HP	BREAKER MODEL	SENSOR TAP	LONG TIME TAP	LONG TIME TIME BAND	INST. TAP	REFERENCES
CHARGING PUMP	3P201A	150	0061	225	1.9	INTERMEDIATE	10.0	ATTACHMENTS 6 & 16, 5613-E-5 Rev. 0
	3P201B	150	0061	225	1.55	MAXIMUM	10.0	ATTACHMENTS 6 & 16, 5613-E-5 Rev. 0
	3P201C	150	SS-3	400	1.0	MINIMUM	5.0	FLO 53-20.5004 REV. 11 (Ref. 4.10) & 5613-E-5 Rev. 0
CONTAINMENT SPRAY PUMP	3P214A	250	0061	300	2.2	INTERMEDIATE	12.5	ATTACHMENTS 6 & 16, 5613-E-5 Rev. 0
	3P214B	250	0061	300	2.5	MAXIMUM	10.0	ATTACHMENTS 6 & 16, 5613-E-5 Rev. 0

CALCULATION SHEET

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 3 OF 20

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smink	03/27/92	Robert R. Larsen	3/27/92

SWGR 3A 4.16KV

Degraded Voltage Protection: LC 3B01

Swgr voltage assumed equal to LC voltage
times xfmr turns ratio including 2.5 % tap
Drop across xfmr ignored for conservatism

	ITE Relay	IAV RELAY Pickup Setting: 98.75 V							
Time	PU - 60	60-14	13	12	11	10	8	6	4
IAV Dial 5	---	0.900	0.890	0.876	0.860	0.843	0.800	0.720	0.545
Relay Voltage	105.48	88.88	87.89	86.51	84.93	83.25	79.00	71.10	53.82
Voltage @LC	421.9	355.5	351.6	346.0	339.7	333.0	316.0	284.4	215.3
Voltage @ Swgr	3748.1	3158.0	3122.9	3073.8	3017.7	2958.0	2807.1	2526.4	1912.4
pu V (4KV Base	0.9370	0.7895	0.7807	0.7685	0.7544	0.7395	0.7018	0.6316	0.4781

Motor:	3P215A	SI Pump	
Horsepower	350	Cable Impedance	0.0524
PF	0.88	P.U. Impedance	0.0010
Efficiency	0.94	Base KVA	315.6
Cable Rest.	0.0393	Motor Base Amps	45.6
Cable React	0.0346		
LRC/FLA	6.40		
Stall Torq%	266	Stall Volts	0.613

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0011	0.0013	0.0013	0.0013	0.0014	0.0014	0.0015	0.0016	0.0022
MTR VOLTS(pu)	0.9359	0.7882	0.7794	0.7671	0.7530	0.7381	0.7003	0.6300	0.4759
AMPS(pu)	1.0685	1.2687	1.2830	1.3036	1.3279	1.3548	1.4279	1.5874	2.1012
RUNNING AMPS	48.7	57.8	58.5	59.4	60.5	61.7	65.1	72.3	95.7
LRC AMPS	----	----	----	----	----	----	----	----	138.5
CURVE POINTS	48.7	57.8	58.5	59.4	60.5	61.7	65.1	72.3	138.5

Motor:	3P9A	ICW Pump	
Horsepower	325	Cable Impedance	0.0586
PF	0.82	P.U. Impedance	0.0012
Efficiency	0.928	Base KVA	318.6
Cable Rest.	0.044	Motor Base Amps	46.0
Cable React	0.0387		
LRC/FLA	5.80		
Stall Torq%	230	Stall Volts	0.659

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0012	0.0015	0.0015	0.0015	0.0015	0.0016	0.0017	0.0019	0.0025
MTR VOLTS(pu)	0.9358	0.7880	0.7792	0.7669	0.7529	0.7379	0.7001	0.6298	0.4756
AMPS(pu)	1.0686	1.2690	1.2833	1.3039	1.3283	1.3552	1.4283	1.5879	2.1024
RUNNING AMPS	49.1	58.4	59.0	60.0	61.1	62.3	65.7	73.0	96.7
LRC AMPS	----	----	----	----	----	----	----	167.3	126.7
CURVE POINTS	49.1	58.4	59.0	60.0	61.1	62.3	65.7	167.3	126.7

Motor:	3P211A	CCW Pump	
Horsepower	450	Cable Impedance	0.0498
PF	0.9	P.U. Impedance	0.0012
Efficiency	0.93	Base KVA	401.1
Cable Rest.	0.0374	Motor Base Amps	57.9
Cable React	0.0329		
LRC/FLA	4.74		
Stall Torq%	200	Stall Volts	0.707

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0013	0.0016	0.0016	0.0016	0.0017	0.0017	0.0018	0.0020	0.0026
MTR VOLTS(pu)	0.9357	0.7879	0.7791	0.7668	0.7528	0.7378	0.7000	0.6296	0.4755
AMPS(pu)	1.0687	1.2692	1.2835	1.3041	1.3284	1.3554	1.4286	1.5883	2.1032
RUNNING AMPS	61.9	73.5	74.3	75.5	76.9	78.5	82.7	91.9	121.8
LRC AMPS	----	----	----	----	----	----	191.4	172.3	130.4
CURVE POINTS	61.9	73.5	74.3	75.5	76.9	78.5	191.4	172.3	130.4

Motor:	3P210A	RHR Pump	
Horsepower	300	Cable Impedance	0.0483
PF	0.89	Cable Imped. pu	0.0008
Efficiency	0.934	Base KVA	269.2
Cable Rest.	0.0363	Motor Base Amps	38.9
Cable React	0.0319		
LRC/FLA	6.22		
Stall Torq%	270	Stall Volts	0.609

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0009	0.0010	0.0010	0.0011	0.0011	0.0011	0.0012	0.0013	0.0017
MTR VOLTS(pu)	0.9361	0.7885	0.7797	0.7674	0.7533	0.7384	0.7006	0.6303	0.4764
AMPS(pu)	1.0682	1.2683	1.2826	1.3031	1.3274	1.3543	1.4273	1.5865	2.0992
RUNNING AMPS	41.5	49.3	49.8	50.6	51.6	52.6	55.5	61.7	81.6
LRC AMPS	----	----	----	----	----	----	----	----	115.0
CURVE POINTS	41.5	49.3	49.8	50.6	51.6	52.6	55.5	61.7	115.0

CALCULATION SHEET

APPENDIX A
JOB 21701-523
CALC 21701-523-E-02
SHT 4 OF 20

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

SWGR 3B 4.16KV
LC Supply: 3B02 IAV controls voltage

Swgr voltage assumed equal to LC voltage
times xfmr turns ratio including 2.5 % tap
Drop across xfmr ignored for conservatism

	ITE Relay	IAV RELAY Pickup Setting: 100.5 V							
Time	PU - 60	60-14	13	12	11	10	8	6	4
Relay Voltage	106.22	90.45	89.45	88.04	86.43	84.72	80.40	72.36	54.77
Voltage @LC	424.9	361.8	357.8	352.2	345.7	338.9	321.6	289.4	219.1
Voltage @ Swgr	3774.4	3214.0	3178.3	3128.3	3071.1	3010.4	2856.9	2571.2	1946.2
pu V (4KV Base	0.9436	0.8035	0.7946	0.7821	0.7678	0.7526	0.7142	0.6428	0.4866

Motor:	3P215B	SI Pump	
Horsepower	350	Cable Impedance	0.0494
PF	0.88	P.U. Impedance	0.0010
Efficiency	0.94	Base KVA	315.6
Cable Rest.	0.0371	Motor Base Amps	45.6
Cable React	0.0326		
LRC/FLA	6.40		
Stall Torq%	266	Stall Volts	0.613

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0010	0.0012	0.0012	0.0012	0.0013	0.0013	0.0014	0.0015	0.0020
MTR VOLTS(pu)	0.9426	0.8023	0.7933	0.7808	0.7665	0.7513	0.7129	0.6413	0.4846
AMPS(pu)	1.0609	1.2464	1.2605	1.2807	1.3046	1.3310	1.4028	1.5594	2.0638
RUNNING AMPS	48.3	56.8	57.4	58.3	59.4	60.6	63.9	71.0	94.0
LRC AMPS	----	----	----	----	----	----	----	----	141.0
CURVE POINTS	48.3	56.8	57.4	58.3	59.4	60.6	63.9	71.0	141.0

Motor:	3P9B	ICW Pump	
Horsepower	325	Cable Impedance	0.0598
PF	0.82	P.U. Impedance	0.0012
Efficiency	0.928	Base KVA	318.6
Cable Rest.	0.0449	Motor Base Amps	46.0
Cable React	0.0395		
LRC/FLA	5.80		
Stall Torq%	230	Stall Volts	0.659

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0013	0.0015	0.0015	0.0015	0.0016	0.0016	0.0017	0.0019	0.0025
MTR VOLTS(pu)	0.9423	0.8020	0.7931	0.7805	0.7662	0.7510	0.7125	0.6409	0.4841
AMPS(pu)	1.0612	1.2469	1.2609	1.2812	1.3051	1.3315	1.4034	1.5602	2.0657
RUNNING AMPS	48.8	57.3	58.0	58.9	60.0	61.2	64.5	71.8	95.0
LRC AMPS	----	----	----	----	----	----	----	170.3	128.9
CURVE POINTS	48.8	57.3	58.0	58.9	60.0	61.2	64.5	170.3	128.9

Motor:	3P211B	CCW Pump	
Horsepower	450	Cable Impedance	0.0494
PF	0.9	P.U. Impedance	0.0012
Efficiency	0.93	Base KVA	401.1
Cable Rest.	0.0371	Motor Base Amps	57.9
Cable React	0.0326		
LRC/FLA	4.74		
Stall Torq%	200	Stall Volts	0.707

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0013	0.0015	0.0016	0.0016	0.0016	0.0016	0.0017	0.0019	0.0026
MTR VOLTS(pu)	0.9423	0.8020	0.7930	0.7805	0.7662	0.7510	0.7125	0.6409	0.4840
AMPS(pu)	1.0613	1.2470	1.2610	1.2813	1.3052	1.3316	1.4035	1.5604	2.0661
RUNNING AMPS	61.4	72.2	73.0	74.2	75.6	77.1	81.3	90.3	119.6
LRC AMPS	----	----	----	----	----	----	----	175.4	132.7
CURVE POINTS	61.4	72.2	73.0	74.2	75.6	77.1	81.3	175.4	132.7

Motor:	3P210B	RHR Pump	
Horsepower	300	Cable Impedance	0.0457
PF	0.89	P.U. Impedance	0.0008
Efficiency	0.934	Base KVA	269.2
Cable Rest.	0.0343	Motor Base Amps	38.9
Cable React	0.0302		
LRC/FLA	6.22		
Stall Torq%	270	Stall Volts	0.609

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0008	0.0010	0.0010	0.0010	0.0010	0.0010	0.0011	0.0012	0.0016
MTR VOLTS(pu)	0.9428	0.8025	0.7936	0.7811	0.7668	0.7516	0.7131	0.6416	0.4850
AMPS(pu)	1.0607	1.2460	1.2601	1.2803	1.3041	1.3305	1.4022	1.5586	2.0620
RUNNING AMPS	41.2	48.4	49.0	49.8	50.7	51.7	54.5	60.6	80.1
LRC AMPS	----	----	----	----	----	----	----	----	117.1
CURVE POINTS	41.2	48.4	49.0	49.8	50.7	51.7	54.5	60.6	117.1

CALCULATION SHEET

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 5 OF 20

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

SWGR 3D 4.16KV Tied to Bus 3A
Degraded Voltage Protection: LC 3B01 via 3A
3A - 3D tie cable=.0072+j.016 ohms= 0.0175

3D Bus Loading

ICW	318.6
CCW	401.1
3D Total	719.7

Motor:	3P9C	ICW Pump	
Horsepower	325	Cable Impedance	0.0397
PF	0.82	P.U. Impedance	0.0008
Efficiency	0.928	Base KVA	318.6
Cable Rest.	0.0298	Motor Base Amps	46.0
Cable React	0.0262		
LRC/FLA	5.80		
Stall Torq%	230	Stall Volts	0.659

Motor:	3P211C	CCW Pump							
Horsepower	450	Cable Impedance	0.0509						
PF	0.9	P.U. Impedance	0.0013						
Efficiency	0.93	Base KVA	401.1						
Cable Rest.	0.0382	Motor Base Amps	57.9						
Cable React	0.0336								
LRC/FLA	4.74								
Stall Torq%	200	Stall Volts	0.707						

	ITE Relay	IAV RELAY Pickup Setting: 98.75 V							
Time	PU - 60	60-14	13	12	11	10	8	6	4
IAV Dial 5	---	0.900	0.890	0.876	0.860	0.843	0.800	0.720	0.545
Relay Voltage	105.48	88.88	87.89	86.51	84.93	83.25	79.00	71.10	53.82
Voltage @LC	421.9	355.5	351.6	346.0	339.7	333.0	316.0	284.4	215.3
Voltage @ 3A	3748.1	3158.0	3122.9	3073.8	3017.7	2958.0	2807.1	2526.4	1912.4
Voltage @ 3D	3742.3	3151.1	3116.0	3066.7	3010.5	2950.7	2799.4	2517.8	1900.9
pu V (4KV Base	0.9356	0.7878	0.7790	0.7667	0.7526	0.7377	0.6998	0.6295	0.4752

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0008	0.0010	0.0010	0.0010	0.0011	0.0011	0.0011	0.0013	0.0017
MTR VOLTS(pu)	0.9347	0.7868	0.7780	0.7657	0.7516	0.7366	0.6987	0.6282	0.4736
AMPS(pu)	1.0698	1.2710	1.2854	1.3061	1.3306	1.3576	1.4312	1.5919	2.1116
RUNNING AMPS	49.2	58.5	59.1	60.1	61.2	62.4	65.8	73.2	97.1
LRC AMPS	----	----	----	----	----	----	----	167.1	126.2
CURVE POINTS	49.2	58.5	59.1	60.1	61.2	62.4	65.8	167.1	126.2

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0014	0.0016	0.0016	0.0017	0.0017	0.0017	0.0018	0.0020	0.0027
MTR VOLTS(pu)	0.9342	0.7862	0.7774	0.7650	0.7509	0.7359	0.6980	0.6274	0.4725
AMPS(pu)	1.0704	1.2720	1.2864	1.3072	1.3317	1.3588	1.4326	1.5938	2.1162
RUNNING AMPS	62.0	73.6	74.5	75.7	77.1	78.7	82.9	92.3	122.5
LRC AMPS	----	----	----	----	----	----	190.9	171.7	129.6
CURVE POINTS	62.0	73.6	74.5	75.7	77.1	78.7	190.9	171.7	129.6

CALCULATION SHEET

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 6 OF 20

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

SWGR 3D 4.16KV Tied to Bus 3B
Degraded Voltage Protection: LC 3802 via 3B
3B-3D tie cable=.0077+j.0172 ohms = 0.0188

3D Bus Loading

ICW	318.6
CCW	401.1
3D Total	719.7

Motor:	3P9C	ICW Pump	
Horsepower	325	Cable Impedance	0.0397
PF	0.82	P.U. Impedance	0.0008
Efficiency	0.928	Base KVA	318.6
Cable Rest.	0.0298	Motor Base Amps	46.0
Cable React	0.0262		
LRC/FLA	5.80		
Stall Torq%	230	Stall Volts	0.659

Motor:	3P211C	CCW Pump	
Horsepower	450	Cable Impedance	0.0509
PF	0.9	P.U. Impedance	0.0013
Efficiency	0.93	Base KVA	401.1
Cable Rest.	0.0382	Motor Base Amps	57.9
Cable React	0.0336		
LRC/FLA	4.74		
Stall Torq%	200	Stall Volts	0.707

	ITE Relay	IAV RELAY Pickup Setting: 100.5 V							
Time	PU - 60	60-14	13	12	11	10	8	6	4
IAV Dial 5	---	0.900	0.890	0.876	0.860	0.843	0.800	0.720	0.545
Relay Voltage	106.22	90.45	89.45	88.04	86.43	84.72	80.40	72.36	54.77
Voltage @LC	424.9	361.8	357.8	352.2	345.7	338.9	321.6	289.4	219.1
Voltage @ 3A	3774.4	3214.0	3178.3	3128.3	3071.1	3010.4	2856.9	2571.2	1946.2
Voltage @ 3D	3768.2	3206.7	3170.9	3120.8	3063.5	3002.7	2848.7	2562.1	1934.2
pu V (4KV Base	0.9420	0.8017	0.7927	0.7802	0.7659	0.7507	0.7122	0.6405	0.4835

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0008	0.0010	0.0010	0.0010	0.0010	0.0011	0.0011	0.0012	0.0016
MTR VOLTS(pu)	0.9412	0.8007	0.7917	0.7792	0.7649	0.7496	0.7111	0.6393	0.4819
AMPS(pu)	1.0625	1.2489	1.2631	1.2834	1.3074	1.3340	1.4063	1.5642	2.0751
RUNNING AMPS	48.9	57.4	58.1	59.0	60.1	61.4	64.7	71.9	95.4
LRC AMPS	----	----	----	----	----	----	----	170.1	128.4
CURVE POINTS	48.9	57.4	58.1	59.0	60.1	61.4	64.7	170.1	128.4

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0014	0.0016	0.0016	0.0016	0.0017	0.0017	0.0018	0.0020	0.0027
MTR VOLTS(pu)	0.9407	0.8001	0.7911	0.7786	0.7642	0.7490	0.7104	0.6385	0.4809
AMPS(pu)	1.0631	1.2499	1.2640	1.2844	1.3085	1.3352	1.4077	1.5661	2.0794
RUNNING AMPS	61.5	72.4	73.2	74.4	75.8	77.3	81.5	90.7	120.4
LRC AMPS	----	----	----	----	----	----	----	174.7	131.9
CURVE POINTS	61.5	72.4	73.2	74.4	75.8	77.3	81.5	174.7	131.9

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 7 OF 20

LC 3B01 3A

Time	PU - 60	60-14	13	12	11	10	8	6	4
IAV TD 5	---	0.900	0.890	0.876	0.860	0.843	0.800	0.720	0.545
Relay Voltage	105.48	88.88	87.89	86.51	84.93	83.25	79.00	71.10	53.82
Voltage @MCC	421.9	355.5	351.6	346.0	339.7	333.0	316.0	284.4	215.3
P.U. Voltage	0.9172	0.7728	0.7642	0.7522	0.7385	0.7239	0.6870	0.6183	0.4680

IAV RELAY Pickup Setting: 98.75 V

Motor:	3P201A	Charging Pump	
Horsepower	150	Cable Impedance	0.0374
PF	0.9	P.U. Impedance	0.0238
Efficiency	0.925	Motor Base KVA	134.41
Cable Rest.	0.0254	Motor Base Amps	168.71
Cable React.	0.0275		
LRC/FLA	5.80		
Stall Torq%	230	Stall Volts	0.659

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0267	0.0321	0.0325	0.0331	0.0337	0.0345	0.0366	0.0412	0.0580
MTR VOLTS(pu)	0.8905	0.7407	0.7317	0.7192	0.7047	0.6894	0.6504	0.5771	0.4100
AMPS(pu)	1.1229	1.3500	1.3666	1.3905	1.4190	1.4506	1.5375	1.7329	2.4391
RUNNING AMPS	189.5	227.8	230.6	234.6	239.4	244.7	259.4	292.4	411.5
LRC AMPS	----	----	----	----	----	----	590.7	531.7	402.4
CURVE POINTS	189.5	227.8	230.6	234.6	239.4	244.7	590.7	531.7	402.4

Motor:	3P214A	Cont. Spray Pump	
Horsepower	250	Cable Impedance	0.0163
PF	0.9	P.U. Impedance	0.0170
Efficiency	0.94	Motor Base KVA	220.45
Cable Rest.	0.0065	Motor Base Amps	276.70
Cable React.	0.015		
LRC/FLA	6.18		
Stall Torq%	200	Stall Volts	0.707

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0190	0.0227	0.0230	0.0234	0.0238	0.0243	0.0258	0.0289	0.0398
MTR VOLTS(pu)	0.8983	0.7501	0.7413	0.7288	0.7146	0.6995	0.6612	0.5894	0.4282
AMPS(pu)	1.1133	1.3331	1.3490	1.3720	1.3993	1.4295	1.5124	1.6967	2.3353
RUNNING AMPS	308.0	368.9	373.3	379.6	387.2	395.5	418.5	469.5	646.2
LRC AMPS	----	----	----	----	----	1119.9	1062.8	956.5	724.0
CURVE POINTS	308.0	368.9	373.3	379.6	387.2	1119.9	1062.8	956.5	724.0

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
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LC 3B02 3B

	ITE Relay PU - 60	IAV RELAY Pickup Setting: 60-14	13	12	11	100.5 V 10	8	6	4
Time									
IAV TD 5	---	0.900	0.890	0.876	0.860	0.843	0.800	0.720	0.545
Relay Voltage	106.22	90.45	89.45	88.04	86.43	84.72	80.40	72.36	54.77
Voltage @MCC	424.9	361.8	357.8	352.2	345.7	338.9	321.6	289.4	219.1
P.U. Voltage	0.9237	0.7865	0.7778	0.7655	0.7516	0.7367	0.6991	0.6292	0.4763

				TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
Motor:	3P201B	Charging Pump											
Horsepower	150	Cable Impedance	0.0479	CABLE DROP(pu)	0.0342	0.0408	0.0413	0.0421	0.0429	0.0439	0.0466	0.0528	0.0760
PF	0.9	P.U. Impedance	0.0304	MTR VOLTS(pu)	0.8894	0.7457	0.7365	0.7235	0.7086	0.6928	0.6525	0.5764	0.4002
Efficiency	0.925	Motor Base KVA	134.41	AMPS(pu)	1.1243	1.3410	1.3578	1.3822	1.4112	1.4435	1.5326	1.7348	2.4985
Cable Rest.	0.0325	Motor Base Amps	168.71	RUNNING AMPS	189.7	226.2	229.1	233.2	238.1	243.5	258.6	292.7	421.5
Cable React.	0.0352			LRC AMPS	----	----	----	----	----	----	581.5	523.3	396.1
LRC/FLA	5.80			CURVE POINTS	189.7	226.2	229.1	233.2	238.1	243.5	581.5	523.3	396.1
Stall Torq%	230	Stall Volts	0.659										

				TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
Motor:	3P214B	Cont. Spray Pump											
Horsepower	250	Cable Impedance	0.0194	CABLE DROP(pu)	0.0223	0.0264	0.0268	0.0272	0.0278	0.0284	0.0300	0.0337	0.0468
PF	0.905	P.U. Impedance	0.0201	MTR VOLTS(pu)	0.9014	0.7601	0.7510	0.7383	0.7238	0.7083	0.6691	0.5955	0.4295
Efficiency	0.94	Motor Base KVA	219.23	AMPS(pu)	1.1094	1.3156	1.3315	1.3544	1.3816	1.4117	1.4945	1.6793	2.3283
Cable Rest.	0.0077	Motor Base Amps	275.17	RUNNING AMPS	305.3	362.0	366.4	372.7	380.2	388.5	411.2	462.1	640.7
Cable React.	0.0178			LRC AMPS	----	----	----	----	----	----	1057.6	951.8	720.5
LRC/FLA	6.18			CURVE POINTS	305.3	362.0	366.4	372.7	380.2	388.5	1057.6	951.8	720.5
Stall Torq%	200	Stall Volts	0.707										

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 9 OF 20

LC 3H (3B50)
LC Supply: 3B03

		EC-145 Ref.
PSB-1 LC Volts:	366	App. 11 Case 9
PSB-1 MCC V	353	App. 11 Case 9
PSB-1 V Drop	13	
Calculated PmZc	4589	

Motor:	3P201C	Charging Pump	
Horsepower	150	Cable Impedance	0.0333
PF	0.9	P.U. Impedance	0.0213
Efficiency	0.92	Motor Base KVA	135.14
Cable Rest.	0.0226	Motor Base Amps	169.63
Cable React.	0.0245		
LRC/FLA	5.80		
Stall Torq%	230	Stall Volts	0.659

	ITE Relay PU - 60	IAV RELAY Pickup Setting: 60-14	13	12	11	98 V 10	8	6	4
Time									
IAV TD 5	---	0.90	0.89	0.88	0.86	0.84	0.80	0.72	0.55
Relay Voltage	108.31	88.20	87.22	85.85	84.28	82.61	78.40	70.56	53.41
Voltage @LC	433.2	352.8	348.9	343.4	337.1	330.5	313.6	282.2	213.6
Voltage @MCC	422.4	339.3	335.2	329.5	322.9	315.9	298.2	264.9	189.4
P.U. Voltage	0.9182	0.7376	0.7287	0.7162	0.7020	0.6868	0.6483	0.5759	0.4118

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0238	0.0301	0.0305	0.0311	0.0318	0.0325	0.0347	0.0397	0.0606
MTR VOLTS(pu)	0.8944	0.7075	0.6982	0.6852	0.6702	0.6543	0.6136	0.5362	0.3511
AMPS(pu)	1.1181	1.4135	1.4323	1.4595	1.4921	1.5284	1.6297	1.8650	2.8479
RUNNING AMPS	189.7	239.8	243.0	247.6	253.1	259.3	276.4	316.3	483.1
LRC AMPS	----	----	----	----	----	601.4	567.7	504.3	360.6
CURVE POINTS	189.7	239.8	243.0	247.6	253.1	601.4	567.7	504.3	360.6

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 10 OF 20

LC 3H (3B50)
LC Supply: 3B04 EC-145 Ref.

PSB-1 LC Volts:	371	App. 9 Case 10
PSB-1 MCC V	358	App. 9 Case 10
PSB-1 V Drop	13	
Calculated PmZc	4654	

Motor:	3P201C	Charging Pump	
Horsepower	150	Cable Impedance	0.0333
PF	0.9	P.U. Impedance	0.0213
Efficiency	0.92	Motor Base KVA	135.14
Cable Rest.	0.0226	Motor Base Amps	169.63
Cable React.	0.0245		
LRC/FLA	5.80		
Stall Torq%	230	Stall Volts	0.659

	ITE Relay PU - 60	IAV RELAY Pickup Setting: 60-14	13	12	11	98 V 10	8	6	4
Time									
IAV TD 5	---	0.900	0.890	0.876	0.860	0.843	0.800	0.720	0.545
Relay Voltage	108.22	88.20	87.22	85.85	84.28	82.61	78.40	70.56	53.41
Voltage @LC	432.9	352.8	348.9	343.4	337.1	330.5	313.6	282.2	213.6
Voltage @MCC	421.8	339.1	335.0	329.3	322.7	315.7	298.0	264.7	189.0
P.U. Voltage	0.9171	0.7371	0.7282	0.7158	0.7015	0.6863	0.6478	0.5753	0.4109

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0238	0.0301	0.0305	0.0311	0.0318	0.0326	0.0347	0.0397	0.0608
MTR VOLTS(pu)	0.8932	0.7070	0.6977	0.6847	0.6697	0.6538	0.6131	0.5356	0.3501
AMPS(pu)	1.1195	1.4144	1.4332	1.4605	1.4931	1.5296	1.6312	1.8671	2.8563
RUNNING AMPS	189.9	239.9	243.1	247.7	253.3	259.5	276.7	316.7	484.5
LRC AMPS	----	----	----	----	----	601.0	567.3	503.8	359.8
CURVE POINTS	189.9	239.9	243.1	247.7	253.3	601.0	567.3	503.8	359.8

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Knight	03/27/92	Robert R. Loraen	3/27/92

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 11 OF 20

MCC 3A (3B05)
LC Supply: 3B01

		EC-145 Ref.
PSB-1 LC Volts:	369.5	App. 11 Case 9
PSB-1 MCC V	369	App. 11 Case 9
PSB-1 V Drop	0.5	
Calculated PmZc	184.5	

Motor:	3P10A	EDG FO XFER	
Horsepower	0.75	Cable Impedance	0.5613
PF	0.85	P.U. Impedance	0.0030
Efficiency	0.59	Motor Base KVA	1.12
Cable Rest.	0.5612	Motor Base Amps	1.40
Cable React.	0.0122		
LRC/FLA	6.00		
Stall Torq%	190	Stall Volts	0.725

Motor:	3V34A	EDG ROOM VENT FAN	
Horsepower	5	Cable Impedance	0.4808
PF	0.85	P.U. Impedance	0.0108
Efficiency	0.92	Motor Base KVA	4.77
Cable Rest.	0.4807	Motor Base Amps	5.99
Cable React.	0.0104		
LRC/FLA	6.00		
Stall Torq%	190	Stall Volts	0.725

	ITE Relay	IAV RELAY Pickup Setting: 98.75 V							
Time	PU - 60	60-14	13	12	11	10	8	6	4
IAV TD 5	---	0.900	0.890	0.876	0.860	0.843	0.800	0.720	0.545
Relay Voltage	105.48	88.88	87.89	86.51	84.93	83.25	79.00	71.10	53.82
Voltage @LC	421.9	355.5	351.6	346.0	339.7	333.0	316.0	284.4	215.3
Voltage @MCC	421.5	355.0	351.0	345.5	339.2	332.4	315.4	283.7	214.4
P.U. Voltage	0.9163	0.7717	0.7631	0.7511	0.7373	0.7227	0.6857	0.6168	0.4661

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0032	0.0039	0.0039	0.0040	0.0040	0.0041	0.0043	0.0048	0.0064
MTR VOLTS(pu)	0.9130	0.7678	0.7592	0.7471	0.7333	0.7186	0.6813	0.6120	0.4597
AMPS(pu)	1.0953	1.3024	1.3172	1.3385	1.3638	1.3917	1.4677	1.6340	2.1754
RUNNING AMPS	1.5	1.8	1.8	1.9	1.9	1.9	2.1	2.3	3.0
LRC AMPS	----	----	----	----	----	6.0	5.7	5.1	3.8
CURVE POINTS	1.5	1.8	1.8	1.9	1.9	6.0	5.7	5.1	3.8

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0120	0.0143	0.0145	0.0147	0.0150	0.0153	0.0162	0.0181	0.0245
MTR VOLTS(pu)	0.9043	0.7574	0.7486	0.7363	0.7223	0.7074	0.6695	0.5987	0.4416
AMPS(pu)	1.1059	1.3203	1.3358	1.3581	1.3845	1.4137	1.4937	1.6702	2.2646
RUNNING AMPS	6.6	7.9	8.0	8.1	8.3	8.5	8.9	10.0	13.6
LRC AMPS	----	----	----	----	24.9	24.4	23.1	20.8	15.7
CURVE POINTS	6.6	7.9	8.0	8.1	24.9	24.4	23.1	20.8	15.7

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC 21701-523-E-02
SHT 12 OF 20

MCC 3B (3B06)
LC Supply: 3B02 EC-145 Ref.

PSB-1 LC Volts:	385	App. 5 Case 10	
PSB-1 MCC V	379	App. 5 Case 10	
PSB-1 V Drop	6		
Calculated PmZc	2274		

Motor:	3V30A	EMERG CONT CLR FAN	
Horsepower	30	Cable Impedance	0.1956
PF	0.808	P.U. Impedance	0.0283
Efficiency	0.904	Motor Base KVA	30.64
Cable Rest.	0.1939	Motor Base Amps	38.46
Cable React.	0.0256		
LRC/FLA	6.18		
Stall Torq%	263	Stall Volts	0.617

Motor:	3V3A	EMERG CONT FILT FAN	
Horsepower	75	Cable Impedance	0.0387
PF	0.862	P.U. Impedance	0.0128
Efficiency	0.929	Motor Base KVA	69.87
Cable Rest.	0.032	Motor Base Amps	87.69
Cable React.	0.0218		
LRC/FLA	6.30		
Stall Torq%	247	Stall Volts	0.636

Motor:	E16A/E17A	CONT ROOM A/C AHU	
Horsepower	34	Cable Impedance	0.1316
PF	0.85	P.U. Impedance	0.0202
Efficiency	0.92	Motor Base KVA	32.43
Cable Rest.	0.1308	Motor Base Amps	40.71
Cable React.	0.0143	Base Amps & LRC are total	
LRC/FLA	4.53	for 4 Motors. (Ref. 4.11)	
Stall Torq%	190	Stall Volts	0.725

Motor:	3V36	AIR,PART.&GAS MONITOR	
Horsepower	2	Cable Impedance	0.9103
PF	0.88	P.U. Impedance	0.0092
Efficiency	0.79	Motor Base KVA	2.15
Cable Rest.	0.9101	Motor Base Amps	2.70
Cable React.	0.0198	NOTE: Cable not in EC-145	
LRC/FLA	6.00	407' #12 per C&R schedule	
Stall Torq%	190	Stall Volts	0.725

Note: FLA based on PC/M 89-587 which replaced the motor. (See Attachment 3)

	ITE Relay	IAV RELAY Pickup Setting: 100.5 V							
Time	PU - 60	60-14	13	12	11	10	8	6	4
IAV TD 5	---	0.900	0.890	0.876	0.860	0.843	0.800	0.720	0.545
Relay Voltage	106.22	90.45	89.45	88.04	86.43	84.72	80.40	72.36	54.77
Voltage @LC	424.9	361.8	357.8	352.2	345.7	338.9	321.6	289.4	219.1
Voltage @MCC	419.5	355.4	351.3	345.6	339.0	332.0	314.4	281.4	208.2
P.U. Voltage	0.9119	0.7726	0.7637	0.7512	0.7370	0.7218	0.6834	0.6116	0.4525

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0322	0.0386	0.0391	0.0398	0.0407	0.0416	0.0443	0.0505	0.0750
MTR VOLTS(pu)	0.8797	0.7340	0.7246	0.7114	0.6963	0.6802	0.6391	0.5612	0.3775
AMPS(pu)	1.1368	1.3623	1.3800	1.4056	1.4361	1.4702	1.5647	1.7820	2.6489
RUNNING AMPS	43.7	52.4	53.1	54.1	55.2	56.5	60.2	68.5	101.9
LRC AMPS	----	----	----	----	----	----	----	123.7	91.5
CURVE POINTS	43.7	52.4	53.1	54.1	55.2	56.5	60.2	123.7	91.5

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0142	0.0169	0.0171	0.0174	0.0178	0.0182	0.0192	0.0217	0.0303
MTR VOLTS(pu)	0.8976	0.7557	0.7466	0.7338	0.7192	0.7037	0.6642	0.5900	0.4223
AMPS(pu)	1.1141	1.3233	1.3394	1.3627	1.3904	1.4212	1.5057	1.6950	2.3682
RUNNING AMPS	97.7	116.0	117.5	119.5	121.9	124.6	132.0	148.6	207.7
LRC AMPS	----	----	----	----	----	----	----	312.7	231.4
CURVE POINTS	97.7	116.0	117.5	119.5	121.9	124.6	132.0	312.7	231.4

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0227	0.0271	0.0274	0.0279	0.0285	0.0291	0.0309	0.0350	0.0501
MTR VOLTS(pu)	0.8892	0.7456	0.7363	0.7234	0.7085	0.6927	0.6525	0.5767	0.4024
AMPS(pu)	1.1246	1.3413	1.3581	1.3824	1.4114	1.4436	1.5326	1.7341	2.4850
RUNNING AMPS	45.8	54.6	55.3	56.3	57.5	58.8	62.4	70.6	101.2
LRC AMPS	----	----	----	126.9	124.5	122.0	115.5	103.4	76.5
CURVE POINTS	45.8	54.6	55.3	126.9	124.5	122.0	115.5	103.4	76.5

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0102	0.0121	0.0123	0.0125	0.0127	0.0130	0.0138	0.0155	0.0214
MTR VOLTS(pu)	0.9016	0.7605	0.7514	0.7387	0.7242	0.7088	0.6696	0.5962	0.4311
AMPS(pu)	1.1091	1.3150	1.3308	1.3536	1.3808	1.4108	1.4934	1.6774	2.3195
RUNNING AMPS	3.0	3.6	3.6	3.7	3.7	3.8	4.0	4.5	6.3
LRC AMPS	----	----	----	----	11.3	11.1	10.5	9.4	6.9
CURVE POINTS	3.0	3.6	3.6	3.7	11.3	11.1	10.5	9.4	6.9

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC 21701-523-E-02
SHT 13 OF 320
PJS 3/27/92

MCC 3C (3B07)
LC Supply: 3B03 EC-145 Ref.

PSB-1 LC Volts:	366	App. 11 Case 9
PSB-1 MCC V	355	App. 11 Case 9
PSB-1 V Drop	11	
Calculated PmZc	3905	

	ITE Relay PU - 60	60-14	IAV RELAY Pickup Setting: 13	12	11	98 V 10	8	6	4
Time	---	0.900	0.890	0.876	0.860	0.843	0.800	0.720	0.545
IAV TD 5	108.22	88.20	87.22	85.85	84.28	82.61	78.40	70.56	53.41
Relay Voltage	432.9	352.8	348.9	343.4	337.1	330.5	313.6	282.2	213.6
Voltage @LC	423.7	341.4	337.3	331.6	325.1	318.2	300.6	267.7	193.5
Voltage @MCC	0.9210	0.7421	0.7333	0.7209	0.7068	0.6917	0.6535	0.5818	0.4206
P.U. Voltage									

Motor:	3V30C	EMERG CONT COOLER FAN	
Horsepower	30	Cable Impedance	0.2636
PF	0.808	P.U. Impedance	0.0382
Efficiency	0.904	Motor Base KVA	30.64
Cable Rest.	0.2617	Motor Base Amps	38.46
Cable React.	0.0312		
LRC/FLA	6.18		
Stall Torq%	263	Stall Volts	0.617

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0435	0.0556	0.0564	0.0575	0.0589	0.0605	0.0648	0.0753	0.1325
MTR VOLTS(pu)	0.8775	0.6865	0.6769	0.6634	0.6479	0.6312	0.5887	0.5065	0.2881
AMPS(pu)	1.1396	1.4567	1.4773	1.5074	1.5436	1.5842	1.6987	1.9743	3.4712
RUNNING AMPS	43.8	56.0	56.8	58.0	59.4	60.9	65.3	75.9	133.5
LRC AMPS	----	----	----	----	----	----	125.7	111.9	80.9
CURVE POINTS	43.8	56.0	56.8	58.0	59.4	60.9	125.7	111.9	80.9

Motor:	3V3C	EMERG CONT. FILTER FAN	
Horsepower	75	Cable Impedance	0.0433
PF	0.862	P.U. Impedance	0.0143
Efficiency	0.929	Motor Base KVA	69.87
Cable Rest.	0.0358	Motor Base Amps	87.69
Cable React.	0.0243		
LRC/FLA	6.30		
Stall Torq%	247	Stall Volts	0.636

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0158	0.0198	0.0200	0.0204	0.0208	0.0213	0.0226	0.0257	0.0373
MTR VOLTS(pu)	0.9052	0.7223	0.7132	0.7005	0.6859	0.6704	0.6309	0.5562	0.3833
AMPS(pu)	1.1047	1.3844	1.4021	1.4275	1.4579	1.4917	1.5852	1.7980	2.6091
RUNNING AMPS	96.9	121.4	123.0	125.2	127.8	130.8	139.0	157.7	228.8
LRC AMPS	----	----	----	----	----	----	331.2	294.9	213.2
CURVE POINTS	96.9	121.4	123.0	125.2	127.8	130.8	331.2	294.9	213.2

Motor:	3V65A	SWGR 3D ROOM SUPPLY FAN	
Horsepower	2	Cable Impedance	0.8554
PF	0.808	P.U. Impedance	0.0086
Efficiency	0.865	Motor Base KVA	2.13
Cable Rest.	0.855	Motor Base Amps	2.68
Cable React.	0.0272		
LRC/FLA	7.63		
Stall Torq%	358	Stall Volts	0.529

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0095	0.0118	0.0120	0.0122	0.0124	0.0127	0.0135	0.0152	0.0216
MTR VOLTS(pu)	0.9115	0.7303	0.7213	0.7087	0.6943	0.6790	0.6400	0.5666	0.3989
AMPS(pu)	1.0970	1.3694	1.3864	1.4110	1.4402	1.4728	1.5625	1.7649	2.5068
RUNNING AMPS	2.9	3.7	3.7	3.8	3.9	3.9	4.2	4.7	6.7
LRC AMPS	----	----	----	----	----	----	----	----	8.1
CURVE POINTS	2.9	3.7	3.7	3.8	3.9	3.9	4.2	4.7	8.1

CALCULATION SHEET

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 14 OF 20

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

MCC 3D (3B08)
LC Supply: 3B03

		EC-145 Ref.
PSB-1 LC Volts:	366	App. 11
PSB-1 MCC V	348	Case 9
PSB-1 V Drop	18	
Calculated PmZc	6264	

Motor:	3V3B	EMERG CONT FILTER FAN	
Horsepower	75	Cable Impedance	0.0458
PF	0.862	P.U. Impedance	0.0151
Efficiency	0.929	Motor Base KVA	69.87
Cable Rest.	0.0379	Motor Base Amps	87.69
Cable React.	0.0258		
LRC/FLA	6.30		
Stall Torq%	247	Stall Volts	0.636

Motor:	3V30B	EMERG CONT COOLER FAN	
Horsepower	30	Cable Impedance	0.2507
PF	0.808	P.U. Impedance	0.0363
Efficiency	0.904	Motor Base KVA	30.64
Cable Rest.	0.249	Motor Base Amps	38.46
Cable React.	0.0294		
LRC/FLA	6.18		
Stall Torq%	263	Stall Volts	0.617

Motor:	S74B	COMPUTER ROOM CHILLER UNIT	
Horsepower	65	Cable Impedance	0.0759
PF	-	P.U. Impedance	0.0236
Efficiency	-	Motor Base KVA	65.65
Cable Rest.	0.0691	Total Load Amps	82.40
Cable React.	0.0315	Compressor Amps	62
LRC/FLA	5.48/6.44	Fan/Pump A ea.	6.8
Stall Torq%	230/274	Stall Volts	.659/.604

Note:S74B consists of 2 fans,1 pump & 1 comp. mtr
Total Load Amps equals sum of all loads
Motor FLA Ref. 5177-206-M724-27-4, also
LRC and Stall Torq% data available via
Ref. 5177-206-M724-43-1. Worst case Stall Torq%
and LRC used for the Pump/Fan combination.

	ITE Relay	IAV RELAY Pickup Setting:				98 V			
Time	PU - 60	60-14	13	12	11	10	8	6	4
IAV TD 5	---	0.90	0.89	0.88	0.86	0.84	0.80	0.72	0.55
Relay Voltage	108.31	88.20	87.22	85.85	84.28	82.61	78.40	70.56	53.41
Voltage @LC	433.2	352.8	348.9	343.4	337.1	330.5	313.6	282.2	213.6
Voltage @MCC	418.2	334.0	329.9	324.1	317.4	310.3	292.2	258.0	178.6
P.U. Voltage	0.9092	0.7262	0.7172	0.7045	0.6900	0.6745	0.6351	0.5608	0.3882

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0170	0.0215	0.0218	0.0222	0.0227	0.0232	0.0248	0.0284	0.0440
MTR VOLTS(pu)	0.8922	0.7047	0.6954	0.6823	0.6673	0.6512	0.6103	0.5323	0.3442
AMPS(pu)	1.1208	1.4190	1.4380	1.4656	1.4986	1.5355	1.6385	1.8785	2.9054
RUNNING AMPS	98.3	124.4	126.1	128.5	131.4	134.7	143.7	164.7	254.8
LRC AMPS	----	----	----	----	----	----	320.3	282.8	195.8
CURVE POINTS	98.3	124.4	126.1	128.5	131.4	134.7	320.3	282.8	195.8

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0419	0.0540	0.0548	0.0560	0.0574	0.0590	0.0635	0.0747	0.1572
MTR VOLTS(pu)	0.8673	0.6722	0.6623	0.6485	0.6326	0.6155	0.5716	0.4861	0.2310
AMPS(pu)	1.1530	1.4877	1.5098	1.5420	1.5808	1.6247	1.7494	2.0572	4.3286
RUNNING AMPS	44.3	57.2	58.1	59.3	60.8	62.5	67.3	79.1	166.5
LRC AMPS	----	----	----	----	----	130.9	123.3	108.9	75.3
CURVE POINTS	44.3	57.2	58.1	59.3	60.8	130.9	123.3	108.9	75.3

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0267	0.0340	0.0345	0.0352	0.0360	0.0370	0.0396	0.0457	0.0753
MTR VOLTS(pu)	0.8825	0.6922	0.6826	0.6693	0.6539	0.6375	0.5956	0.5150	0.3129
AMPS(pu)	1.1332	1.4448	1.4649	1.4941	1.5292	1.5685	1.6791	1.9416	3.1963
RUN AMPS COMP.	70.3	89.6	90.8	92.6	94.8	97.2	104.1	120.4	198.2
LRC AMPS COMP.	----	----	----	----	207.6	203.0	191.1	168.7	116.8
COMP. CURVE PT	70.3	89.6	90.8	92.6	207.6	203.0	191.1	168.7	116.8
RUN AMPS P/FAN	7.7	9.8	10.0	10.2	10.4	10.7	11.4	13.2	21.7
LRC AMPS P/FAN	----	----	----	----	----	----	24.1	21.3	14.8
PUMP/FAN PTS	7.7	9.8	10.0	10.2	10.4	10.7	24.1	21.3	14.8

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC 21701-523-E-02
SHT 15 OF 20

Motor:	S75B	COMPUTER ROOM CHILLER			TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
Horsepower	5	Cable Impedance	0.6391		CABLE DROP(pu)	0.0184	0.0233	0.0236	0.0240	0.0246	0.0252	0.0269	0.0309	0.0481
PF	0.84	P.U. Impedance	0.0164		MTR VOLTS(pu)	0.8908	0.7029	0.6936	0.6804	0.6654	0.6493	0.6082	0.5299	0.3401
Efficiency	0.82	Motor Base KVA	5.42		AMPS(pu)	1.1226	1.4226	1.4418	1.4696	1.5029	1.5401	1.6441	1.8871	2.9405
Cable Rest.	0.6388	Motor Base Amps	6.80		RUNNING AMPS	7.6	9.7	9.8	10.0	10.2	10.5	11.2	12.8	20.0
Cable React.	0.0203				LRC AMPS	----	----	----	----	----	----	----	21.0	14.5
LRC/FLA	6.04				CURVE POINTS	7.6	9.7	9.8	10.0	10.2	10.5	11.2	21.0	14.5
Stall Torq%	274	Stall Volts	0.604											
Motor:	S77B	COMPUTER ROOM AC-AHU			TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
Horsepower	5	Cable Impedance	0.8077		CABLE DROP(pu)	0.0233	0.0297	0.0301	0.0307	0.0314	0.0322	0.0344	0.0397	0.0637
PF	0.84	P.U. Impedance	0.0207		MTR VOLTS(pu)	0.8858	0.6965	0.6871	0.6738	0.6586	0.6423	0.6007	0.5211	0.3245
Efficiency	0.82	Motor Base KVA	5.42		AMPS(pu)	1.1289	1.4357	1.4555	1.4841	1.5184	1.5569	1.6647	1.9190	3.0820
Cable Rest.	0.8073	Motor Base Amps	6.80		RUNNING AMPS	7.7	9.8	9.9	10.1	10.3	10.6	11.3	13.0	20.9
Cable React.	0.0257				LRC AMPS	----	----	----	----	----	----	23.2	20.5	14.2
LRC/FLA	6.04				CURVE POINTS	7.7	9.8	9.9	10.1	10.3	10.6	23.2	20.5	14.2
Stall Torq%	274	Stall Volts	0.604											
Motor:	S78B	COMPUTER ROOM AC-AHU			TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
Horsepower	5	Cable Impedance	0.7164		CABLE DROP(pu)	0.0206	0.0262	0.0265	0.0271	0.0277	0.0284	0.0303	0.0349	0.0550
PF	0.84	P.U. Impedance	0.0183		MTR VOLTS(pu)	0.8885	0.7000	0.6906	0.6774	0.6623	0.6461	0.6048	0.5259	0.3331
Efficiency	0.82	Motor Base KVA	5.42		AMPS(pu)	1.1254	1.4286	1.4480	1.4762	1.5099	1.5477	1.6534	1.9014	3.0017
Cable Rest.	0.716	Motor Base Amps	6.80		RUNNING AMPS	7.6	9.7	9.8	10.0	10.3	10.5	11.2	12.9	20.4
Cable React.	0.0228				LRC AMPS	----	----	----	----	----	----	----	20.7	14.3
LRC/FLA	6.04				CURVE POINTS	7.6	9.7	9.8	10.0	10.3	10.5	11.2	20.7	14.3
Stall Torq%	274	Stall Volts	0.604											
Motor:	V29B	CONT.ROOM EMERG FILTER FAN			TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
Horsepower	5	Cable Impedance	0.5338		CABLE DROP(pu)	0.0153	0.0193	0.0196	0.0200	0.0204	0.0209	0.0223	0.0255	0.0392
PF	0.85	P.U. Impedance	0.0137		MTR VOLTS(pu)	0.8939	0.7069	0.6976	0.6845	0.6696	0.6536	0.6128	0.5352	0.3490
Efficiency	0.81	Motor Base KVA	5.42		AMPS(pu)	1.1187	1.4147	1.4336	1.4609	1.4935	1.5300	1.6318	1.8683	2.8652
Cable Rest.	0.5335	Motor Base Amps	6.80		RUNNING AMPS	7.6	9.6	9.7	9.9	10.2	10.4	11.1	12.7	19.5
Cable React.	0.017				LRC AMPS	----	----	----	----	----	----	----	22.6	15.6
LRC/FLA	6.44				CURVE POINTS	7.6	9.6	9.7	9.9	10.2	10.4	11.1	22.6	15.6
Stall Torq%	307	Stall Volts	0.571											

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Sink	03/27/92	Robert K. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 16 OF 20

Motor:	E16C/E17C CONT ROOM AC-AHU		
Horsepower	34	Cable Impedance	0.1539
PF	-	P.U. Impedance	0.0222
Efficiency	-	Load Base KVA	30.48
Cable Rest.	0.153	Load Base Amps	38.30
Cable React.	0.0167	Base amps & LRC are total	
LRC/FLA	4.53	for 4 Motors. (Ref. 4.11)	
Stall Torq%	190	Stall Volts	0.725

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0251	0.0319	0.0324	0.0330	0.0338	0.0346	0.0371	0.0428	0.0696
MTR VOLTS(pu)	0.8841	0.6943	0.6848	0.6715	0.6562	0.6398	0.5981	0.5180	0.3186
AMPS(pu)	1.1311	1.4404	1.4603	1.4893	1.5240	1.5629	1.6721	1.9306	3.1389
RUNNING AMPS	43.3	55.2	55.9	57.0	58.4	59.9	64.0	73.9	120.2
LRC AMPS	----	114.5	113.1	111.1	108.8	106.3	100.1	88.4	61.2
CURVE POINTS	43.3	114.5	113.1	111.1	108.8	106.3	100.1	88.4	61.2

Motor:	V77/E231 ELECT EQPT ROOM AHU		
Horsepower	36	Cable Impedance	0.0786
PF	-	P.U. Impedance	0.0098
Efficiency	-	Load Base KVA	26.45
Cable Rest.	0.0773	Load Base Amps	33.20
Cable React.	0.0142	Comp Amps	17.3
LRC/FLA	-	AHU Amps	9.3
		Condenser Fan	6.3
Stall Torq%	-	Stall Volts	-

Note: Motor Data for the AHU and Condenser Fan can be referenced in Attachment 13
Curve Pts calculated seperately for each

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0109	0.0138	0.0140	0.0142	0.0145	0.0149	0.0159	0.0181	0.0272
MTR VOLTS(pu)	0.8982	0.7124	0.7032	0.6903	0.6754	0.6596	0.6193	0.5427	0.3610
AMPS(pu)	1.1133	1.4037	1.4221	1.4488	1.4806	1.5161	1.6148	1.8427	2.7704
COMP RUN AMPS	19.1	24.1	24.4	24.8	25.3	25.9	27.6	31.4	46.2
COMP LRC AMPS	----	----	----	70.9	69.5	67.9	64.0	56.5	39.1
COMP CURVE PTs	19.1	24.1	24.4	70.9	69.5	67.9	64.0	56.5	39.1
AHU RUN AMPS	10.4	13.1	13.2	13.5	13.8	14.1	15.0	17.1	25.7
AHU LRC AMPS	----	----	----	----	----	----	37.8	33.4	23.1
AHU CURVE PTs	10.4	13.1	13.2	13.5	13.8	14.1	37.8	33.4	23.1
COND FAN RUN A	7.0	8.8	9.0	9.1	9.3	9.5	10.2	11.6	17.4
COND FAN LRC A	----	----	----	----	----	----	----	24.1	16.7
COND FAN CURVE	7.0	8.8	9.0	9.1	9.3	9.5	10.2	24.1	16.7

The 200% stall torque asssumed for the compressor is based on Attachment 15. The FLA of 17.3 will give a torque value of 43 ft-lbs, compared with a max. torque value of 114 ft-lbs giving us a breakdown torque % of 265. Therefore, our 200% assumption is extremely conservative.

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 17 OF 20

MCC 3D (3B08)
LC Supply: 3B04

		EC-145 Ref.
PSB-1 LC Volts:	371	App. 9 Case 10
PSB-1 MCC V	354	App. 9 Case 10
PSB-1 V Drop	17	
Calculated PmZc	6018	

Motor:	3V3B	EMERG CONT FILTER FAN	
Horsepower	75	Cable Impedance	0.0458
PF	0.862	P.U. Impedance	0.0151
Efficiency	0.929	Motor Base KVA	69.87
Cable Rest.	0.0379	Motor Base Amps	87.69
Cable React.	0.0258		
LRC/FLA	6.30		
Stall Torq%	247	Stall Volts	0.636

Motor:	3V30B	EMERG CONT COOLER FAN	
Horsepower	30	Cable Impedance	0.2507
PF	0.808	P.U. Impedance	0.0363
Efficiency	0.904	Motor Base KVA	30.64
Cable Rest.	0.249	Motor Base Amps	38.46
Cable React.	0.0294		
LRC/FLA	6.18		
Stall Torq%	263	Stall Volts	0.617

Motor:	S74B	COMPUTER ROOM CHILLER UNIT	
Horsepower	65	Cable Impedance	0.0759
PF	-	P.U. Impedance	0.0236
Efficiency	-	Motor Base KVA	65.65
Cable Rest.	0.0691	Motor Base Amps	82.40
Cable React.	0.0315	Compressor Amps	62
LRC/FLA	5.48/6.44	Fan Amps	6.8
Stall Torq%	230/274	Stall Volts	.659/.604

Note:S74B consists of 2 fans,1 pump & 1 comp mtr
Total Load Amps Equals Sum of all loads
Motor FLA Ref. 5177-206-M724-27-4, also
LRC and Stall Torq% data available via
Ref. 5177-206-M724-43-1. Worst case Stall Torq%
and LRC used for the Pump/Fan combination.

	ITE Relay	IAV RELAY Pickup Setting:				98 V			
Time	PU - 60	60-14	13	12	11	10	8	6	4
IAV TD 5	---	0.90	0.89	0.88	0.86	0.84	0.80	0.72	0.55
Relay Voltage	108.22	88.20	87.22	85.85	84.28	82.61	78.40	70.56	53.41
Voltage @LC	432.8	352.8	348.9	343.4	337.1	330.5	313.6	282.2	213.6
Voltage @MCC	418.4	334.8	330.7	324.9	318.2	311.1	293.1	259.0	180.3
P.U. Voltage	0.9096	0.7279	0.7189	0.7062	0.6918	0.6763	0.6371	0.5631	0.3919

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0170	0.0214	0.0217	0.0221	0.0226	0.0232	0.0247	0.0283	0.0435
MTR VOLTS(pu)	0.8926	0.7065	0.6972	0.6841	0.6691	0.6532	0.6124	0.5347	0.3484
AMPS(pu)	1.1203	1.4155	1.4344	1.4618	1.4945	1.5310	1.6330	1.8701	2.8702
RUNNING AMPS	98.2	124.1	125.8	128.2	131.1	134.3	143.2	164.0	251.7
LRC AMPS	----	----	----	----	----	----	321.3	284.0	197.6
CURVE POINTS	98.2	124.1	125.8	128.2	131.1	134.3	321.3	284.0	197.6

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0418	0.0539	0.0547	0.0558	0.0572	0.0588	0.0633	0.0743	0.1503
MTR VOLTS(pu)	0.8678	0.6740	0.6642	0.6504	0.6345	0.6175	0.5738	0.4888	0.2416
AMPS(pu)	1.1524	1.4836	1.5055	1.5375	1.5759	1.6193	1.7427	2.0459	4.1397
RUNNING AMPS	44.3	57.1	57.9	59.1	60.6	62.3	67.0	78.7	159.2
LRC AMPS	----	----	----	----	----	----	123.7	109.3	76.1
CURVE POINTS	44.3	57.1	57.9	59.1	60.6	62.3	123.7	109.3	76.1

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0267	0.0340	0.0344	0.0351	0.0359	0.0368	0.0394	0.0455	0.0742
MTR VOLTS(pu)	0.8829	0.6939	0.6844	0.6711	0.6558	0.6395	0.5977	0.5175	0.3177
AMPS(pu)	1.1326	1.4411	1.4610	1.4900	1.5248	1.5638	1.6731	1.9323	3.1477
RUN AMPS COMP.	70.2	89.3	90.6	92.4	94.5	97.0	103.7	119.8	195.2
LRC AMPS COMP.	----	----	----	----	208.2	203.5	191.7	169.4	117.9
COMP. CURVE PT	70.2	89.3	90.6	92.4	208.2	203.5	191.7	169.4	117.9
RUN AMPS P/FAN	7.7	9.8	9.9	10.1	10.4	10.6	11.4	13.1	21.4
LRC AMPS P/FAN	----	----	----	----	----	----	24.2	21.4	14.9
PUMP/FAN PTS	7.7	9.8	9.9	10.1	10.4	10.6	24.2	21.4	14.9

CALCULATION SHEET

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 18 OF 20

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Snipe	03/27/92	Robert R. Larsen	3/27/92

Motor:	S75B	COMPUTER ROOM CHILLER		TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
Horsepower	5	Cable Impedance	0.6391	CABLE DROP(pu)	0.0184	0.0232	0.0235	0.0240	0.0245	0.0251	0.0268	0.0307	0.0475
PF	0.84	P.U. Impedance	0.0164	MTR VOLTS(pu)	0.8913	0.7047	0.6953	0.6823	0.6672	0.6512	0.6103	0.5323	0.3444
Efficiency	0.82	Motor Base KVA	5.42	AMPS(pu)	1.1220	1.4191	1.4381	1.4657	1.4987	1.5356	1.6385	1.8785	2.9040
Cable Rest.	0.6388	Motor Base Amps	6.80	RUNNING AMPS	7.6	9.6	9.8	10.0	10.2	10.4	11.1	12.8	19.7
Cable React.	0.0203			LRC AMPS	----	----	----	----	----	----	----	21.0	14.6
LRC/FLA	6.04			CURVE POINTS	7.6	9.6	9.8	10.0	10.2	10.4	11.1	21.0	14.6
Stall Torq%	274	Stall Volts	0.604										

Motor:	S77B	COMPUTER ROOM AC-AHU		TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
Horsepower	5	Cable Impedance	0.8077	CABLE DROP(pu)	0.0233	0.0296	0.0300	0.0306	0.0313	0.0321	0.0343	0.0395	0.0628
PF	0.84	P.U. Impedance	0.0207	MTR VOLTS(pu)	0.8863	0.6983	0.6889	0.6756	0.6605	0.6442	0.6028	0.5236	0.3290
Efficiency	0.82	Motor Base KVA	5.42	AMPS(pu)	1.1283	1.4321	1.4517	1.4801	1.5141	1.5522	1.6589	1.9099	3.0392
Cable Rest.	0.8073	Motor Base Amps	6.80	RUNNING AMPS	7.7	9.7	9.9	10.1	10.3	10.6	11.3	13.0	20.7
Cable React.	0.0257			LRC AMPS	----	----	----	----	----	----	23.3	20.5	14.3
LRC/FLA	6.04			CURVE POINTS	7.7	9.7	9.9	10.1	10.3	10.6	23.3	20.5	14.3
Stall Torq%	274	Stall Volts	0.604										

Motor:	S78B	COMPUTER ROOM AC-AHU		TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
Horsepower	5	Cable Impedance	0.7164	CABLE DROP(pu)	0.0206	0.0261	0.0265	0.0270	0.0276	0.0283	0.0302	0.0347	0.0543
PF	0.84	P.U. Impedance	0.0183	MTR VOLTS(pu)	0.8890	0.7018	0.6924	0.6792	0.6642	0.6480	0.6069	0.5284	0.3375
Efficiency	0.82	Motor Base KVA	5.42	AMPS(pu)	1.1249	1.4250	1.4443	1.4722	1.5057	1.5431	1.6477	1.8927	2.9626
Cable Rest.	0.716	Motor Base Amps	6.80	RUNNING AMPS	7.6	9.7	9.8	10.0	10.2	10.5	11.2	12.9	20.1
Cable React.	0.0228			LRC AMPS	----	----	----	----	----	----	----	20.8	14.5
LRC/FLA	6.04			CURVE POINTS	7.6	9.7	9.8	10.0	10.2	10.5	11.2	20.8	14.5
Stall Torq%	274	Stall Volts	0.604										

Motor:	V29B	CONT.ROOM EMERG FILTER FAN		TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
Horsepower	5	Cable Impedance	0.5338	CABLE DROP(pu)	0.0153	0.0193	0.0195	0.0199	0.0204	0.0208	0.0222	0.0254	0.0387
PF	0.85	P.U. Impedance	0.0137	MTR VOLTS(pu)	0.8943	0.7086	0.6993	0.6863	0.6714	0.6555	0.6149	0.5376	0.3532
Efficiency	0.81	Motor Base KVA	5.42	AMPS(pu)	1.1182	1.4112	1.4299	1.4570	1.4894	1.5256	1.6264	1.8600	2.8316
Cable Rest.	0.5335	Motor Base Amps	6.80	RUNNING AMPS	7.6	9.6	9.7	9.9	10.1	10.4	11.1	12.6	19.3
Cable React.	0.017			LRC AMPS	----	----	----	----	----	----	----	22.7	15.8
LRC/FLA	6.44			CURVE POINTS	7.6	9.6	9.7	9.9	10.1	10.4	11.1	22.7	15.8
Stall Torq%	307	Stall Volts	0.571										

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert R. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC 21701-523-E-02
SHT 19 OF 20

Motor:	E16C/E17C	CONT ROOM AC-AHU	
Horsepower	34	Cable Impedance	0.1539
PF	-	P.U. Impedance	0.0222
Efficiency	-	Load Base KVA	30.48
Cable Rest.	0.153	Load Base Amps	38.30
Cable React.	0.0167	Base amps & LRC are total	
LRC/FLA	4.53	for 4 motors. (Ref. 4.11)	
Stall Torq%	190	Stall Volts	0.725

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0251	0.0319	0.0323	0.0329	0.0337	0.0345	0.0369	0.0426	0.0686
MTR VOLTS(pu)	0.8845	0.6960	0.6866	0.6733	0.6581	0.6418	0.6002	0.5205	0.3233
AMPS(pu)	1.1305	1.4367	1.4565	1.4852	1.5196	1.5581	1.6662	1.9214	3.0933
RUNNING AMPS	43.3	55.0	55.8	56.9	58.2	59.7	63.8	73.6	118.5
LRC AMPS	----	114.8	113.3	111.3	109.1	106.6	100.4	88.8	61.8
CURVE POINTS	43.3	114.8	113.3	111.3	109.1	106.6	100.4	88.8	61.8

Motor:	V77/E231	ELECT EQPT ROOM AHU	
Horsepower	36	Cable Impedance	0.0786
PF	-	P.U. Impedance	0.0098
Efficiency	-	Load Base KVA	26.45
Cable Rest.	0.0773	Load Base Amps	33.20
Cable React.	0.0142	Comp Amps	17.3
LRC/FLA	-	AHU Amps	9.3
		Condenser Fan	6.3
Stall Torq%	-	Stall Volts	-

Note: Motor data for the AHU and Condenser Fan can be referenced in Attachment 13 & Attachment 15 for compressor data. Curve Pts calculated separately for each

TIME (sec)	PU - 60	60-14	13	12	11	10	8	6	4
CABLE DROP(pu)	0.0109	0.0138	0.0139	0.0142	0.0145	0.0149	0.0158	0.0180	0.0269
MTR VOLTS(pu)	0.8987	0.7141	0.7049	0.6920	0.6772	0.6615	0.6213	0.5450	0.3649
AMPS(pu)	1.1128	1.4003	1.4186	1.4450	1.4766	1.5118	1.6096	1.8348	2.7402
COMP RUN AMPS	19.1	24.0	24.3	24.8	25.3	25.9	27.5	31.2	45.7
COMP LRC AMPS	----	----	----	71.1	69.7	68.1	64.2	56.7	39.5
COMP CURVE PTs	19.1	24.0	24.3	71.1	69.7	68.1	64.2	56.7	39.5
AHU RUN AMPS	10.3	13.0	13.2	13.4	13.7	14.1	15.0	17.1	25.5
AHU LRC AMPS	----	----	----	----	----	----	37.9	33.5	23.3
AHU CURVE PTs	10.3	13.0	13.2	13.4	13.7	14.1	37.9	33.5	23.3
COND FAN RUN A	7.0	8.8	8.9	9.1	9.3	9.5	10.1	11.6	17.3
COND FAN LRC A	----	----	----	----	----	----	----	24.2	16.8
COND FAN CURVE	7.0	8.8	8.9	9.1	9.3	9.5	10.1	24.2	16.8

The 200% stall torque asssumed for the compressor is based on Attachment 15. The FLA of 17.3 will give a torque value of 43 ft-lbs, compared with a max. torque value of 114 ft-lbs giving us a breakdown torque % of 265. Therefore, our 200% assumption is extremely conservative.

CALCULATION SHEET

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
21701-523	21701-523-E-02	0	

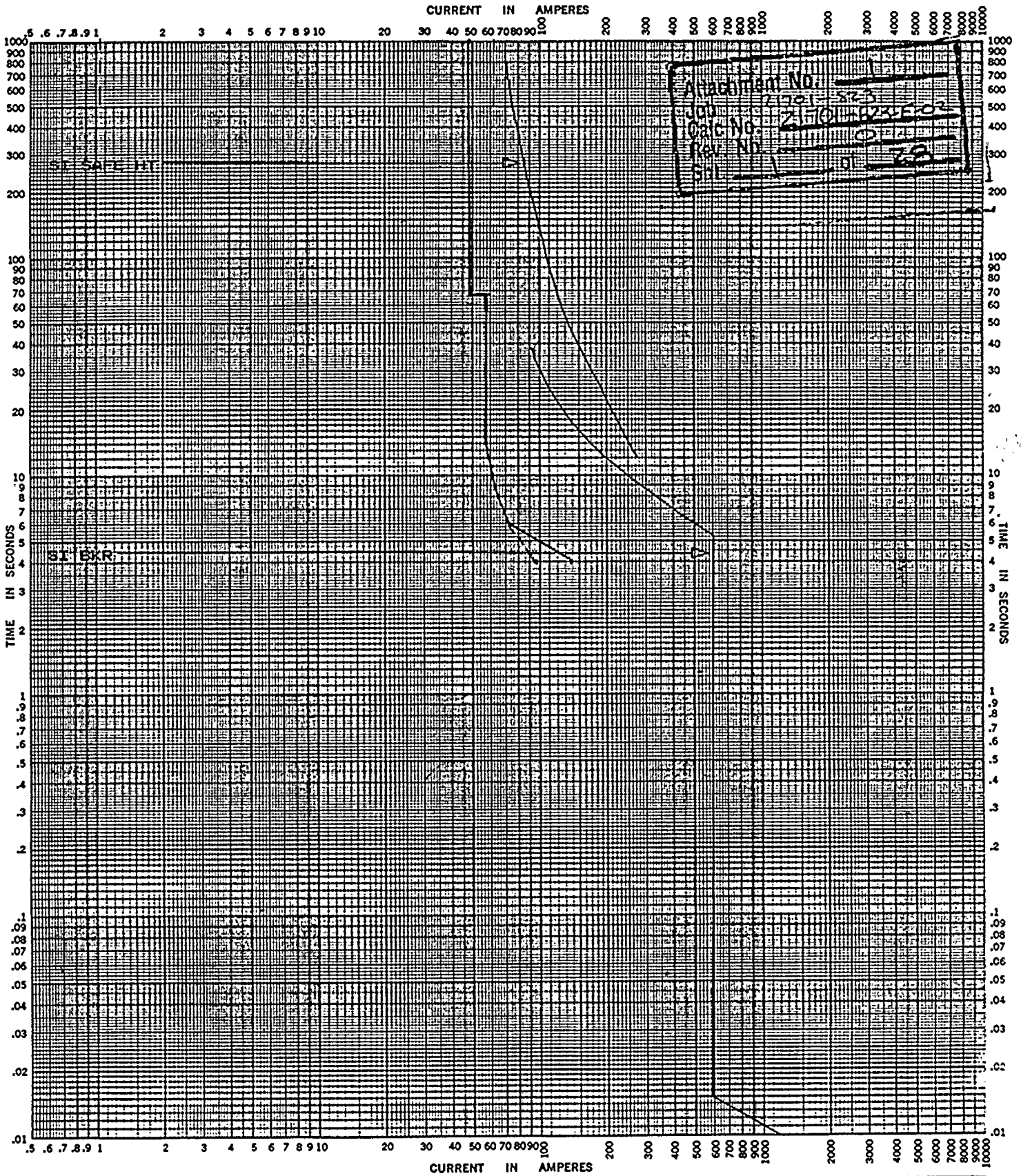
ORIGINATOR	DATE	CHECKED	DATE
Paul J. Smith	03/27/92	Robert K. Larsen	3/27/92

APPENDIX A
JOB 21701-523
CALC. 21701-523-E-02
SHT 20 OF 20

MCC 3K (3B52)
LC Supply: 3B04

		EC-145 Ref.
PSB-1 LC Volts:	371	App. 5 Case 10
PSB-1 MCC V	370.5	App. 5 Case 10
PSB-1 V Drop	0.5	
Calculated PmZc	185.25	

				ITE Relay	IAV RELAY Pickup Setting:			98 V			
				Time PU - 60	60-14	13	12	11	10	8	6	4
				IAV TD 5 ---	0.900	0.890	0.876	0.860	0.843	0.800	0.720	0.545
				Relay Voltage 108.22	88.20	87.22	85.85	84.28	82.61	78.40	70.56	53.41
				Voltage @LC 432.9	352.8	348.9	343.4	337.1	330.5	313.6	282.2	213.6
				Voltage @MCC 432.5	352.3	348.3	342.9	336.6	329.9	313.0	281.6	212.8
				P.U. Voltage 0.9401	0.7658	0.7573	0.7453	0.7317	0.7172	0.6805	0.6121	0.4625
Motor:	3V34B	EDG ROOM VENT FAN										
Horsepower	5	Cable Impedance	0.0209	TIME (sec) PU - 60	60-14	13	12	11	10	8	6	4
PF	0.85	P.U. Impedance	0.0005	CABLE DROP(pu) 0.0005	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007	0.0008	0.0010
Efficiency	0.92	Motor Base KVA	4.77	MTR VOLTS(pu) 0.9396	0.7652	0.7567	0.7447	0.7310	0.7165	0.6798	0.6114	0.4615
Cable Rest.	0.0208	Motor Base Amps	5.99	AMPS(pu) 1.0643	1.3069	1.3216	1.3428	1.3679	1.3957	1.4711	1.6357	2.1668
Cable React.	0.0023			RUNNING AMPS 6.4	7.8	7.9	8.0	8.2	8.4	8.8	9.8	13.0
LRC/FLA	6.00			LRC AMPS ----	----	----	----	----	25.7	24.4	21.9	16.6
Stall Torq%	190	Stall Volts	0.725	CURVE POINTS 6.4	7.8	7.9	8.0	8.2	25.7	24.4	21.9	16.6
Motor:	3P10B	EDG FO XFER PMP										
Horsepower	0.75	Cable Impedance	0.1616	TIME (sec) PU - 60	60-14	13	12	11	10	8	6	4
PF	0.85	P.U. Impedance	0.0009	CABLE DROP(pu) 0.0009	0.0011	0.0011	0.0011	0.0012	0.0012	0.0013	0.0014	0.0018
Efficiency	0.59	Motor Base KVA	1.12	MTR VOLTS(pu) 0.9392	0.7647	0.7562	0.7442	0.7305	0.7160	0.6792	0.6107	0.4607
Cable Rest.	0.1615	Motor Base Amps	1.40	AMPS(pu) 1.0647	1.3077	1.3225	1.3438	1.3689	1.3967	1.4723	1.6374	2.1706
Cable React.	0.0051			RUNNING AMPS 1.5	1.8	1.9	1.9	1.9	2.0	2.1	2.3	3.0
LRC/FLA	6.00			LRC AMPS ----	----	----	----	----	6.0	5.7	5.1	3.9
Stall Torq%	190	Stall Volts	0.725	CURVE POINTS 1.5	1.8	1.9	1.9	1.9	6.0	5.7	5.1	3.9
Motor:	3V65B	SWGR 3D ROOM SUPPLY FAN										
Horsepower	2	Cable Impedance	1.0035	TIME (sec) PU - 60	60-14	13	12	11	10	8	6	4
PF	0.85	P.U. Impedance	0.0090	CABLE DROP(pu) 0.0097	0.0120	0.0121	0.0123	0.0126	0.0128	0.0136	0.0152	0.0205
Efficiency	0.92	Motor Base KVA	1.91	MTR VOLTS(pu) 0.9304	0.7538	0.7451	0.7330	0.7191	0.7043	0.6669	0.5970	0.4421
Cable Rest.	1.003	Motor Base Amps	2.39	AMPS(pu) 1.0748	1.3266	1.3420	1.3643	1.3906	1.4198	1.4995	1.6751	2.2621
Cable React.	0.0319			RUNNING AMPS 2.6	3.2	3.2	3.3	3.3	3.4	3.6	4.0	5.4
LRC/FLA	6.00			LRC AMPS ----	----	----	----	----	----	----	----	6.3
Stall Torq%	358	Stall Volts	0.529	CURVE POINTS 2.6	3.2	3.2	3.3	3.3	3.4	3.6	4.0	6.3



SI PUMP 3P215A TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

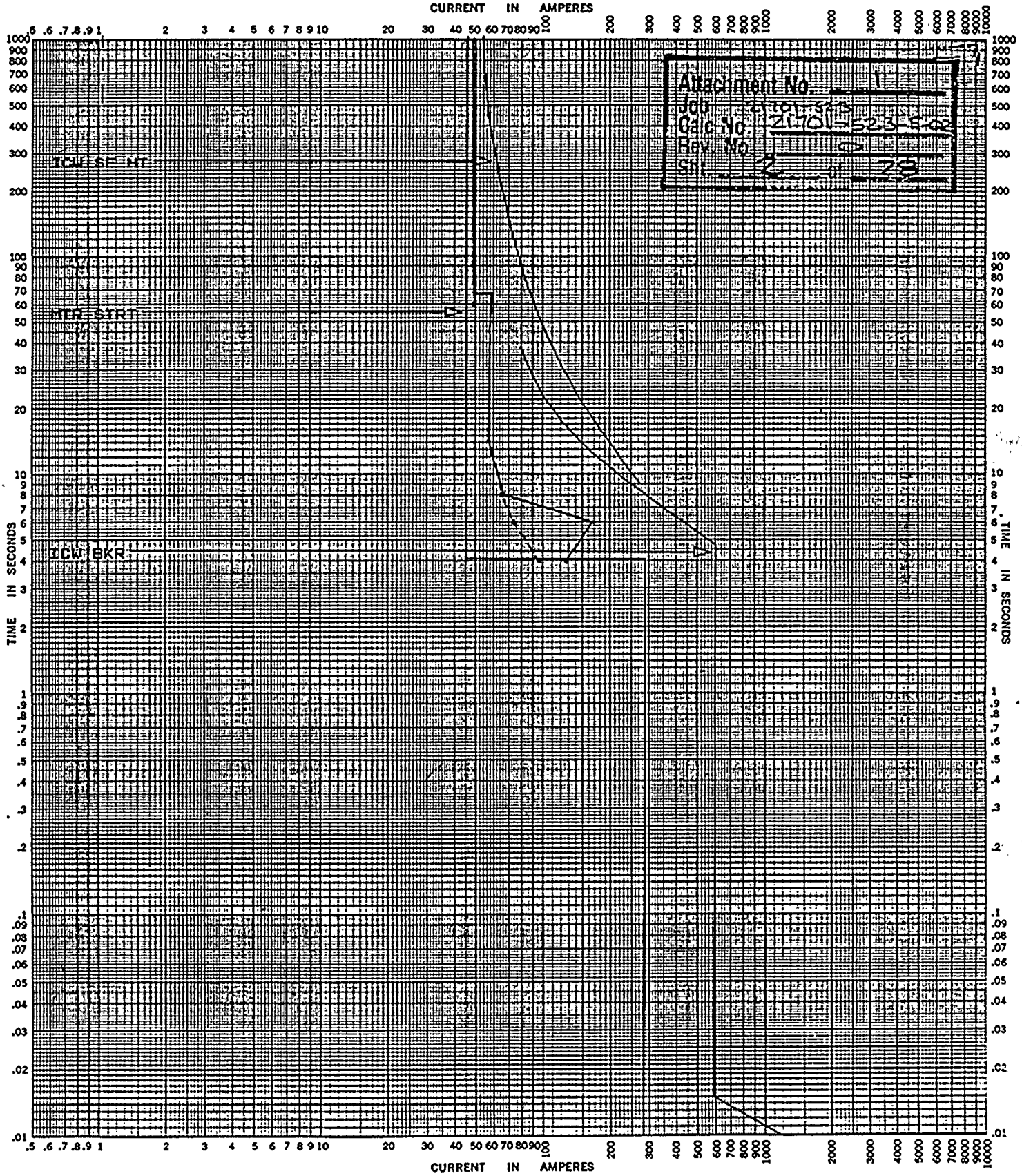
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at 4160 Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to _____ Test points so variations should be _____

No. FIGURE 1
Date 3/10/92

K•Σ TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258

PLA 3/27/92
JLL 3/27/92



ICW PUMP 3P9A

TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

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

2. Curves are plotted to 4160 V Test points so variations should be _____

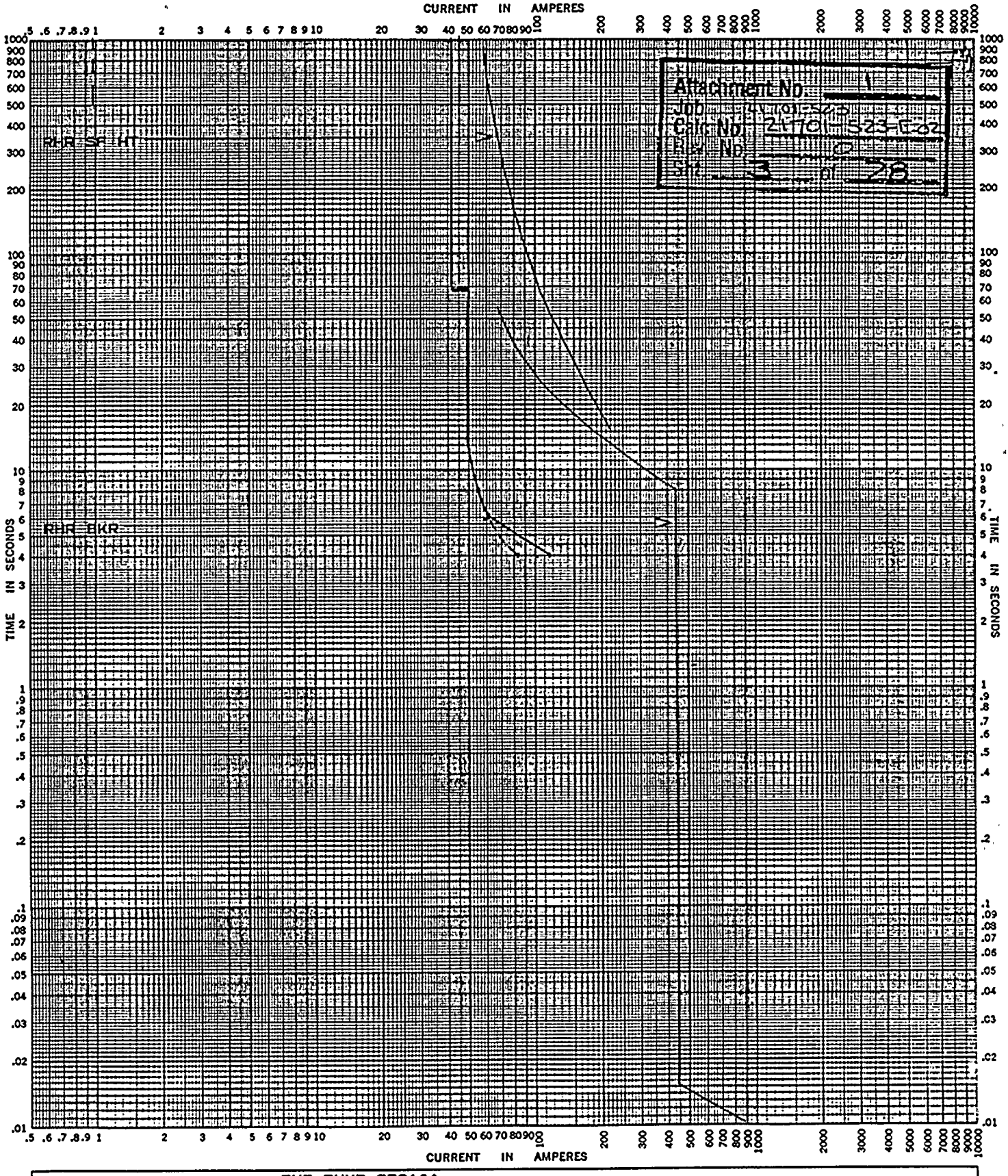
No. FIGURE 2

Date 3/10/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258

3/27/92

3/27/92



RHR PUMP 3P210A TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

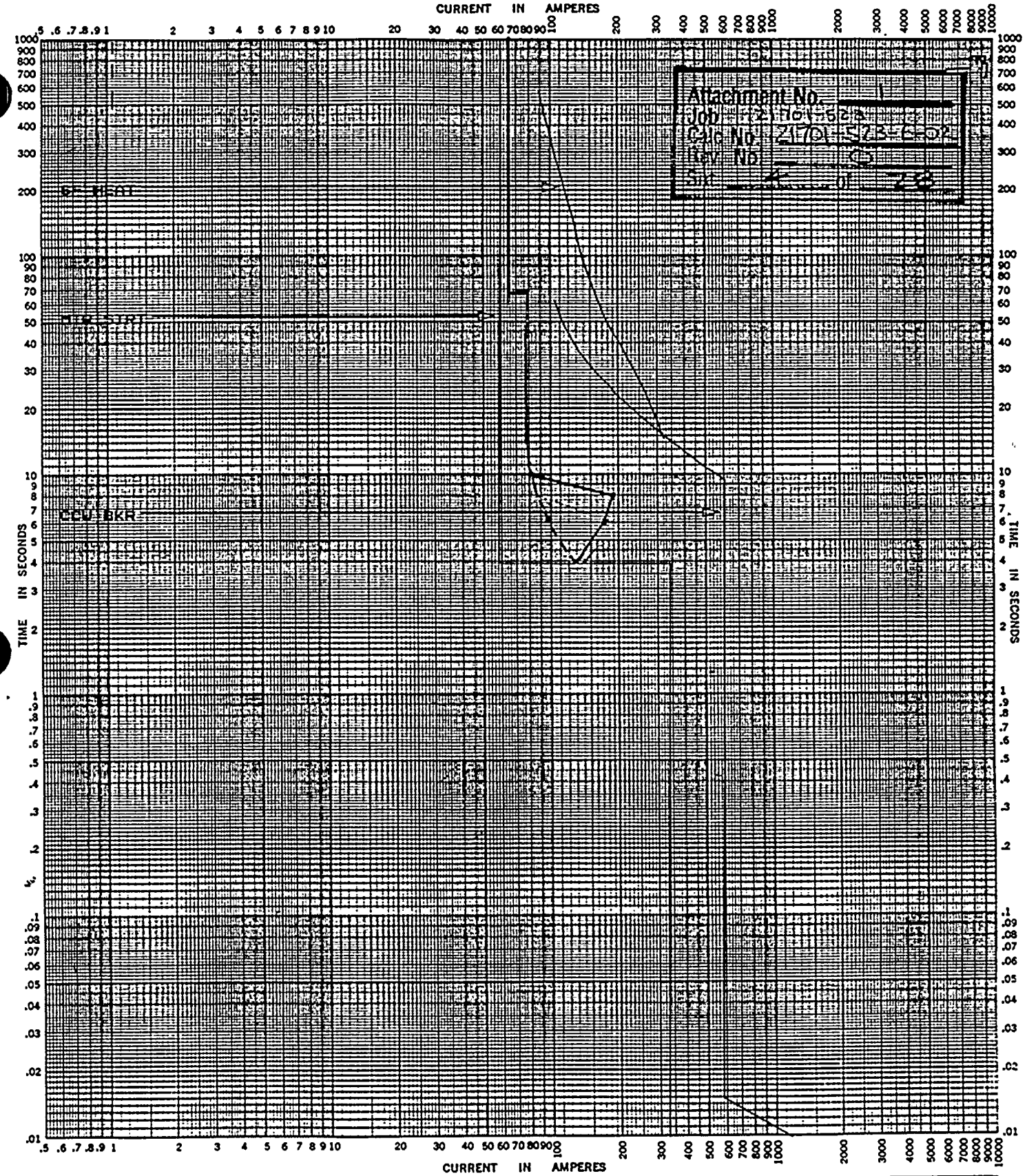
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at 4160 V Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to _____ Test points so variations should be _____

FIGURE 3
No. 3/10/92
Date

K•E TIME-CURRENT CHARACTERISTIC 46 5258
KEUFFEL & ESSER CO. MADE IN U.S.A.

PJH 3/27/92
RRZ 3/27/92



CCW PUMP 3P211 TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

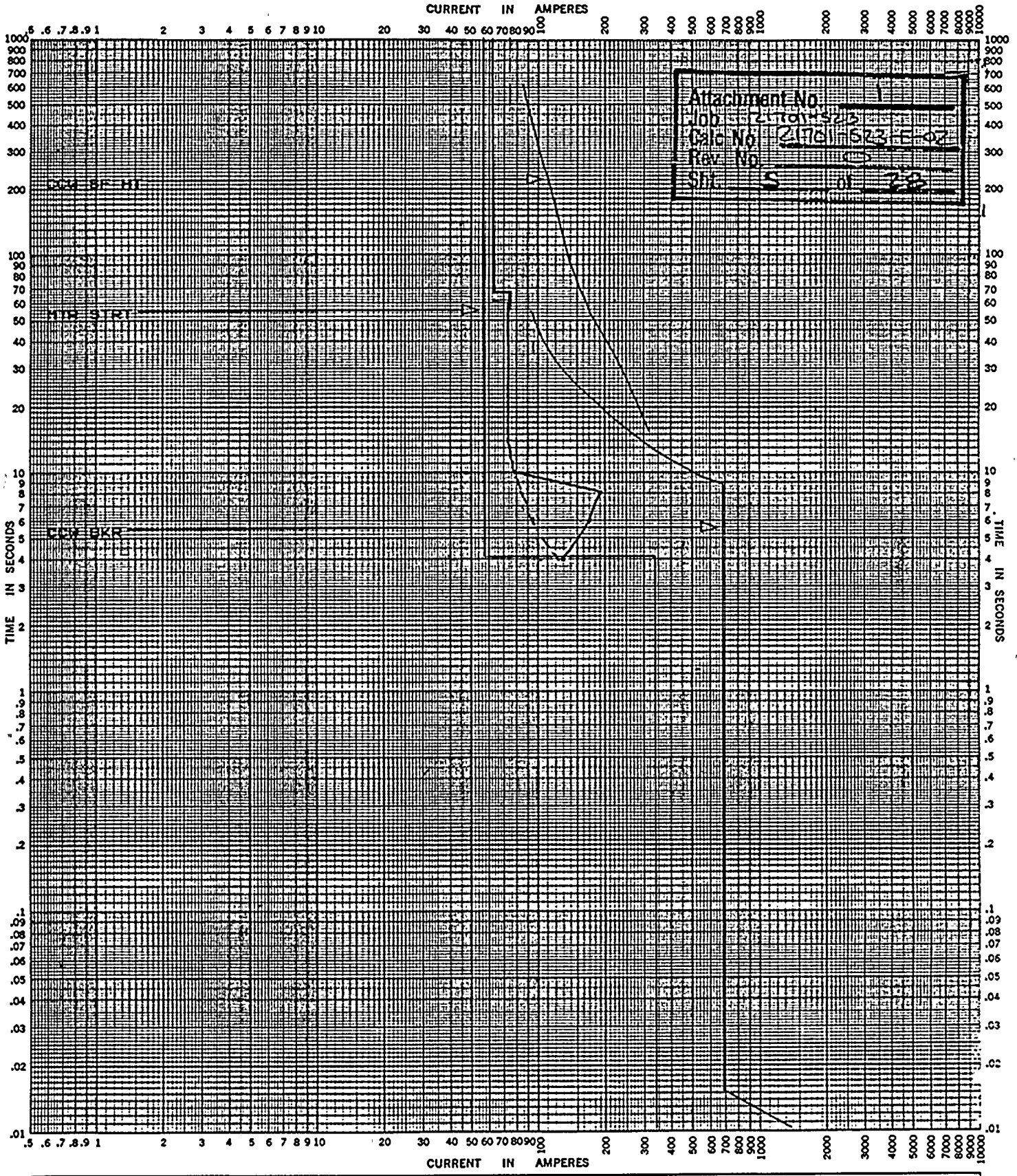
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 4160 V Test points so variations should be _____

No. FIGURE 4
Date 3/10/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5256

PJ 3/27/92
RLL 3/27/92



CCW PUMP 3P211C TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

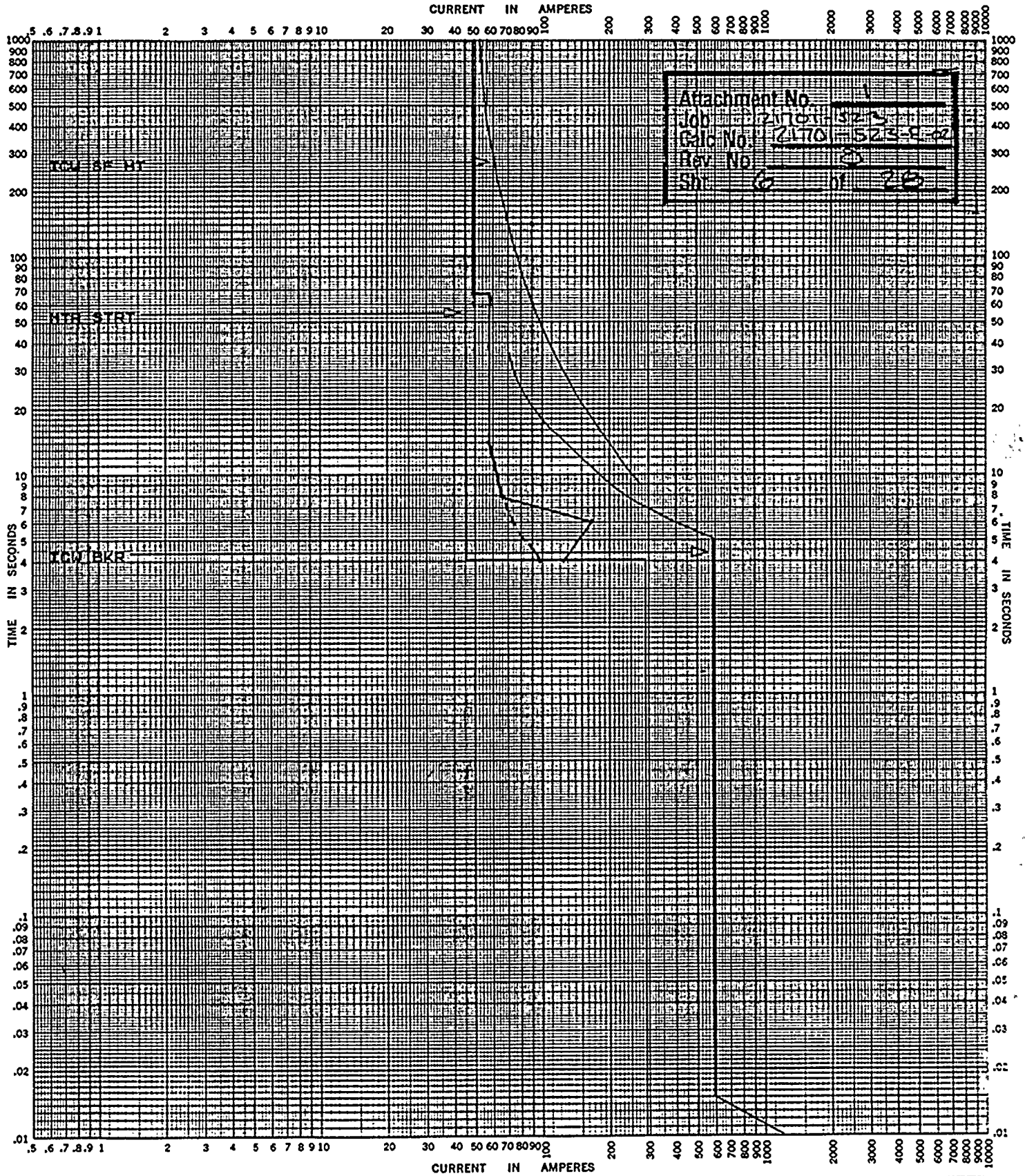
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 4160 0 Test points so variations should be _____

No. FIGURE 5
Date 3/10/92

K•Σ TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258

3/27/92
3/27/92



ICW PUMP 3P9C TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

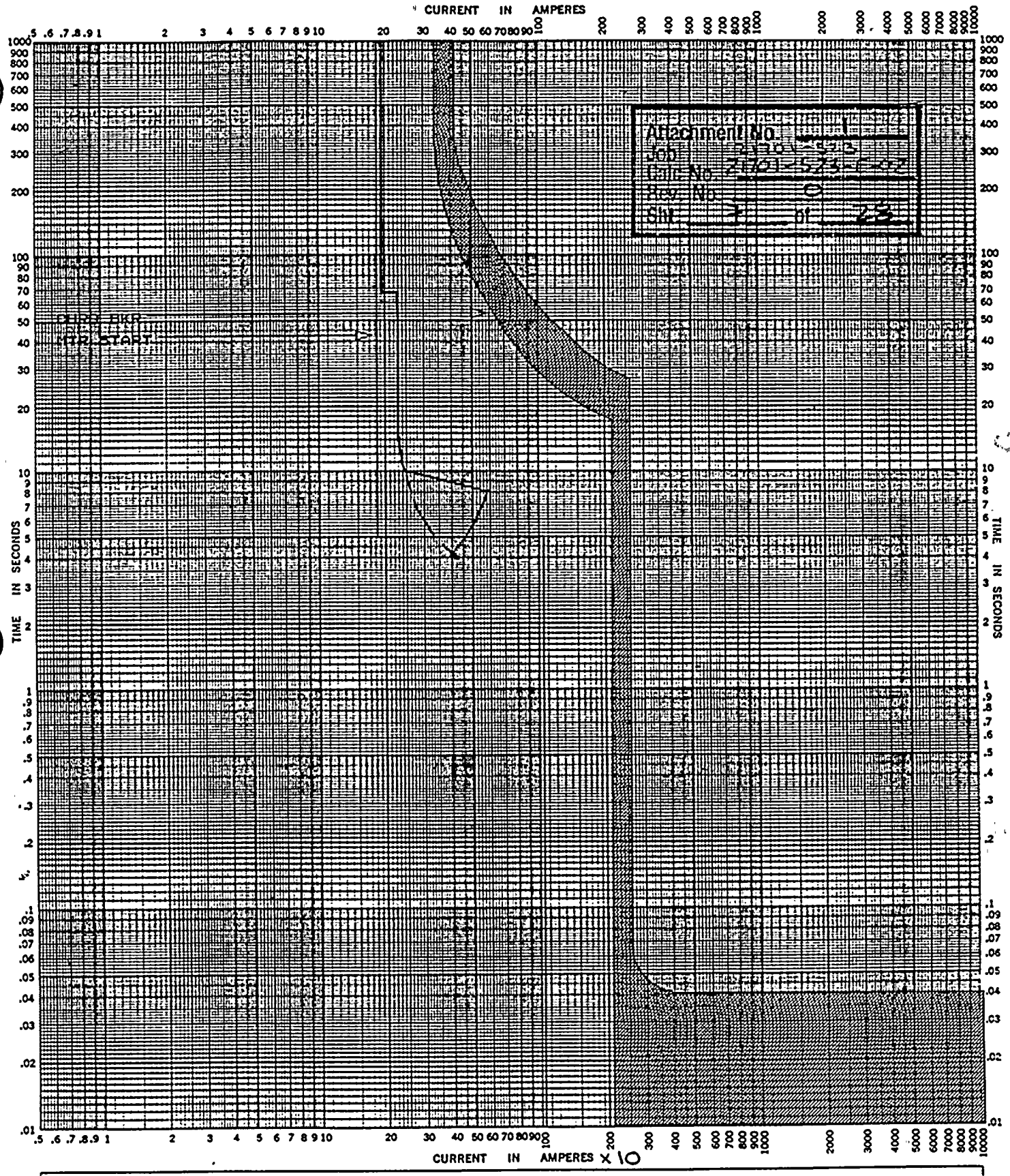
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 4160 V Test points so variations should be _____

No. FIGURE 6
Date 3/10/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258

PJ 3/27/92
RLL 3/27/92



CHARGING PUMP TIME-CURRENT CHARACTERISTIC CURVES

For Fuse Links. In

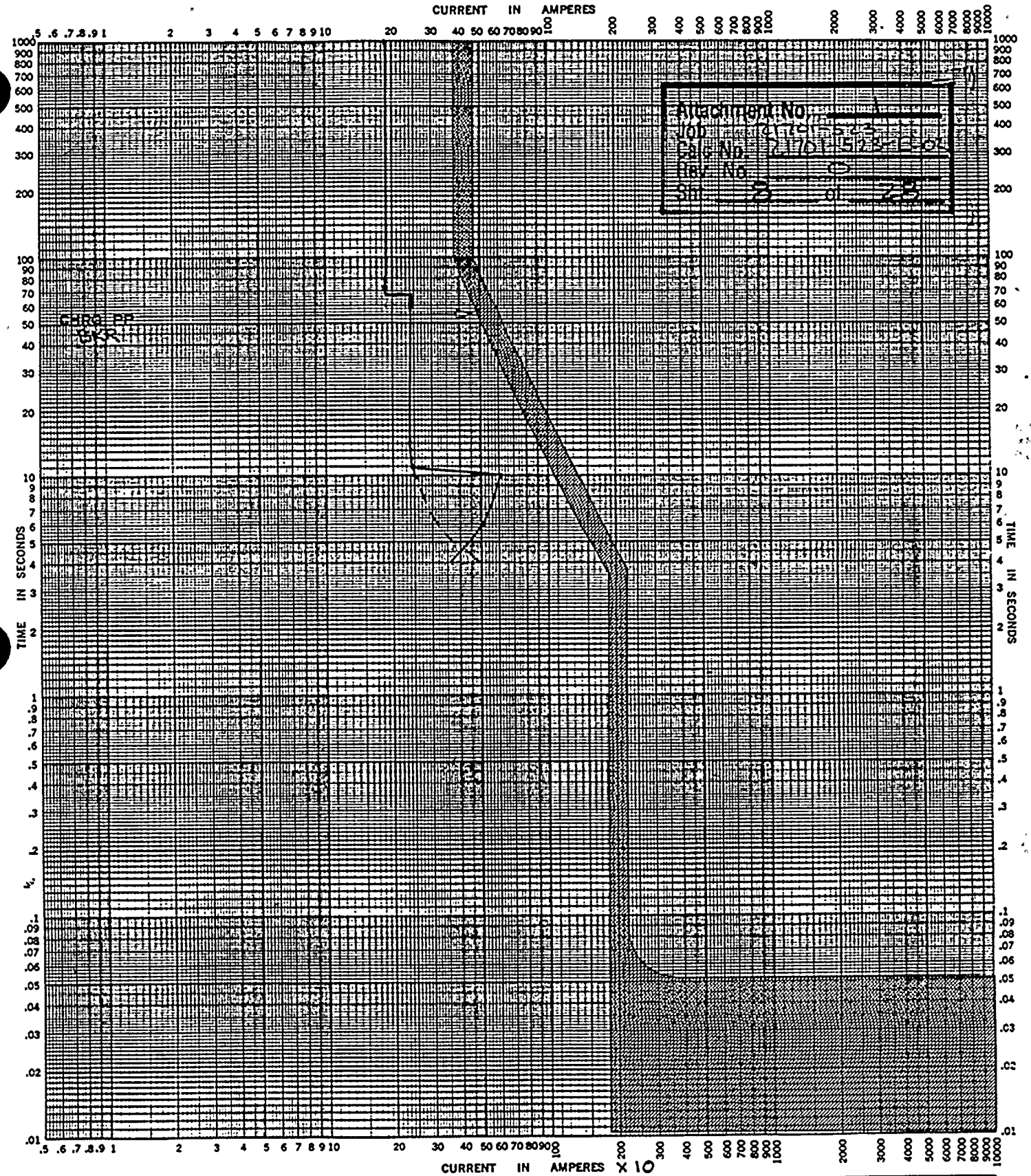
BASIS FOR DATA Standards Dated

1. Tests made at Volts a-c at p-f., starting at 25C with no initial load
2. Curves are plotted to 480 V Test points so variations should be

FIGURE 7
No.
Date 3/17/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258

PJP 3/27/92
TRX 3/27/92



CHRG PP 3C

TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

1. Tests made at 480 V Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to _____ Test points so variations should be _____

FIGURE 8

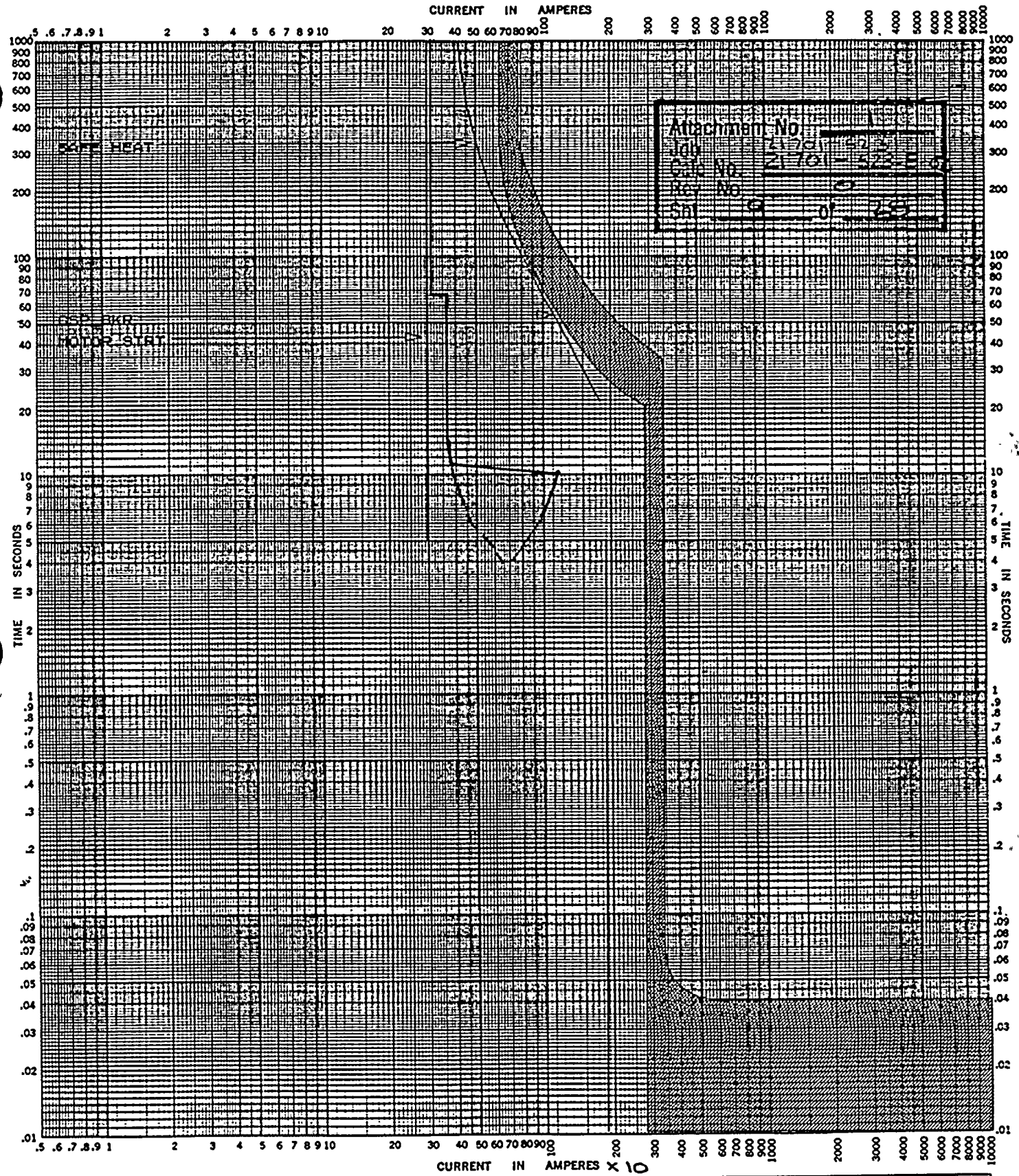
No. _____

Date 3/18/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258

TJB 3/27/92

RZY 3/27/92



CNTMT SPRAY PUMP TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

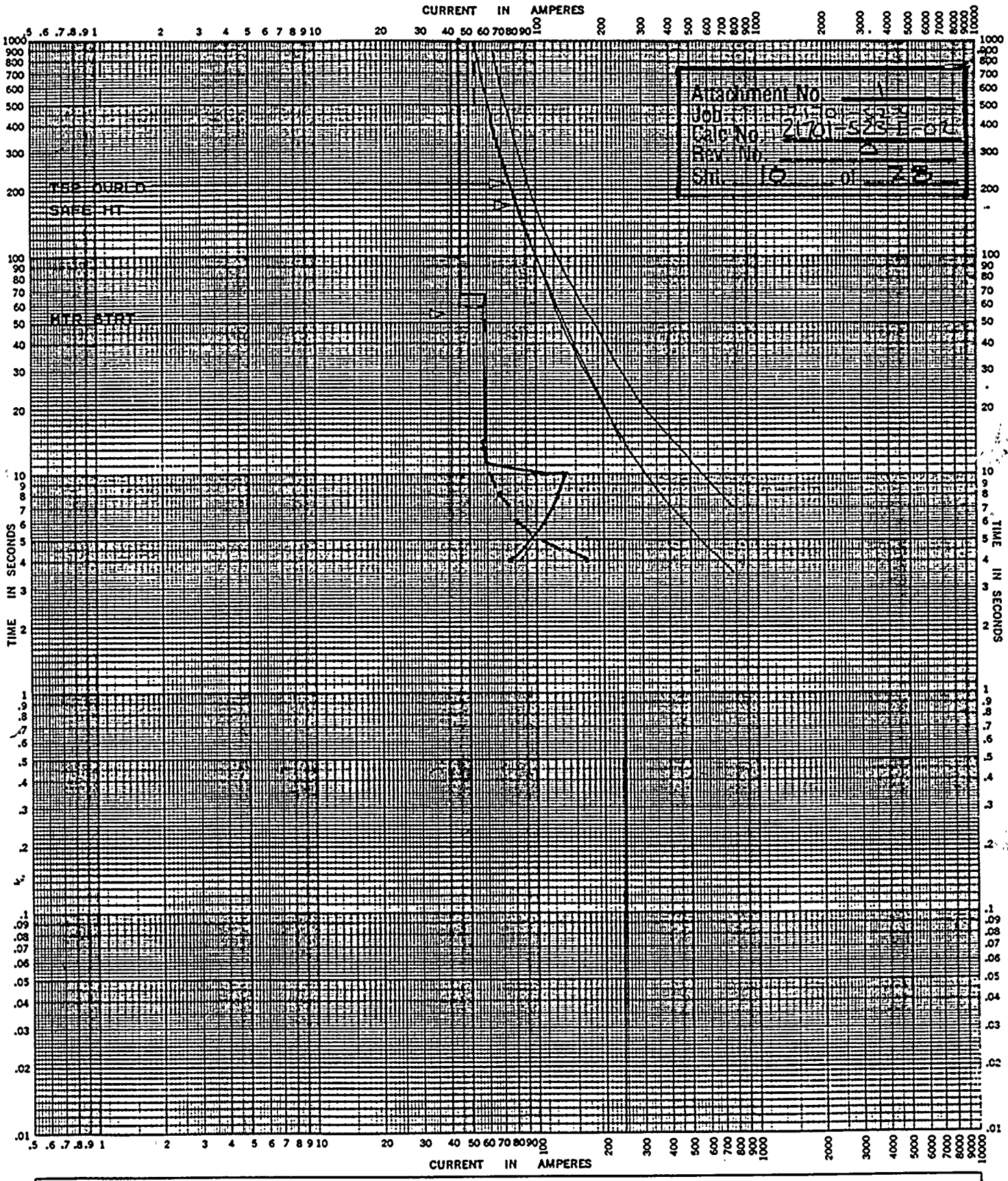
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 0 Test points so variations should be _____

FIGURE 9
No. _____
Date 3/17/92

PJL 3/27/92
JRX 3/27/92

K·E TIME-CURRENT CHARACTERISTIC 48 5258
KEUFFEL & ESSER CO. MADE IN U.S.A.



EMGCY CONT CLR FAN TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

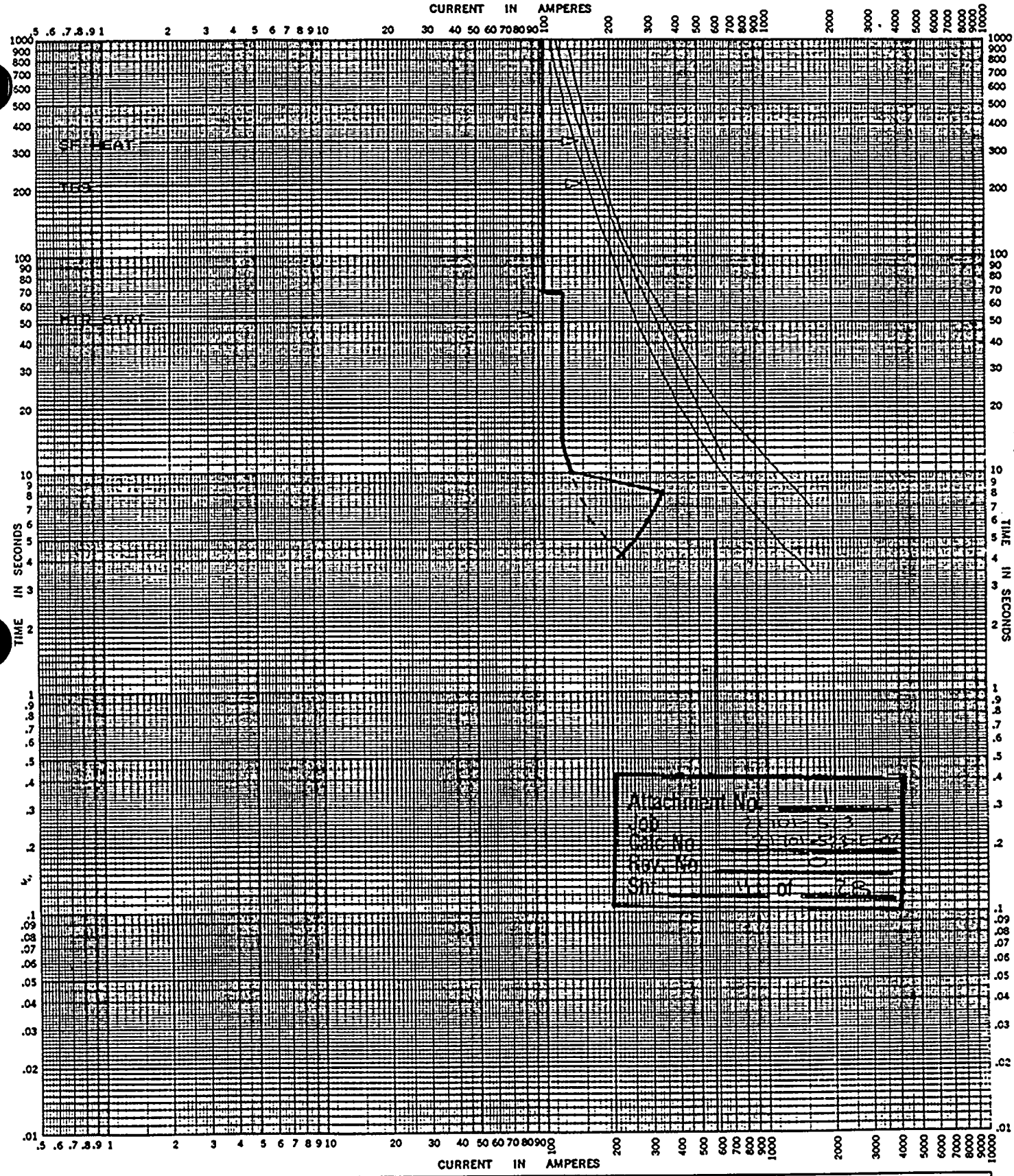
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

FIGURE 10
No. 3/10/92
Date

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258

PJL 3/27/92
JLLZ 3/27/92



EMERG. CONT. FILT FAN TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

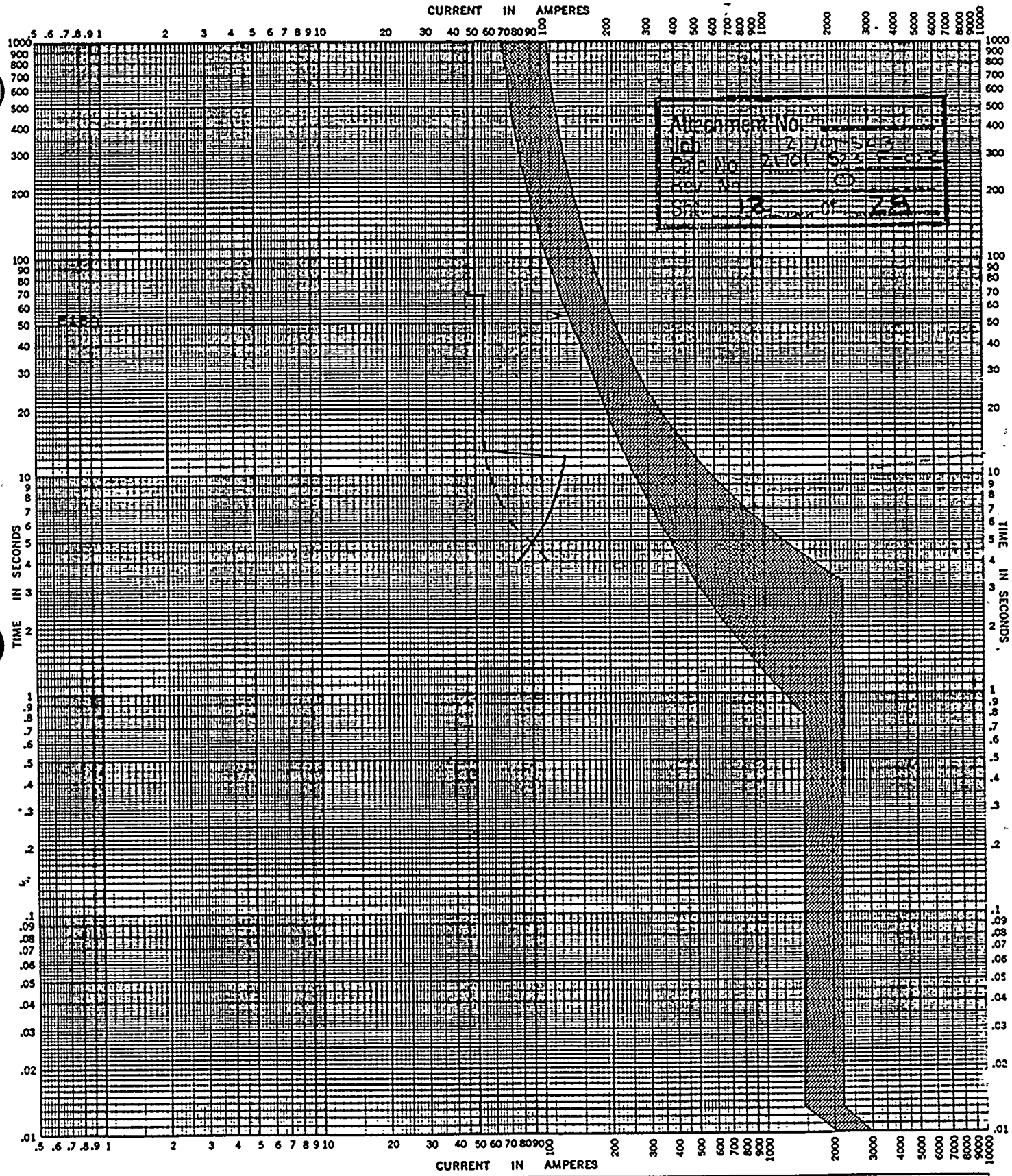
No. FIGURE 11

Date 3/10/92

PA 3/27/92

JLRZ 3/27/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258



CONTROL ROOM A/C TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

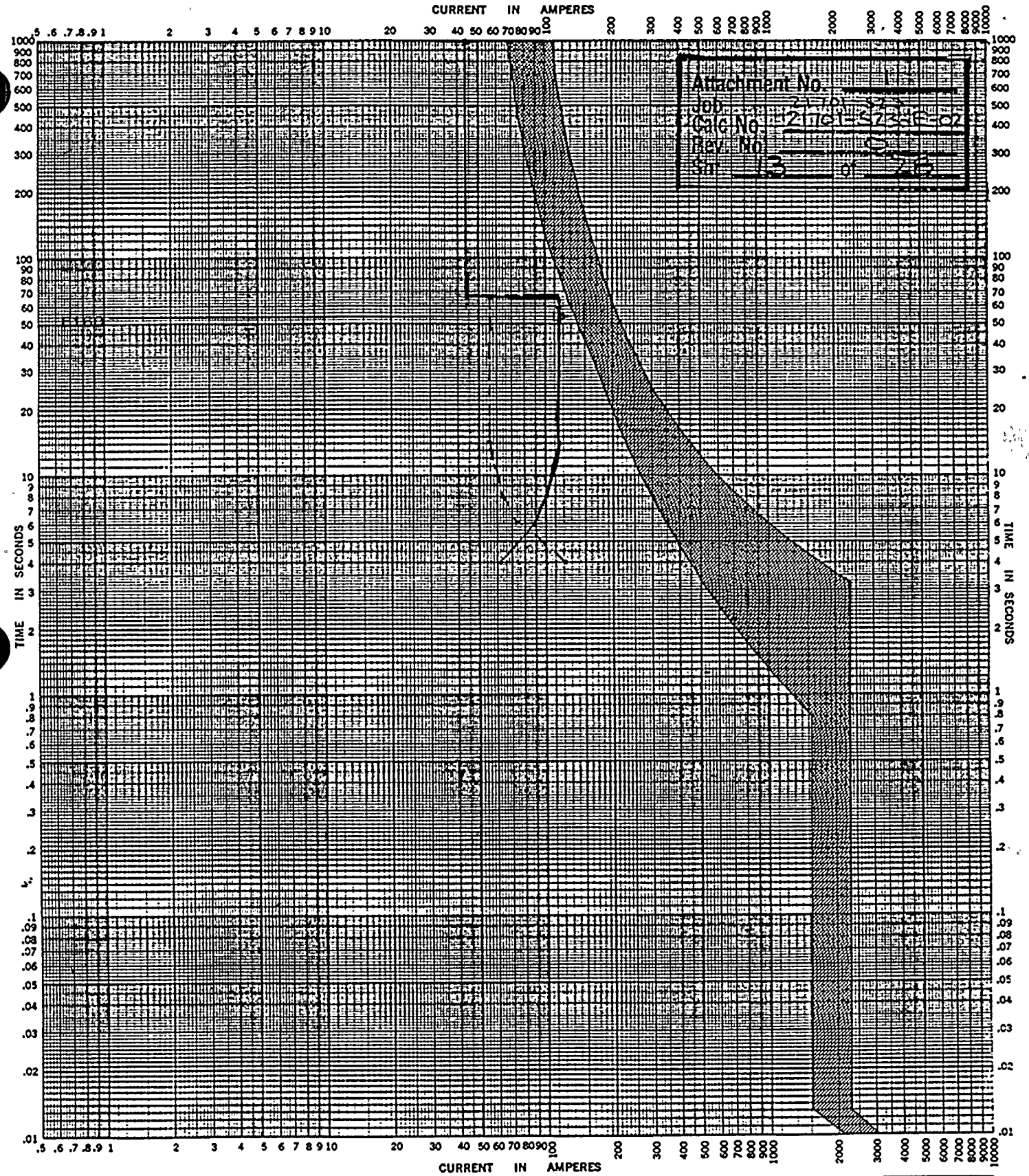
No. FIGURE 12

Date 3/10/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258

PJA 3/27/92

RRZ 3/27/92



CONTROL ROOM A/C TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

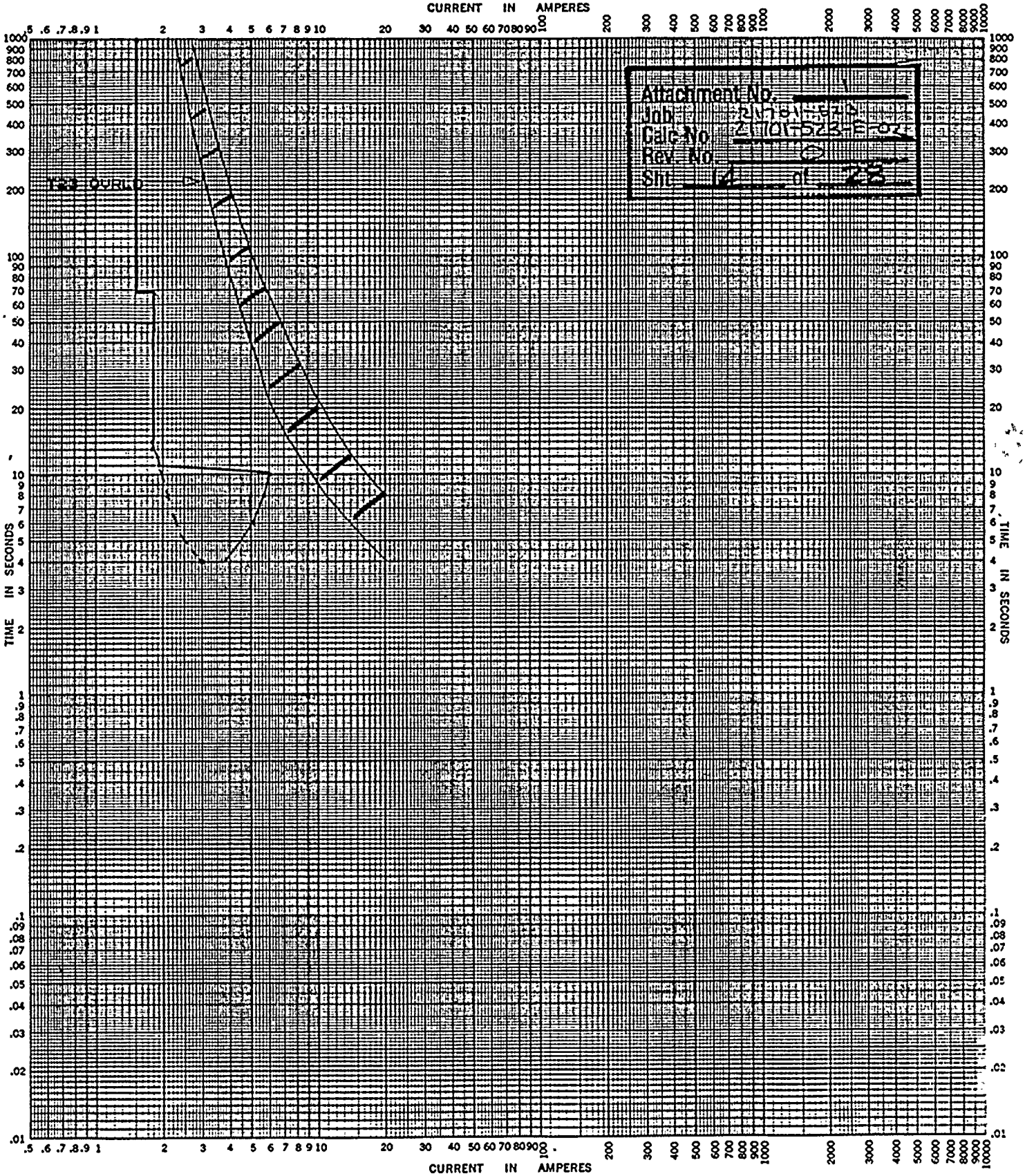
No. FIGURE 13

Date 3/10/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258

3/27/92

3/27/92



EDG FUEL OIL XFER RR 3A TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

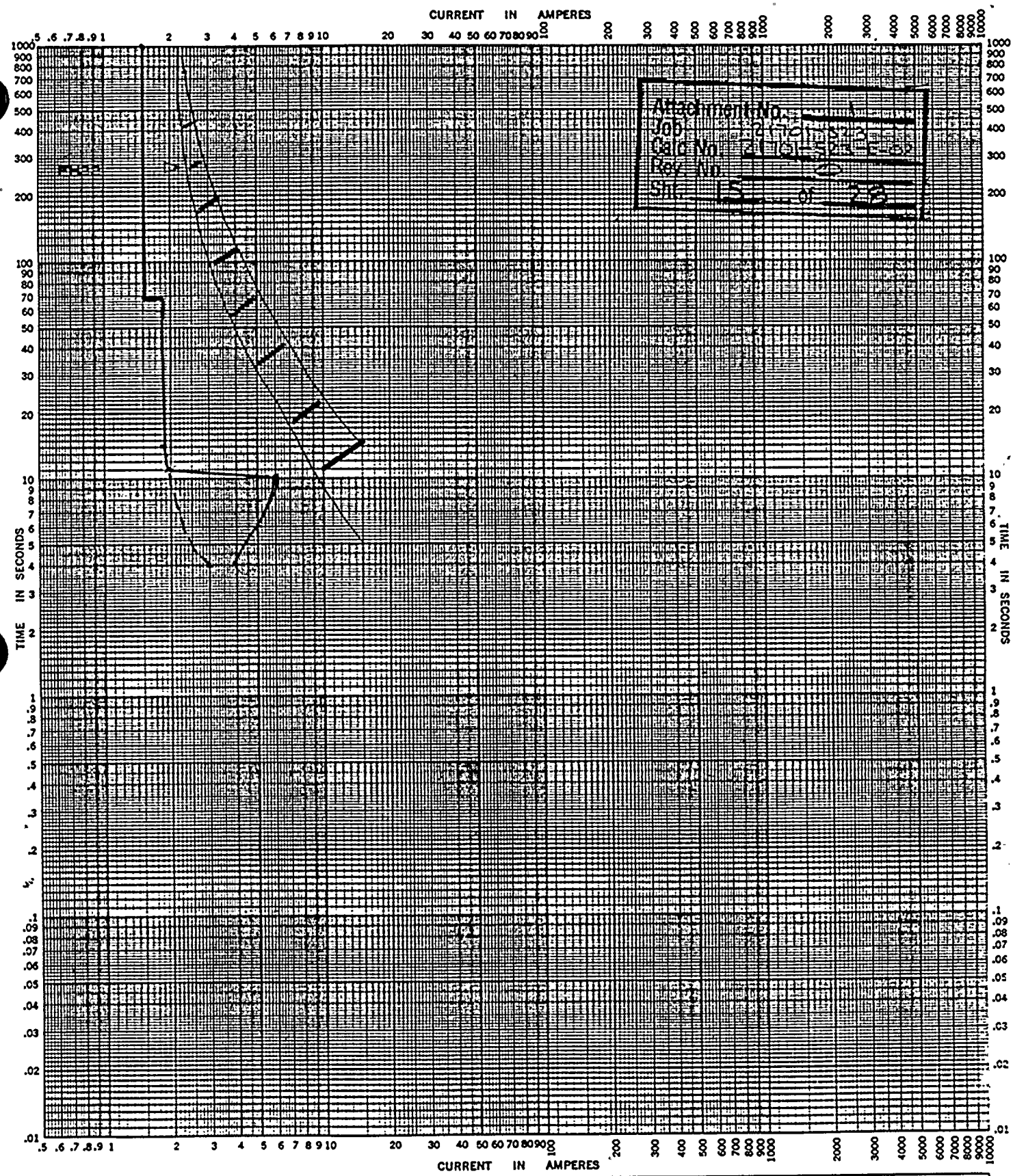
No. FIGURE 14

Date 3/10/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258

3/27/92

3/27/92



EDG FUEL OIL XFER 38
TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

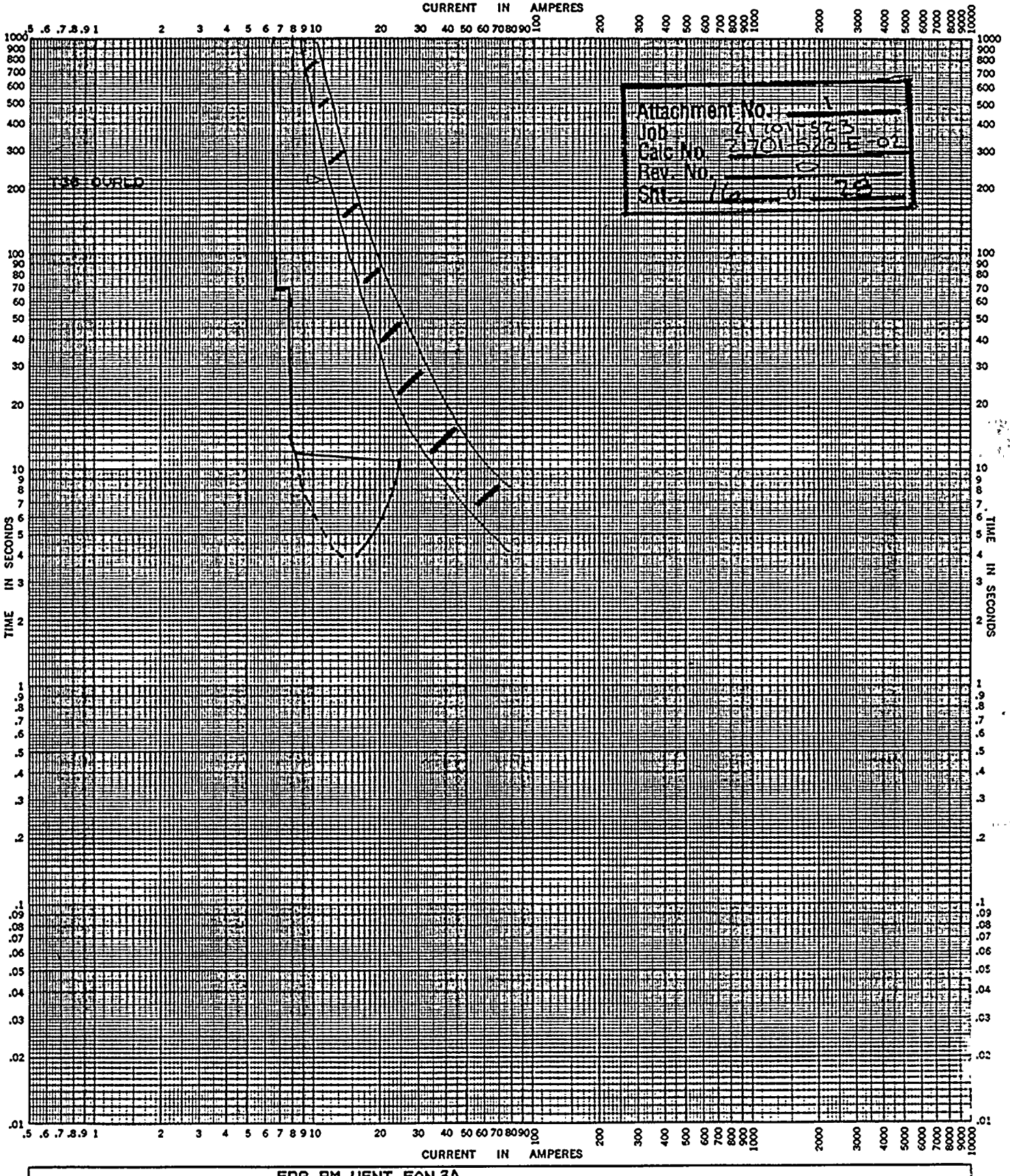
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

No. FIGURE 15
Date 3/10/92

JJA 3/27/92
TRZ 3/27/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258



EDG RM VENT FAN 3A TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

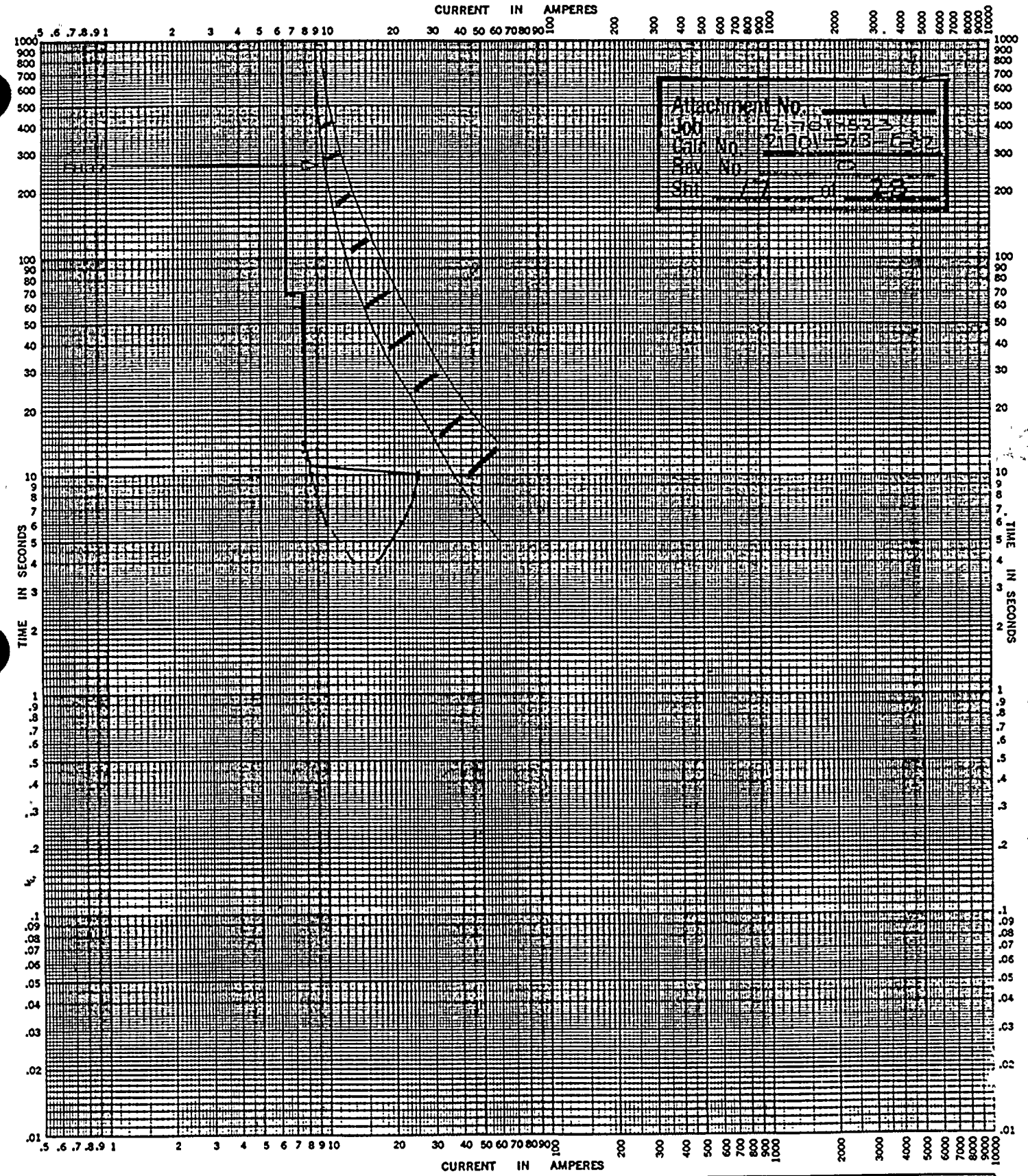
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at 480 V Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to _____ Test points so variations should be _____

No. FIGURE 16
Date 3/10/92

K•Σ TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258

PLD 3/27/92
TTT 3/27/92



EDG RM VENT FAN 3B TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

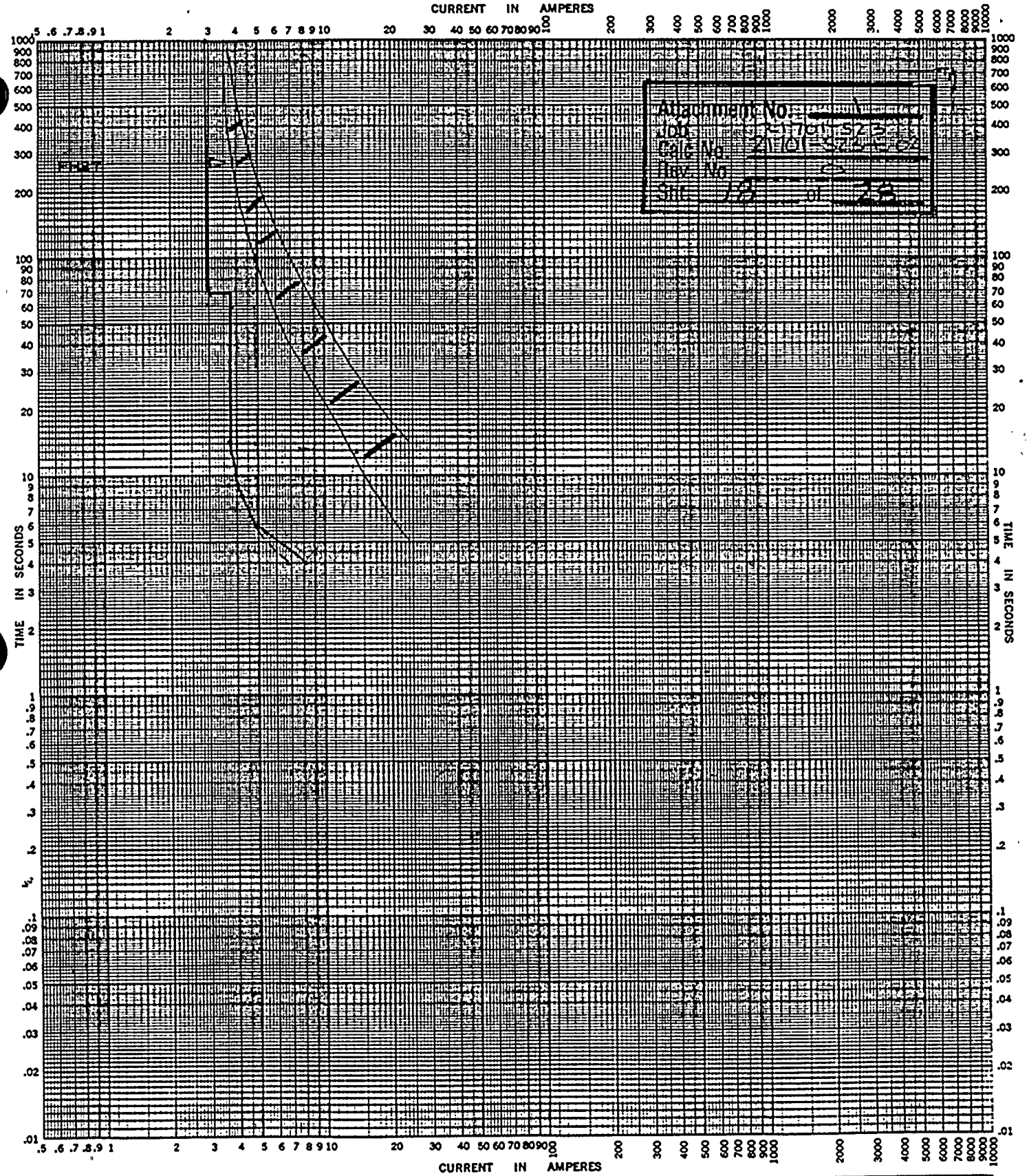
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

No. FIGURE 17
Date 3/10/92

K&E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258

DH 3/27/92
JRR 3/27/92



SWGR 3D RM SUPPLY FN

TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

1. Tests made at 480 V Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to _____ Test points so variations should be _____

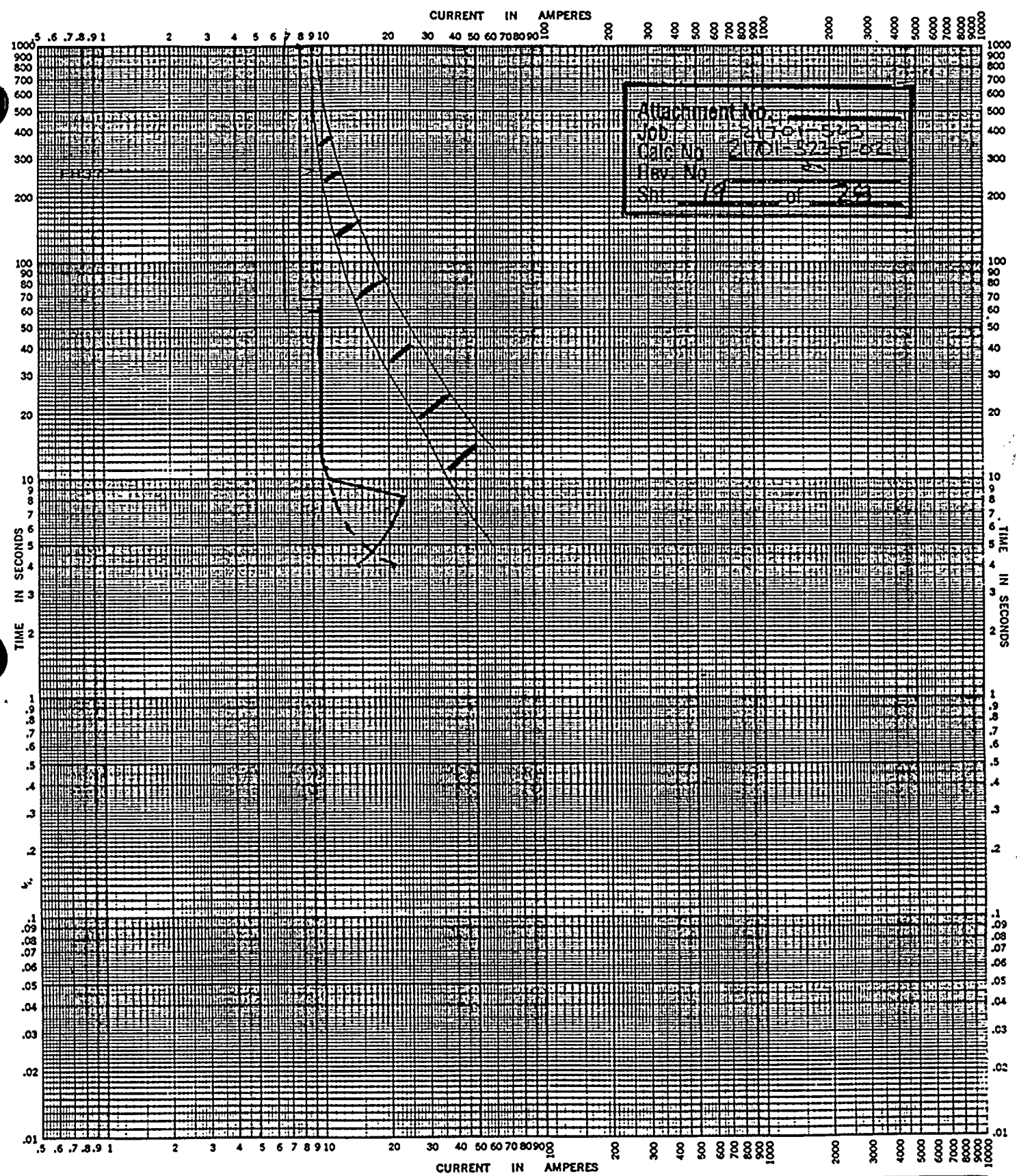
No. FIGURE 18

Date 3/10/92

PJ 3/27/92

RRZ 3/27/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258



COMPUTER RM CHILLER TIME-CURRENT CHARACTERISTIC CURVES

For 1 AHU Fuse Links. In

BASIS FOR DATA Standards Dated

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

2. Curves are plotted to 480 V Test points so variations should be

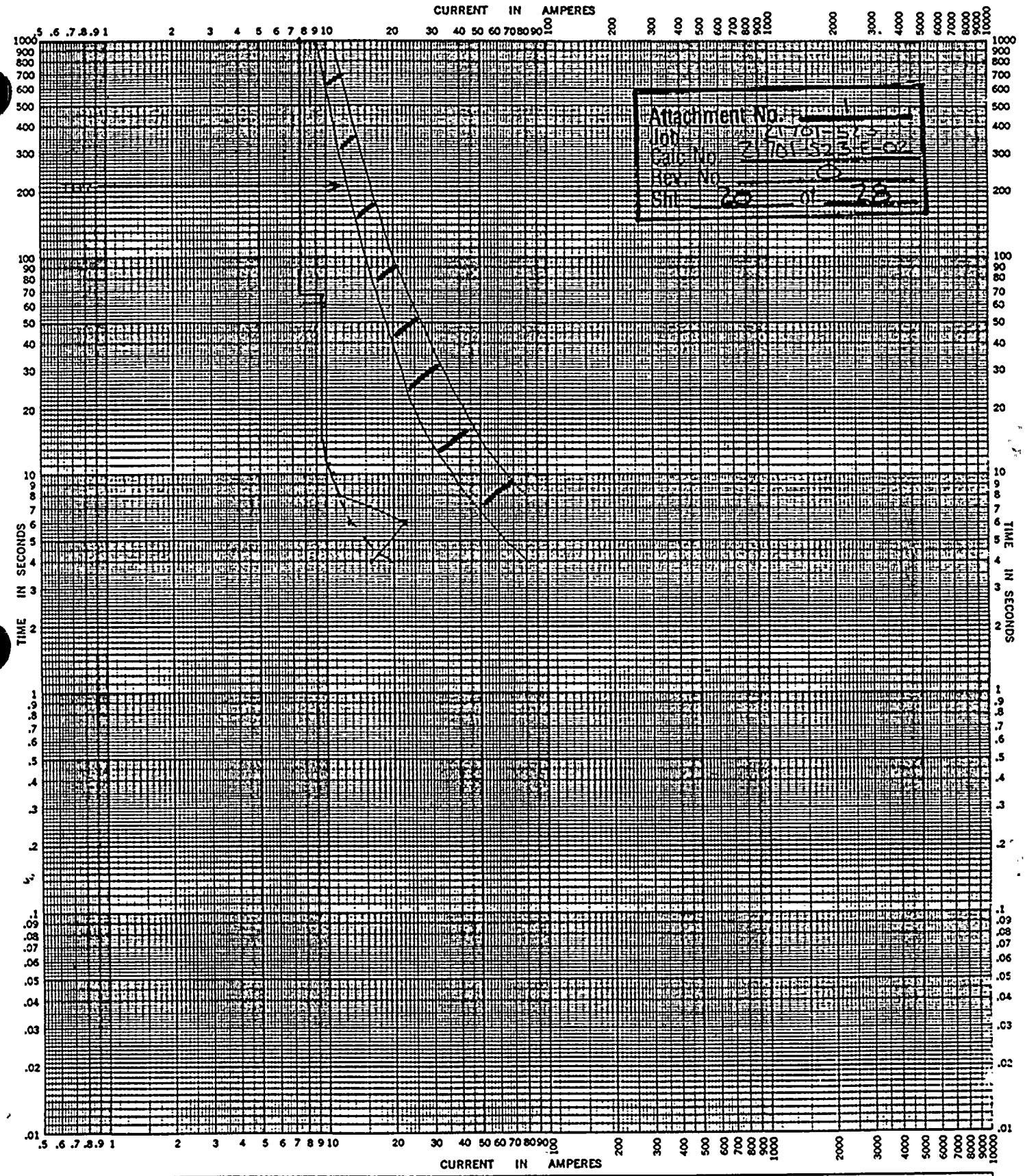
No. FIGURE 19

Date 3/10/92

PJD 3/27/92

RRR 3/27/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258



CONTRL RM EM.FLT.FAN TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

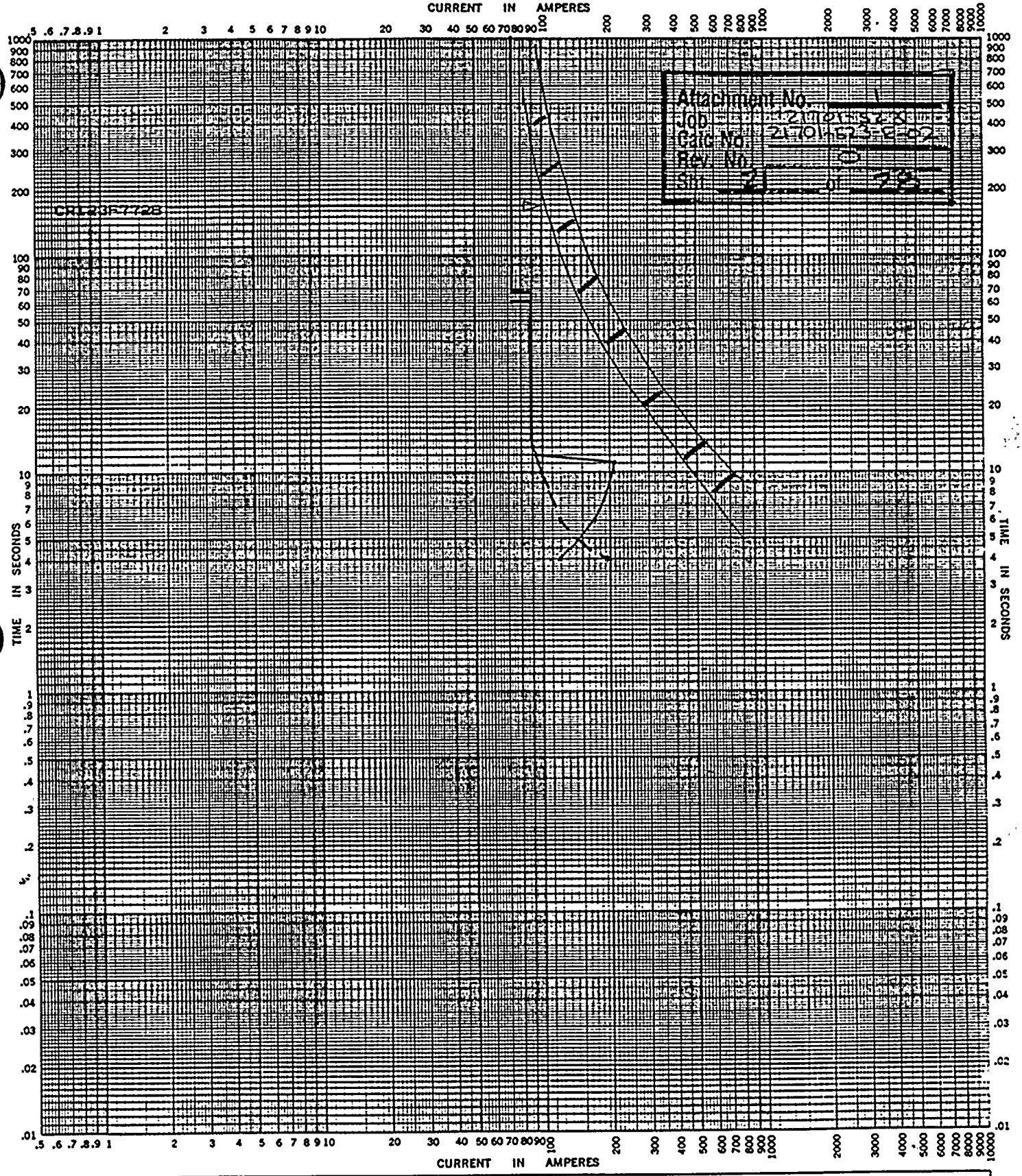
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

No. FIGURE 20
Date 3/10/92

FJD 3/27/92
RRR 3/27/92

K+E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258



COMP RM CHILLER CMPR

TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

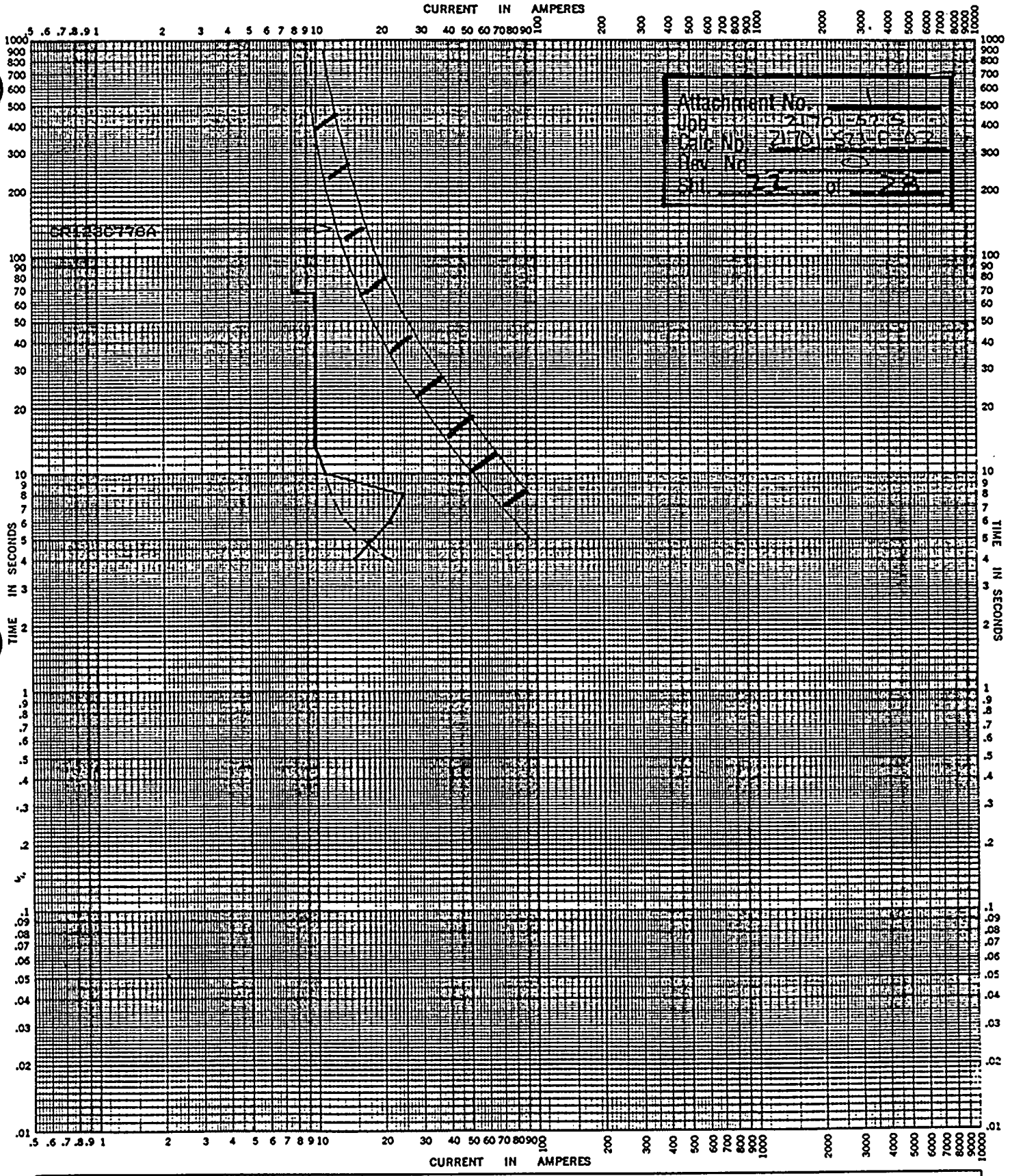
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

FIGURE 21
No. _____
Date 3/17/92

3/27/92
RRX 3/27/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258



COMP RM CHILLER FAN
TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

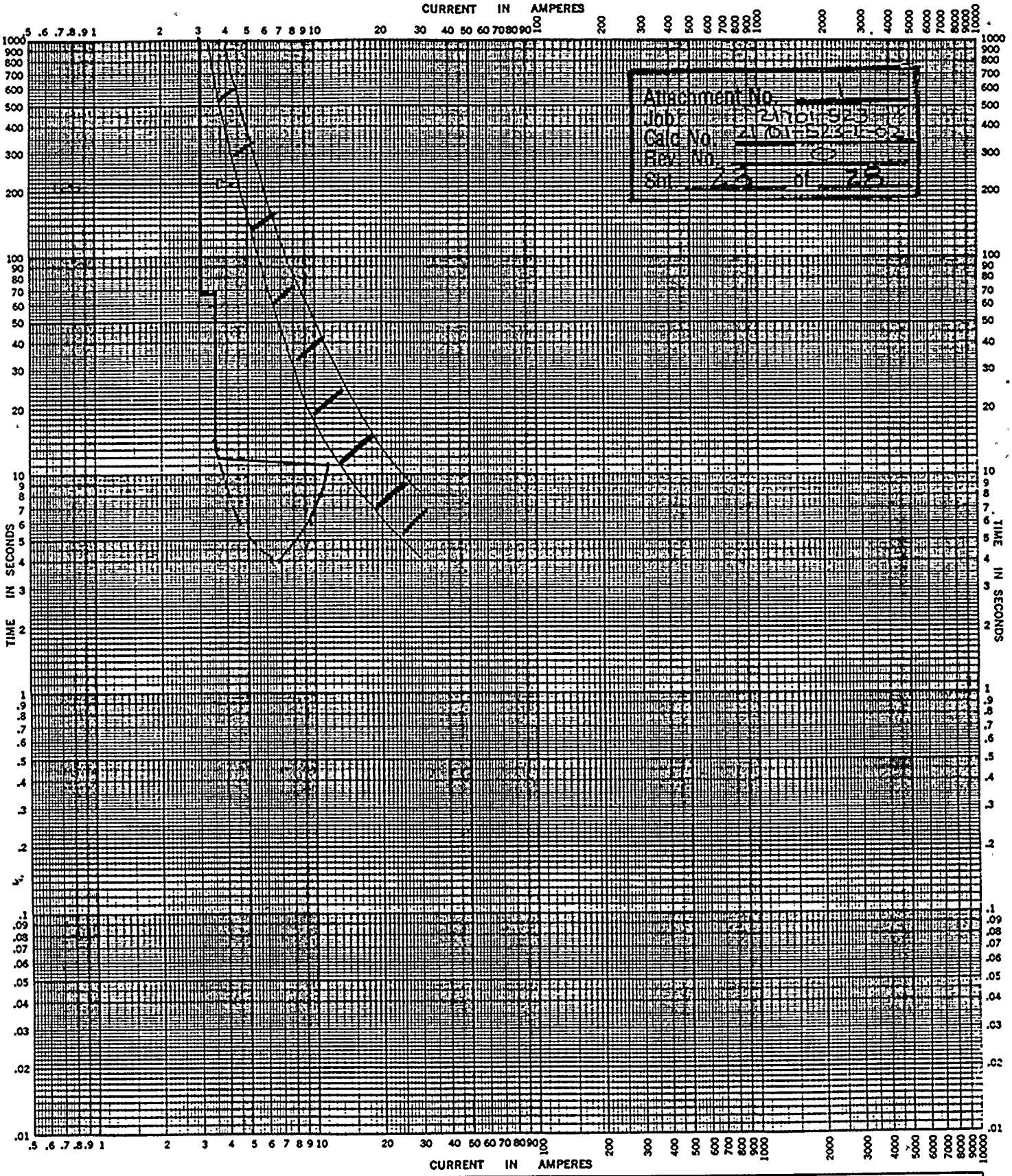
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

FIGURE 22
No. _____
Date 3/17/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258

3/27/92
3/27/92



AIR PART & GAS MONTR

TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

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

2. Curves are plotted to _____ Test points so variations should be _____

FIGURE 23

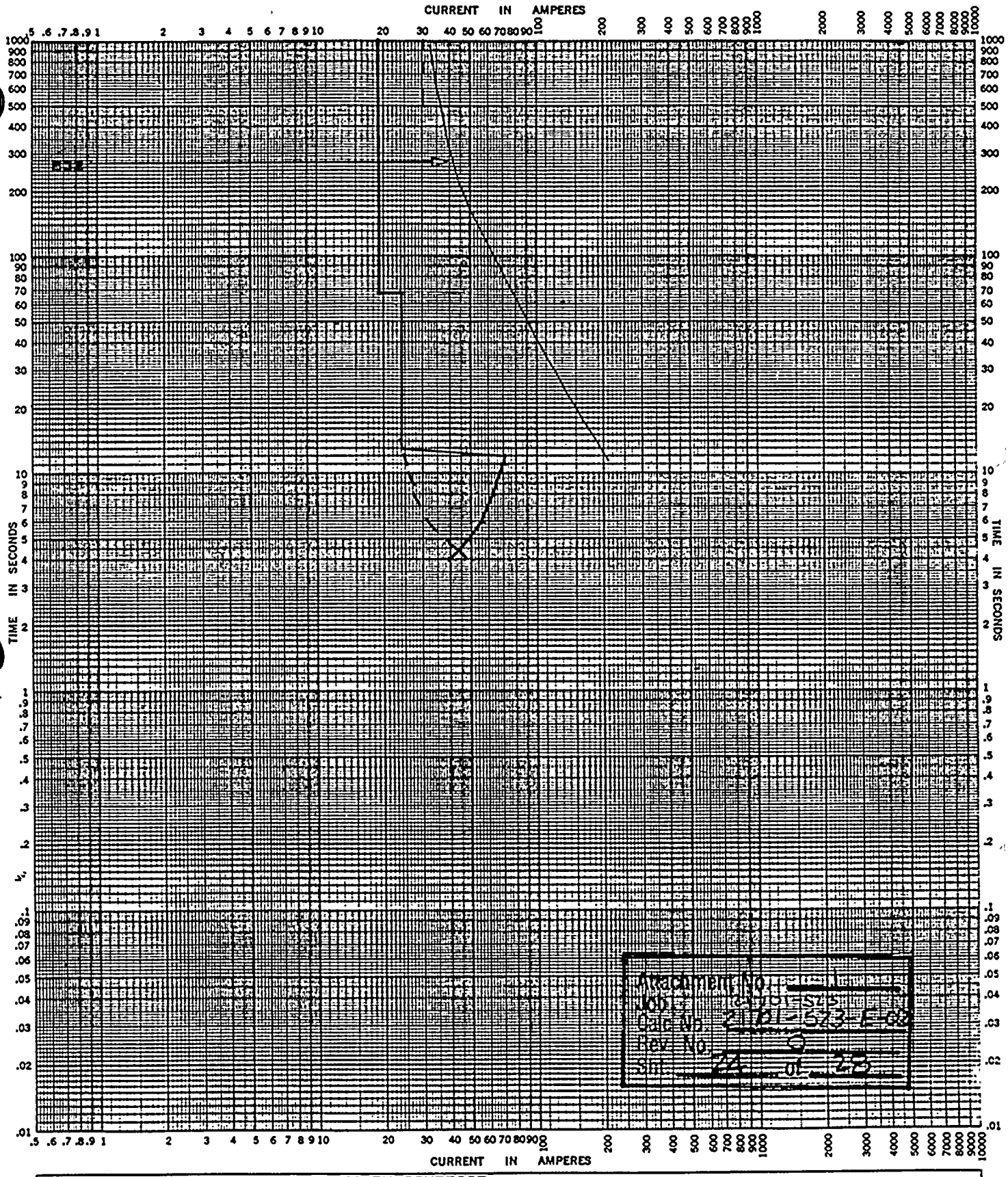
No. _____

Date 3/18/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258

3/27/92

3/27/92



ELEC EQ RM COMPRSSR

TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

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

2. Curves are plotted to _____ Test points so variations should be _____

FIGURE 24

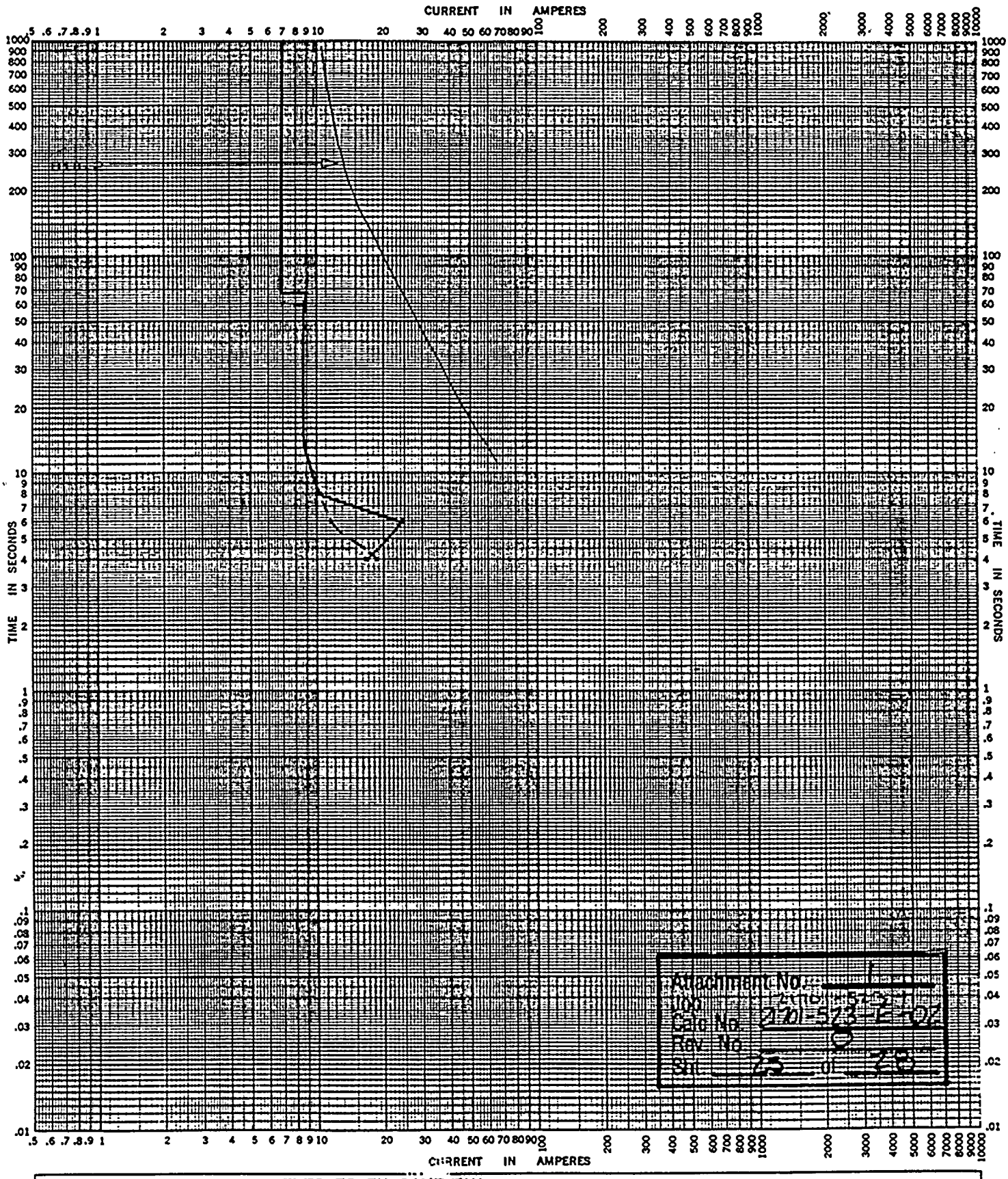
No. _____

Date 3/17/92

Attachment No. 1
Job No. 16191-543
Calc No. 21191-543-E-02
Rev No. 0
Sht 22 of 28

3/27/92
3/27/92

K·E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 48 5258



Attachment No. 4 (to 57-2)
UOD Calc No. 270-573-E-002
Rev. No. 0
Sht 25 of 38

ELEC EQ RM COND FAN TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

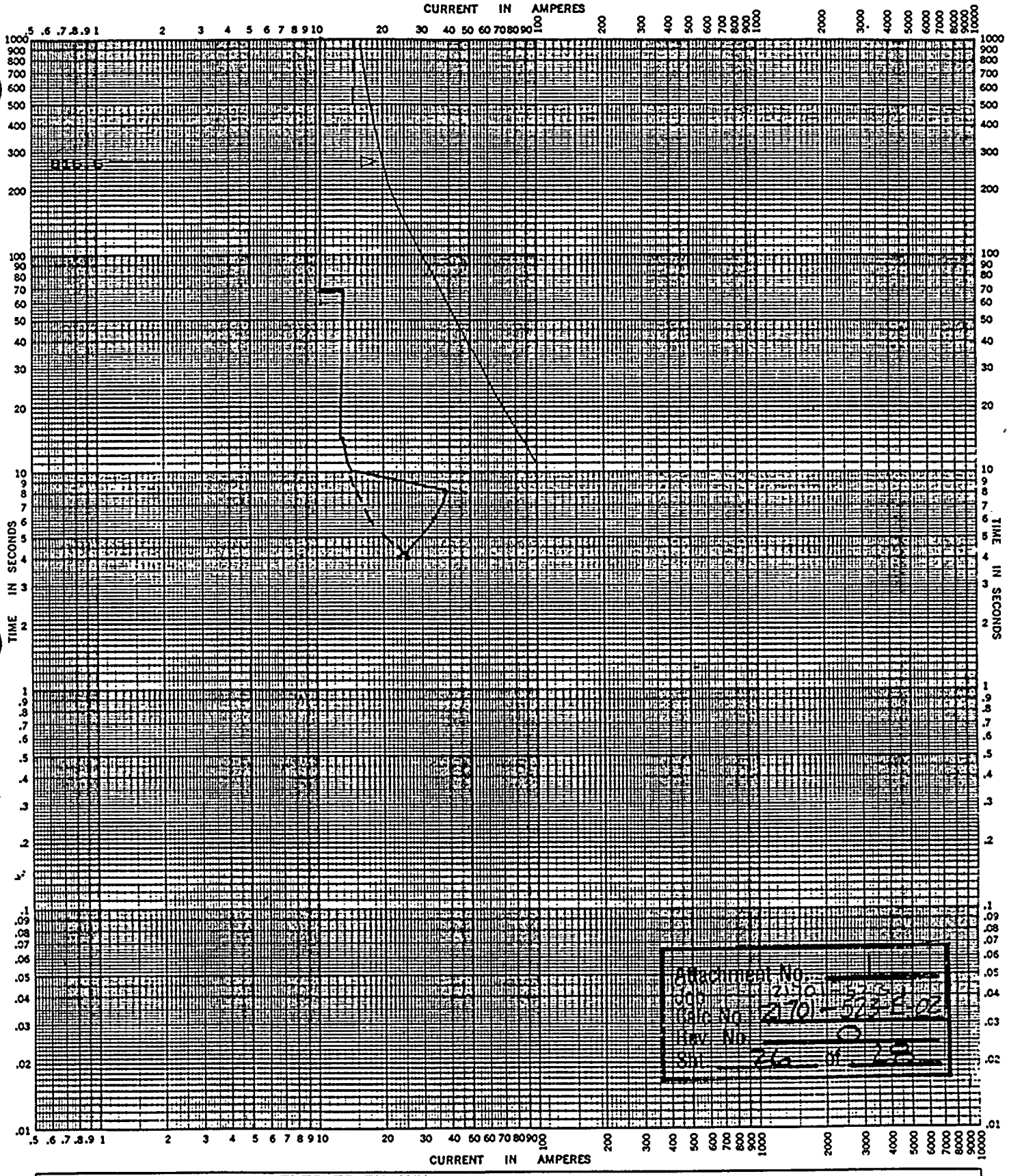
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at 480 V Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to _____ Test points so variations should be _____

FIGURE 25
No. 3/17/92
Date

K+E TIME-CURRENT CHARACTERISTIC 48 5258
KEUFFEL & ESSER CO. MADE IN U.S.A.

PJA 3/27/92
RRL 3/27/92



Attachment No. 2
Calc No. 270-523-E-02
Rev No. 0
Sht 26 of 28

ELEC EQ RM AHU
TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

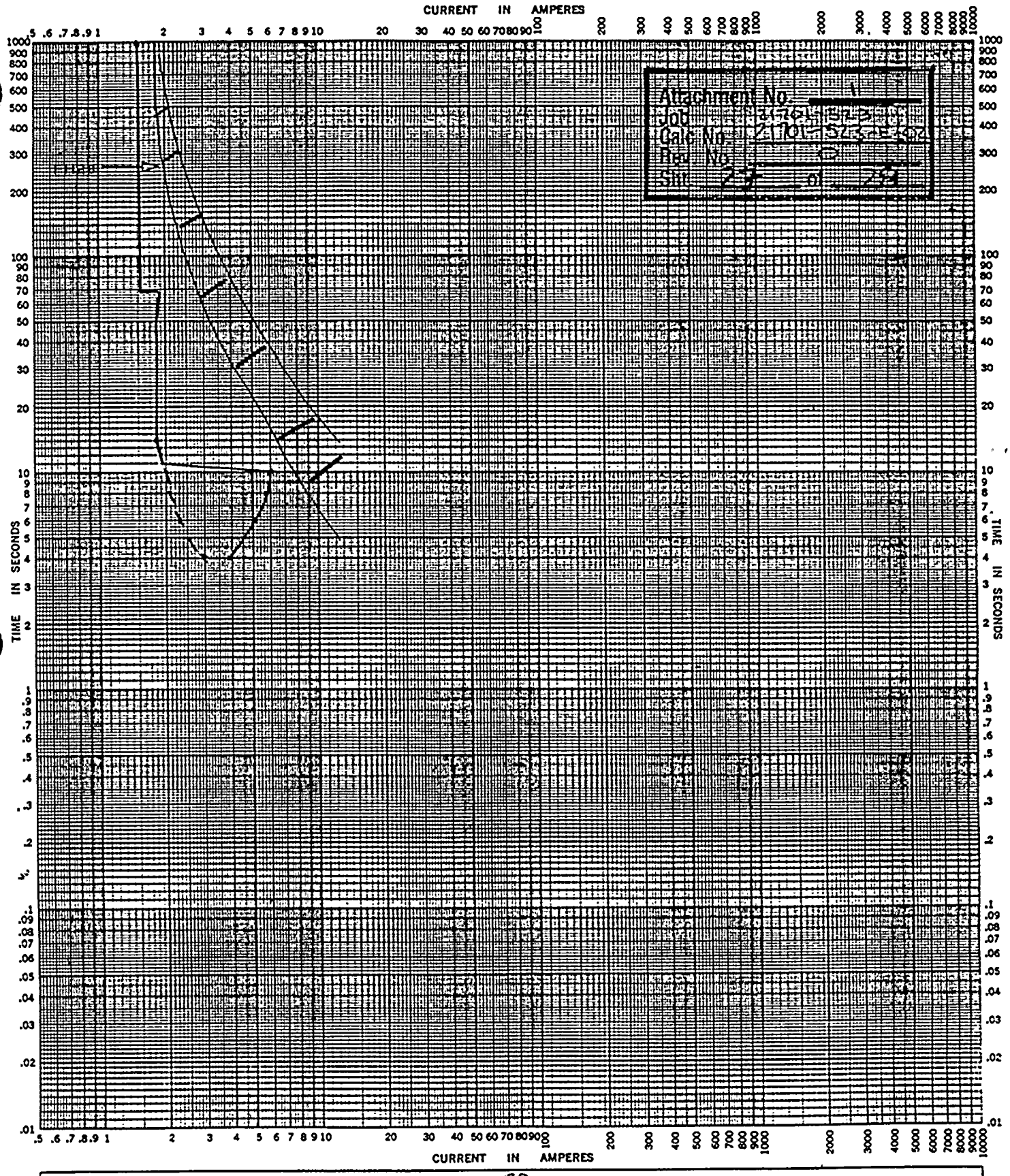
1. Tests made at 480 V Volts a-c at _____ p-f., starting at 25C with no initial load _____

2. Curves are plotted to _____ Test points so variations should be _____

FIGURE 26
No. _____
Date 3/17/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258

PJB 3/27/92
AAZ 3/27/92



EDG FUEL OIL XFER PP 3B
TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

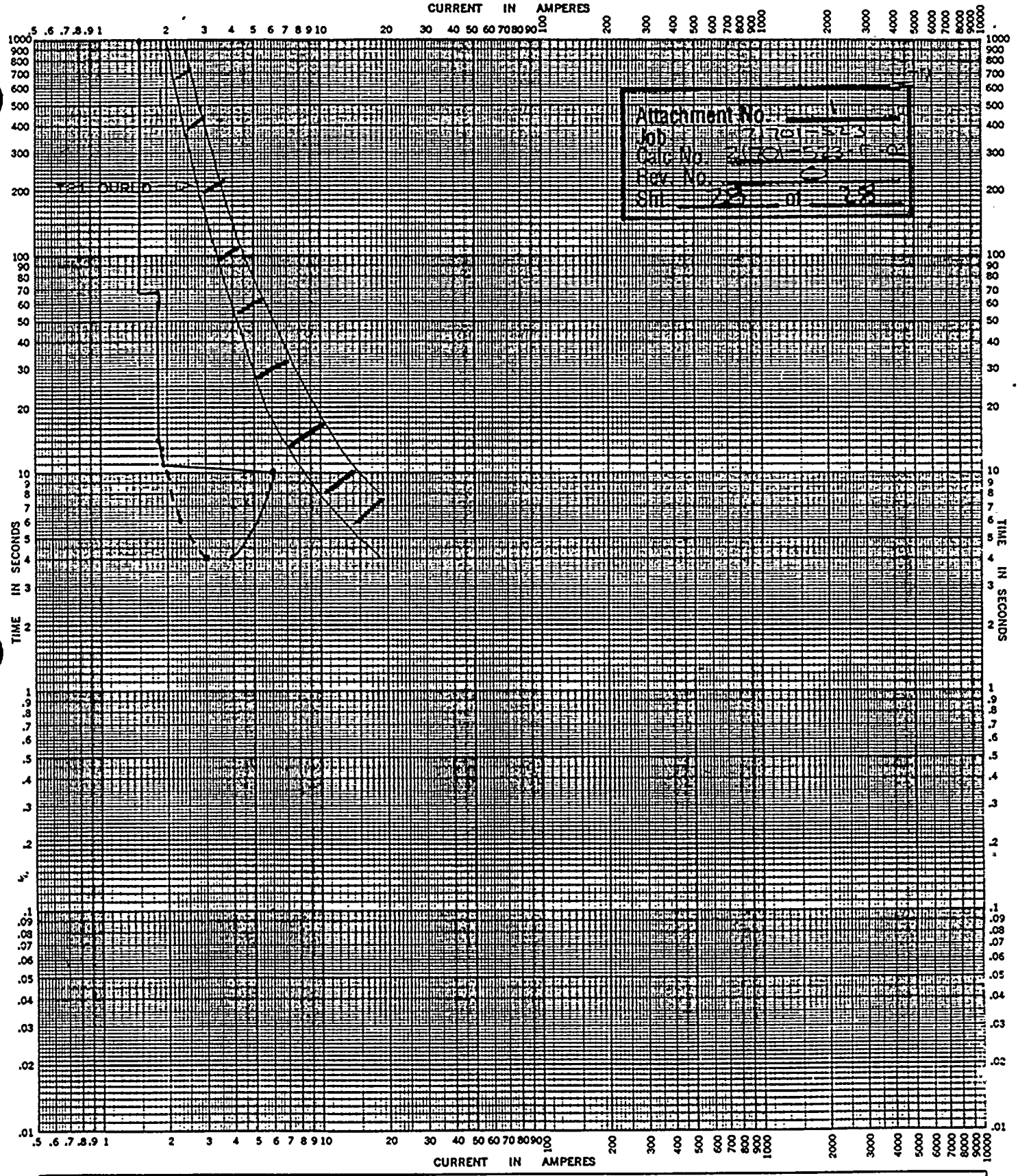
BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

No. FIGURE 27
Date 3/10/92

Paul Smith 3/27/92
TTT 3/27/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258



EDG FUEL OIL XFER PP 3A

TIME-CURRENT CHARACTERISTIC CURVES

For _____ Fuse Links. In _____

BASIS FOR DATA Standards _____ Dated _____

1. Tests made at _____ Volts a-c at _____ p-f., starting at 25C with no initial load _____
2. Curves are plotted to 480 V Test points so variations should be _____

FIGURE 28
No. _____
Date 3/10/92

K•E TIME-CURRENT CHARACTERISTIC KEUFFEL & ESSER CO. MADE IN U.S.A. 46 5258

PJF 3/27/92
ZZZ 3/27/92

FLORIDA POWER & LIG
INTER-OFFICE CORRESPC

PC/M 91-036(UNIT 4)
PAGE 17 OF 40
INPUT DATA REF. NO. 8
SHEET 1 OF 14

TO Mr. W. E. Coe

DATE August 11, 1970

FROM W. H. Rogers, Jr./J. B. Olmstead

COPIES TO J. R. Bensen w/ enclosure
C. R. Stone w/ enclosure

SUBJECT: TURKEY POINT UNIT 3
4 KV MOTOR DATA

Attached is the information requested in your August 4, 1970, memo less the items noted in the Bechtel letter.

JBO/mm

W.H. Rogers Jr.

Attachment No. 2
Job 21701-323
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 1 of 9

FLORIDA POWER & LI
INTER-OFFICE CORRES

RC/M 91-036 (UNIT 4)
PAGE 18 OF 40
INPUT DATA REF. No. 8
SHEET 2 OF 14

TO Mr. W. [redacted]

DATE October 12, 1970

FROM W. H. Rogers, Jr./S. G. Brain

COPIES TO E. L. Bivans w/enc.
Herb Paul w/enc.
J. W. Williams, Jr. w/enc. (
J. R. Bensen w/enc.

SUBJECT: TURKEY POINT UNITS #3 & #4
TIME CURRENT CURVES

Enclosed are the time current curves for Turkey Point #3 & #4, safety injection pumps, component cooling pumps and residual heat removal pumps.

W. H. Rogers Jr

SGB/mm

Enclosures

Attachment No. 2
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 2 of 9

PC/M 91-036 (UNIT 4)
PAGE 19 OF 40
INPUT DATA REF. NO. 8
SHEET 3 OF 14

Post Office Box 607
9801 Shady Grove Road
Gaithersburg, Maryland 20760

August 6, 1970

Attachment No. 2
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 3 of 9

Mr. W. H. Rogers, Jr.
Power Plant Engineering Manager
Florida Power & Light Company
P. O. Box 3100
Miami, Florida 33101

Dear Mr. Rogers:

Subject: Florida Power & Light Company
Turkey Point, Units No. 3 & 4
Bechtel Job 5610
4160V. Motor Data
Bechtel File: 5700
FB-1201

Our Project Superintendent has forwarded to us your request for 4160 volt motor data for the benefit of relay settings.

We attach two sets of the following data:

Motor Data Sheets 25.11-1 and -2 covering all 4160 volt motors.
Safe Time/Current curves on:
- Steam Generator Feed Pump Motor
- Condensate Pump Motor
- Turbine Plant Cooling Water Pump Motor
- Circulating Water Pump Motor
- Intake Cooling Water Pump Motor
- Heater Drain Pump Motor

The remaining four motors are part of the NSSS and we do not have their safe time/current curves. We are writing to Westinghouse requesting that they promptly send you these curves.

Very truly yours,

ORIGINAL SIGNED BY
N. BHATIA

N. K. Bhatia
Project Engineer

JTP:tst

Enclosures (2 sets)

cc: G. Kinsman, J. Coughlin, B. H. Werry, J. W. Keck/J. C. Walden, J. W. Williams (w/a), E. L. Bivans, J. R. Bensen.

PAGE 20 OF 40
INPUT DATA REF. No. 8
SHEET 4 OF 14

	4	4	6	4	8
	Heater Drain Pp	Turb. Plt. Cl. WtrPp	Intake Cl. WtrP	Condens. Pump	Circ. W Pum
MANUFACTURER	LA	LA	LA	LA	W
TYPE	WPX	WPX	WPX	WPX	CS
FRAME DESIGNATION	687 P	648 SU	589	809 PT	75.5
HORSEPOWER OUTPUT	800	400	325	2250	1250
TIME RATING/TEMP. RISE °C	Ct./60	Ct./60	Ct./60	Ct./60	Ct./60
RPM AT FULL LOAD	1785	1785	890	1190	236
VOLTAGE	4000	4000	4000	4000	4000
FULL LOAD AMPS	101	54	45	276	188
*ENCLOSURE	WP II	WP II	WP II	WP II	WP II
VERTICAL OR HORIZONTAL	V	H	V	V	V
BEARINGS (SLEEVE OR BALL)	Ball	Sleeve	Ball	Ball	Kings.
TYPE OF LUBRICATION	Oil	Oil	Oil	Oil	Oil
INSULATION CLASS	B	B	B	B	B
ROTATION (VIEWED FROM END OPP. SHFT)	CCW	CW	Either	CW	CCW
FULL LOAD TORQUE	2333	1175	1900	9843	28,000
STARTING TORQUE - % OF FULL LOAD	112	102	101	118	73
EFFICIENCY - 100% LOAD	94.4	93.8	92.8	95.8	
- 75% LOAD	94.2	93.8	93.0	95.8	
- 50% LOAD		93.0	92.2	95.5	
SERVICE FACTOR	1.15	1.15	1.15	1.15	1.15
IS THERMAL PROTECTION PROVIDED				No	
WEIGHT	6900	3350	5500	15,000	23,200
PHASE	3	3	3	3	3
FREQUENCY	60	60	60	60	60
LOCKED ROTOR CURRENT	600	275	261	1950	860
POWERFACTOR - 100% LOAD	88.7	85	82.2	90.0	
- 75% LOAD	87.0	81	78.0	88.9	
- 50% LOAD		72	66.2	85.1	
NEMA DESIGN LETTER					
SECONDARY AMPS @ FULL LOAD					
SECONDARY VOLTAGE					
SECONDARY OHMS					
BREAKDOWN OR PULLOUT TORQUE - %			~~230~~	265	
RATED FIELD CURRENT					
RATED EXCITER VOLTAGE					
RATED POWER FACTOR					
PULL IN TORQUE - % OF FULL LOAD					
TYPE OF WINDING					
SHUNT FIELD CURRENT					
ALLOWABLE WK² OF LOAD	100	35.8	270	1050	41,000
SPACE HEATERS - WATTS/VOLTS	320/120	270/120	540/120	540/120	3000/12
TWO SPEED MOTORS - NO OF WINDINGS					
TORQUE					
THRUST BEARING CAPACITY - UP (LBS)	---	---	30%	6000	
CAPACITY - DOWN (LBS)	16,000	---	18,590	19,500	42,000

Attachment No. 2
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 4 of 9

*ENCLOSURE: DRIPPROOF (DP), SPLASHPROOF (SP), WEATHER PROTECTED (WP), TOTALLY ENCLOSED NON-VENTILATED (TENV), TOTALLY ENCLOSED FAN COOLED (TEFC), TOTALLY ENCLOSED PIPE VENTILATED (TEPV) ETC., EXPLOSIONPROOF XP. TO INDICATE GUARDED ADD "G".

BECHTEL CORPORATION
POWER DIVISION ENGINEERING

ELECTRIC MOTOR DATA SHEET

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT UNITS 3 & 4

J03 No 5610

25.11-1

REV. 0

1-17-57

	6	4	4	4	6
	Reactor Cl. Pp.	Stm. Gen. Feed Pp.	Residual Heat Rem. Pp.	Safety Inj. Pp.	Comp Cl. P
MANUFACTURER	W	GE	W	W	W
TYPE	CS	K			CSP
FRAME DESIGNATION	62 SPL	8600	509 UPZ	590 US	686.
HORSEPOWER OUTPUT	6000	7000	300	350	450
TIME RATING/TEMP. RISE °C	Ct./ 70	Ct./ 60	/	Ct./ 60	/
RPM AT FULL LOAD	1189	3575	1781	3566	1180
VOLTAGE	4000	4000	4000	4000	4000
FULL LOAD AMPS	760	873	37.6	45.3	57.2
*ENCLOSURE	DP	WP II	WP I	WP I	WP I
VERTICAL OR HORIZONTAL	V	H	V	H	H
BEARINGS (SLEEVE OR BALL)	Kings.	Sleeve		Ball	Ball
TYPE OF LUBRICATION	Oil	Oil			
INSULATION CLASS	B	B	B	B	
ROTATION (VIEWED FROM END OPP.SHFT)	CCW	CW		CW	
FULL LOAD TORQUE		10,300			
STARTING TORQUE-% OF FULL LOAD		70	128	108	
EFFICIENCY - 100% LOAD		95.9	93.4	94.0	
- 75% LOAD		95.3	93.4	93.7	
- 50% LOAD		93.3	92.5	92.4	
SERVICE FACTOR		1.15	1.15	1.15	
IS THERMAL PROTECTION PROVIDED		Yes			
WEIGHT	68,700		3400		4200
PHASE	3	3	3	3	3
FREQUENCY	60	60	60	60	60
LOCKED ROTOR CURRENT	4800	5670	234	290	270
POWERFACTOR - 100% LOAD		90	88.5	88.3	
- 75% LOAD		88	86.1	86.1	
- 50% LOAD		83	79.3	79.7	
NEMA DESIGN LETTER				B	
SECONDARY AMPS @ FULL LOAD					
SECONDARY VOLTAGE					
SECONDARY OHMS					
BREAKDOWN OR PULLOUT TORQUE-%		200	270	266	
RATED FIELD CURRENT					
RATED EXCITER VOLTAGE					
RATED POWER FACTOR					
PULL IN TORQUE - % OF FULL LOAD					
TYPE OF WINDING					
SHUNT FIELD CURRENT					
ALLOWABLE WK² OF LOAD					
SPACE HEATERS - WATTS/VOLTS	2500/ 208	2400/ 240	/	200/ 120	/
TWO SPEED MOTORS-NO OF WINDINGS					
TORQUE					
THRUST BEARING CAPACITY-UP (LBS)		---			
CAPACITY-DOWN (LBS)		---			

Attachment No. 2
Job 21701-523
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*ENCLOSURE; DRIPPROOF (DP), SPLASHPROOF (SP), WEATHER PROTECTED (WP), TOTALLY ENCLOS
NON-VENTILATED (TENV), TOTALLY ENCLOSED FAN COOLED (TEFC), TOTALLY ENCLOSED PIPE V
ILATED (TEPV) ETC., EXPLOSIONPROOF XP. TO INDICATE GUARDED ADD "G".

ALL MOTORS: DATE | APPROVALS | MATL | SUPV | CHK | DR | ENG | DESCRIPTION | REV. 0
A-C MOTORS: SQ. CAGE OR WOUND R. | SYNCH. | D-C
SPECIAL FEATURES

BECHTEL CORPORATION
POWER DIVISION ENGINEERING

ELECTRIC MOTOR DATA SHEET

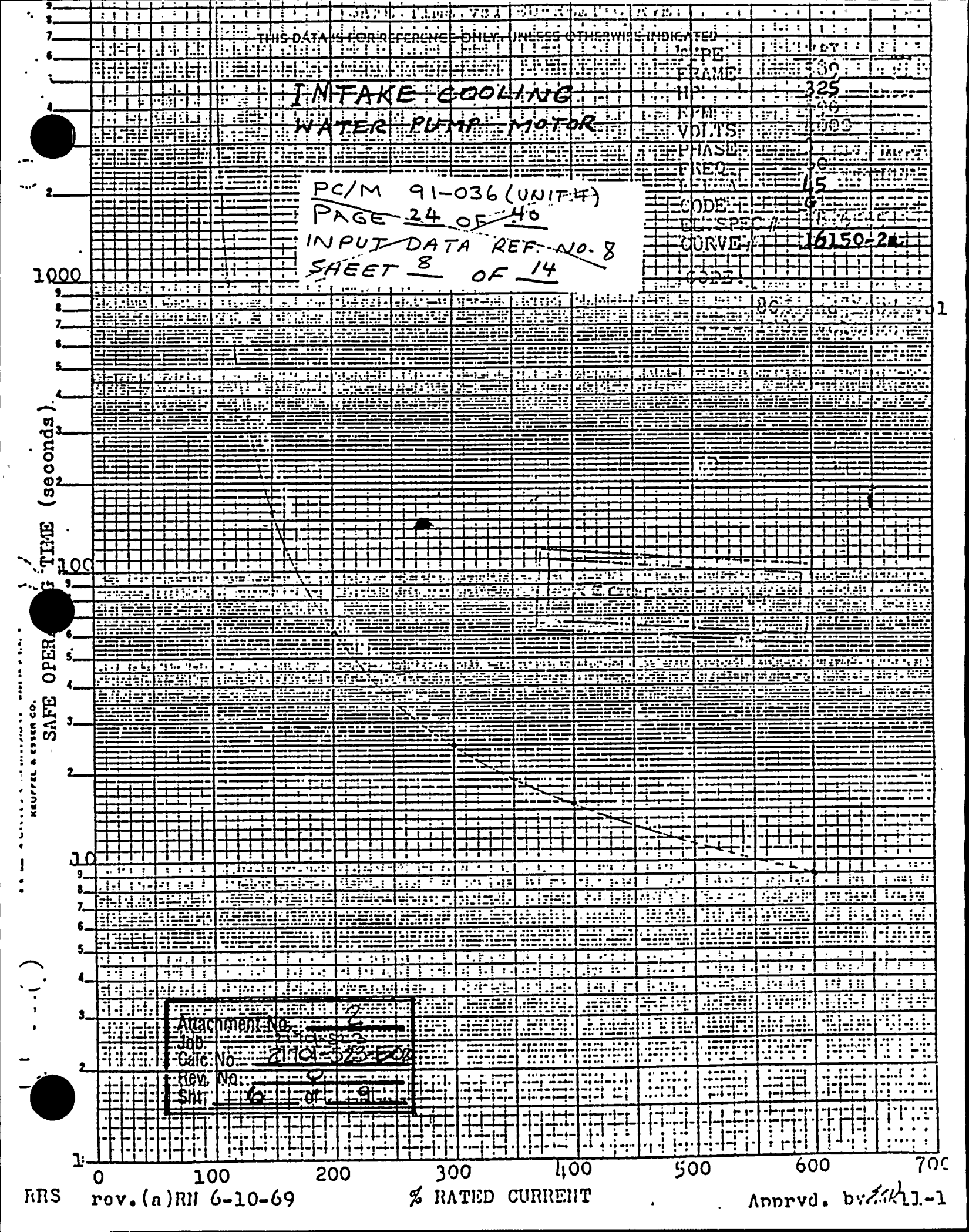
FLORIDA POWER & LIGHT COMPANY
TURKEY POINT UNITS 3 & 4

JCB No 5610

25.11-2

RE

G-102 6-17-57


THIS DATA IS FOR REFERENCE ONLY, UNLESS OTHERWISE INDICATED
INTAKE COOLING
WATER PUMP MOTOR
PC/M 91-036 (UNIT 4)
PAGE 24 OF 40
INPUT DATA REF. NO. 8
SHEET 8 OF 14
FRAME
HP
VOLTS
PHASE
CODE
CURVE
SAFE OPERATING TIME (seconds)
% RATED CURRENT
KEUFFEL & ESSER CO.
Attachment No. 6
Calc No. 2110-52-E-08
Rev. No. 0
Sht 6 of 9
RRS rev.(a)RH 6-10-69
Apprvd. by

TURKEY POINT UNITS 3 & 4

TIME - CURRENT CURVE

WY-35820-L7 - 68F15106

FLA 37.2 300HP S.F. 1.15 1781 R.P.M.

RESIDUAL HEAT

RE-MAG VR1

PC/M 91-036 (UNIT 4)
PAGE 28 OF 40
INPUT DATA REF. NO. 8
SHEET 12 OF 14

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Job No. 21801-522-E00
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TIME IN MINUTES

3 CYCLES X 10 DIVISIONS PER INCH

100 200 300 400 500 600 700

PERCENT F.L. CURRENT

TURKEY POINT UNITS 3 & 4

SAFETY INJECTION PUMPS

TIME - CURRENT CURVE

NA-3474-L7-67F62573

ELA-4553 350HP 4000V 3566 RPM

PCIM 91-036 (UNIT 4)
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INPUT DATA REF. NO. 8
SHEET 13 OF 14

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Job 21701-521
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TIME IN MINUTES

3 CYCLES X 10 DIVISIONS PER INCH

10 9 8 7 6 5 4 3 2 1 .9 .8 .7 .6 .5 .4 .3 .2 .1

100 200 300 400 500 600 700

SIP 2/4/71

RO 542 10529-B COMPONENT COOLING PUMP

TURKEY POINT UNITS 3 & 4

TIME - CURRENT CURVE

NA-53843-L7, 6.0 CR 368V

FLA 57.2, 1.0 S.F. 450 HP 4000V 1185 RPM

PC/M 91-036 (UNIT 4)

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INPUT DATA REF. NO. 8

SHEET 14 OF 14

Attachment No. 2
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Minutes

100 200 300 400 500 600 700

MOTOR DATA SHEET

	EXISTING	PROPOSED BY VENDOR
QUANTITY		1
Service	Component Cooling Water Pump Motor	
Manufacturer	Westinghouse	
Type	CSP-Squirrel Cage Induction	
Frame	686.5S	
Horsepower	450	
Time Rating/Temp. Rise °C	Continuous/90°C	
RPM at Full Load	1184	
Voltage	4000	
Full Load AMPS	58	
Enclosure	Dripproof-WPI(WPII Specified)	
Vertical or Horizontal	Horizontal	
Bearings (Sleeve or Ball	Ball	
Type of Lubrication	Oil	
Insulation Class	B (F specified)	
Rotation (Viewed From End Opposite From Shaft)	CW	
Full Load Torque		
Starting Torque, % of Full Load	60	
Efficiency 100% Load	93.0	
75% Load	92.5	
50% Load	92.0	
Service Factor	1.15	
Is Thermal Protection Provided	No	
Weight	4200 lbs.	
Phase	3	
Frequency	60 Hz.	
Locked Rotor Current	320	
Power Factor 100% Load	90.0	
75% Load	88.5	
50% Load	84.0	
NEMA Design Letter	B	
Rated Power Factor		
Pullout Torque, % of Full Load	200	
Pull in Torque, % of Full Load		
Type of Winding	Form Coil	
Allowable WK of Load	Appendix B Curves	
Space Heaters Watts/Volts	300/120	
Max. NO. of Starts Per Hour & Min.	Spec. Section 12.15	
Length of time between starts	Spec. Section 12.15	
Power Cable/Ground Cable Size	3-1/C #4/0AWG/#4AWG	

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RELIANCE ELECTRIC COMPANY
General Offices
24701 Euclid Ave.
Cleveland 17, Ohio

3V3A

Attachment No. 3
Job 21701-523
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Sht. 2 of 10

PERFORMANCE DATA SHEET

INDUCTION MOTOR

NAMEPLATE DATA

FRAME	HP	TYPE / FORM	PHASE / HERTZ	RPM	VOLTS	AMPERES	DUTY	TEMP. RISE °C	DESIGN LETTER	CODE LETTER	ENC
EC444	75	P/BE	3/60	1185	460	88	Cont.	-	-	G	TEA

DESIGN DATA

E/S	ROTOR	DESIGN NUMBER	TEST ON SALES ORDER	TEST DATE	STATOR RESISTANCE AT : (BETWEEN LINES) OHMS
597318	604882-1-R	-	X-324253	1/27/71	.1114

PERFORMANCE

LOAD	HP	AMPERES	RPM	% POWER FACTOR	% EFFICIENCY	KW INPUT
NO LOAD	0	28	1199	5.6	0	1.24
1/4	19	37	1197	56.1	89.6	15.9
2/4	38	50	1195	77.0	92.0	30.8
3/4	57	69	1192	83.2	92.8	45.7
4/4	75	88	1189	86.2	92.9	60.6
5/4	94	110	1185	86.3	92.5	75.8

SPEED TORQUE

	RPM	TORQUE % FULL LOAD	TORQUE LB. FT.	AMPERES
LOCKED ROTOR	0	134	446	554
PULL UP	200	111	369	545
BREAKDOWN	1150	247	820	289
FULL LOAD	1189	———	333	88

ALL DATA ON 460 VOLTAGE CONNECTION. AMPERES AT OTHER VOLTAGES WILL VARY INVERSELY WITH T VOLTAGE.

REMARKS: WR^2 = 39.4

APPROVED BY _____ DATE 3/15/71

E 1293V1 PRINTED IN U.S.A.

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Calc No. 21701-523-E-02
Rev. No. 0
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MOTOR DATA SHEET

QUANTITY	EXISTING	PROPOSED BY VENDOR
Service	ECC Fan	
Manufacturer	Reliance Electric	
Type	Induction	
Frame	364TCZ	
Horsepower	30	
Time Rating/Temp. Rise °C	Cont/220°F (105°C)	
RPM at Full Load	1175	
Voltage	460	
Full Load AMPS	39	
Enclosure	TEAO	
Vertical or Horizontal	Vertical	
Bearings (Sleeve or Ball)	Ball	
Type of Lubrication	Grease	
Insulation Class	H (SPCL)	
Rotation (Viewed Looking Down From Top)	CW Looking Down	
Full Load Torque	134 Lb-Ft	
Starting Torque, % of Full Load	155%	
Efficiency 100% Load	90.4%	
75% Load	90.3%	
50% Load	88.3%	
Service Factor	1.15	
Thermal Protection	No	
Weight	708 Lbs	
Phase	3	
Frequency	60	
Locked Rotor Current	241 Amps	
Power Factor 100% Load	80.8%	
75% Load	74.6%	
50% Load	64.3%	
NEMA Design Letter	A	
Pull out Torque, % of Full Load	216%	
Pull in Torque, % of Full Load	150%	
Type of Winding	Random Squirrel Cage	
Allowable WK^2 of Load	341 Lb-Ft^2	
Space Heaters Watts/Volts	175/120	
Max No of Starts Per Hour	1 Start/Min	
Length of time between starts		
Power Cable/Ground Cable Size		
Thrust Bearing:		
Capacity Up (lbs.)	1600	
Capacity Down (lbs.)	1600	
Minimum Starting Voltage	80%	
Seismic Qualifications	Not Effected	

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RPA #631066352
Attachment C
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MOTOR DATA SHEET

QUANTITY	EXISTING	PROPOSED BY VENDOR
Service	ECF Fan	
Manufacturer	Reliance Electric	
Type	Induction	
Frame	444TCZ	
Horsepower	75	
Time Rating/Temp. Rise °C	Cont/-	
RPM at Full Load	1185	
Voltage	460	
Full Load AMPS	88	
Enclosure	TEAO	
Vertical or Horizontal	Vertical	
Bearings (Sleeve or Ball)	Ball	
Type of Lubrication	Grease	
Insulation Class	Class H Type RN	
Rotation (Viewed Looking Down From Top)	CW Looking Down	
Full Load Torque	333 Lb-Ft	
Starting Torque, % of Full Load	134%	
Efficiency 100% Load	92.9%	
75% Load	92.8%	
50% Load	92.0%	
Service Factor	1.15	
Thermal Protection	No	
Weight	1300 Lbs	
Phase	3	
Frequency	60	
Locked Rotor Current	554 Amps	
Power Factor 100% Load	86.2%	
75% Load	83.2%	
50% Load	77.0%	
NEMA Design Letter	B	
Pull up Torque, % of Full Load	111%	
Breakdown Torque, % of Full Load	247%	
Type of Winding	Random Squirrel Cage	
Allowable WK^2 of Load	904 Lb-Ft^2 (min)	
Space Heaters Watts/Volts	264 W/120/1/60	
Max No of Starts Per Hour	2 Cold/1 Hot per NEMA	
Length of time between starts		
Power Cable/Ground Cable Size	#4/#4 AWG	
Thrust Bearing:		
Capacity Up (lbs.)		
Capacity Down (lbs.)		
Minimum Starting Voltage	80%	

Rich Wilson - Reliance Elect.

REL. S.O.	FRAME	HP	TYPE	PHASE/ HERTZ	RPM	VOLTS
SYZ-00344	145T	2	P	3/60	1740	460

AMPS	DUTY	AMB°C/ INSUL.	S.F.	NEMA DESIGN	CODE LETTER	ENCL.
2.7	CONT	40/H*	1.15	B	K	TEAO

E/S	ROTOR	TEST S.O.	TEST DATE	STATOR RES.@25°C OHMS (BETWEEN LINES)
536030	602482-09-AE	---	---	7.79

PERFORMANCE

LOAD	HP	AMPERES	RPM	% POWER FACTOR	% EFFICIENCY
NO LOAD	0	1.3	1800	8.67	0
1/4	.50	1.4	1786	42.3	79.7
2/4	1.00	1.7	1772	64.2	86.1
3/4	1.50	2.1	1757	75.6	87.1
4/4	2.00	2.7	1741	80.8	86.5
5/4	2.50	3.3	1722	82.7	85.0

SPEED TORQUE

	RPM	TORQUE % FULL LOAD	TORQUE LB.-FT.	AMPERES
LOCKED ROTOR	0	255	15.4	20.6
PULL UP	250	253	15.2	20.6
BREAKDOWN	1375	358	21.6	13.0
FULL LOAD	1741	100	6.04	2.7

AMPERES SHOWN FOR 460. VOLT CONNECTION. IF OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE. The motor is capable of starting with 75% of rated voltage.

REMARKS: TYPICAL DATA
*TYPE RH INSULATION
P.O. 116647, E+W CODE K0388

RELIANCE ELECTRIC
CLEVELAND, OHIO 44117 U.S.A.

DR. BY C.D.
CK. BY R.W.WILSON
APP. BY J.S.POKELSEK
DATE 04/20/90

A-C MOTOR PERFORMANCE DATA

E2001A-A-001
ISSUE DATE 04/20/90

SWGR 3D Room Supply Fan 3V65A
Vendor Manual V0064.77

File W79258
~~K0388-8~~
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MOTOR NUMBER TOTAL QUANTITY	3	3	6	2	4
SERVICE	Screen Wash Pp.	Inst. Air Comp.	Charging Pump	Spt. Fuel Pit Pump	Cont. Sy Purop
MANUFACTURER	W	LA	W	W	W
TYPE	CS	CJX			
FRAME DESIGNATION	445 UPY	444 U	444 TS		449 TS
HORSEPOWER OUTPUT	100	75	150	100	250
TIME RATING/TEMP. RISE °C	Ct./55	Ct./55	/	/	Ct./
RPM AT FULL LOAD	1780	1775	1770	1775	3550
VOLTAGE	460	460	460	460	460
FULL LOAD AMPS	118	93	169		275
*ENCLOSURE	TEFC	TEFC	DP		WP I
VERTICAL OR HORIZONTAL	V	H	H	H	H
BEARINGS (SLEEVE OR BALL)	Ball	Ball			Ball
TYPE OF LUBRICATION					
INSULATION CLASS	B	B	B		B
ROTATION (VIEWED FROM END OPP.SHFT)	CCW				
FULL LOAD TORQUE	293				
STARTING TORQUE-% OF FULL LOAD	125		120		50
EFFICIENCY - 100% LOAD	90.5		92.5		94.0
- 75% LOAD	90.0		92.6		93.6
- 50% LOAD	88.0		91.9		93.0
SERVICE FACTOR	1.15	1.15	1.15		1.15
IS THERMAL PROTECTION PROVIDED	NO	NO	NO	NO	NO
WEIGHT	2070				1850
PHASE	3	3	3	3	3
FREQUENCY	60	60	60	60	60
LOCKED ROTOR CURRENT	725	558	981		1800
POWERFACTOR - 100% LOAD	89.0		90.1		90.5
- 75% LOAD	88.0		88.7		90.0
- 50% LOAD	83.5		83.8		87.5
NEMA DESIGN LETTER	B	B			
SECONDARY AMPS @ FULL LOAD					
SECONDARY VOLTAGE					
SECONDARY OHMS					
BREAKDOWN OR PULLOUT TORQUE-%	200		230		200
RATED FIELD CURRENT					
RATED EXCITER VOLTAGE					
RATED POWER FACTOR					
PULL IN TORQUE - % OF FULL LOAD					
TYPE OF WINDING					
SHUNT FIELD CURRENT					
ALLOWABLE WK² OF LOAD					
SPACE HEATERS - WATTS/VOLTS	/	150/120	/	/	100/120
TWO SPEED MOTORS-NO OF WINDINGS					
TORQUE					
THRUST BEARING CAPACITY-UP (LBS)					
CAPACITY-DOWN (LBS)	3213				

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*ENCLOSURE; DRIPPROOF (DP), SPLASHPROOF (SP), WEATHER PROTECTED (WP), TOTALLY ENCLOSED NON-VENTILATED (TENV), TOTALLY ENCLOSED FAN COOLED (TEFC), TOTALLY ENCLOSED PIPE VENTILATED (TEPV) ETC., EXPLOSIONPROOF XP. TO INDICATE GUARDED ADD "G".

DATE | APPROVALS | MATL | SUPV | CHK | DR | ENG | DESCRIPTION | REV.

ALL MOTORS
A.C MOTORS — 3Ø. CAGE OR WOUND R. — SYNCH. — D.C
SPECIAL FEATURES

BECHTEL CORPORATION
POWER DIVISION ENGINEERING

ELECTRIC MOTOR DATA SHEET

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT UNITS 3 & 4

JOB No 5610

11-3

REV. 0

5-10-57
6-17-57

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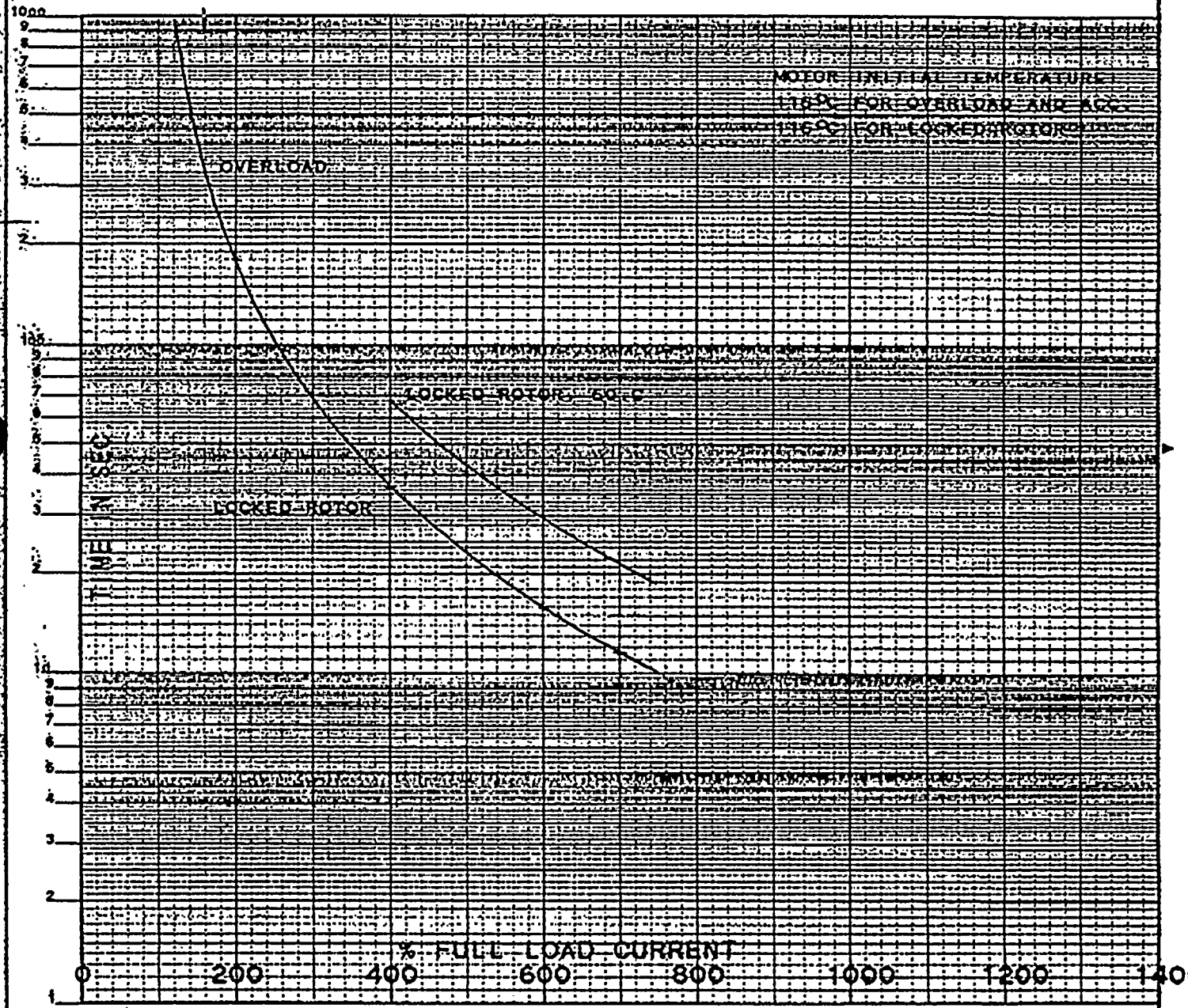
Sht. 1 of 10 PJS 3/27/92

IEEE 620 → STATOR LIMITED @ 215°C Total Temp.
300' motorette sensed
0 heat dissipation
Doesn't include vent and fan

REL. S.O. SYZ-00423	RPM 1180	S.F. 1.0	ROTOR 414957-72-GE
FRAME 444TCZ	VOLTS 460	NEMA DESIGN B	TEST S.O. TYPICAL DATA
HP 75	AMPS 88.3	CODE LETTER H	TEST DATE ---
TYPE P	DUTY CONT	ENCLOSURE TEAO	STATOR RES.@ 25°C .117
PHASE/HERTZ 3/60	AMB°C/INSUL 50/H*	E/S 497211	OHMS (BETWEEN LINES)



THERMAL LIMIT CURVE

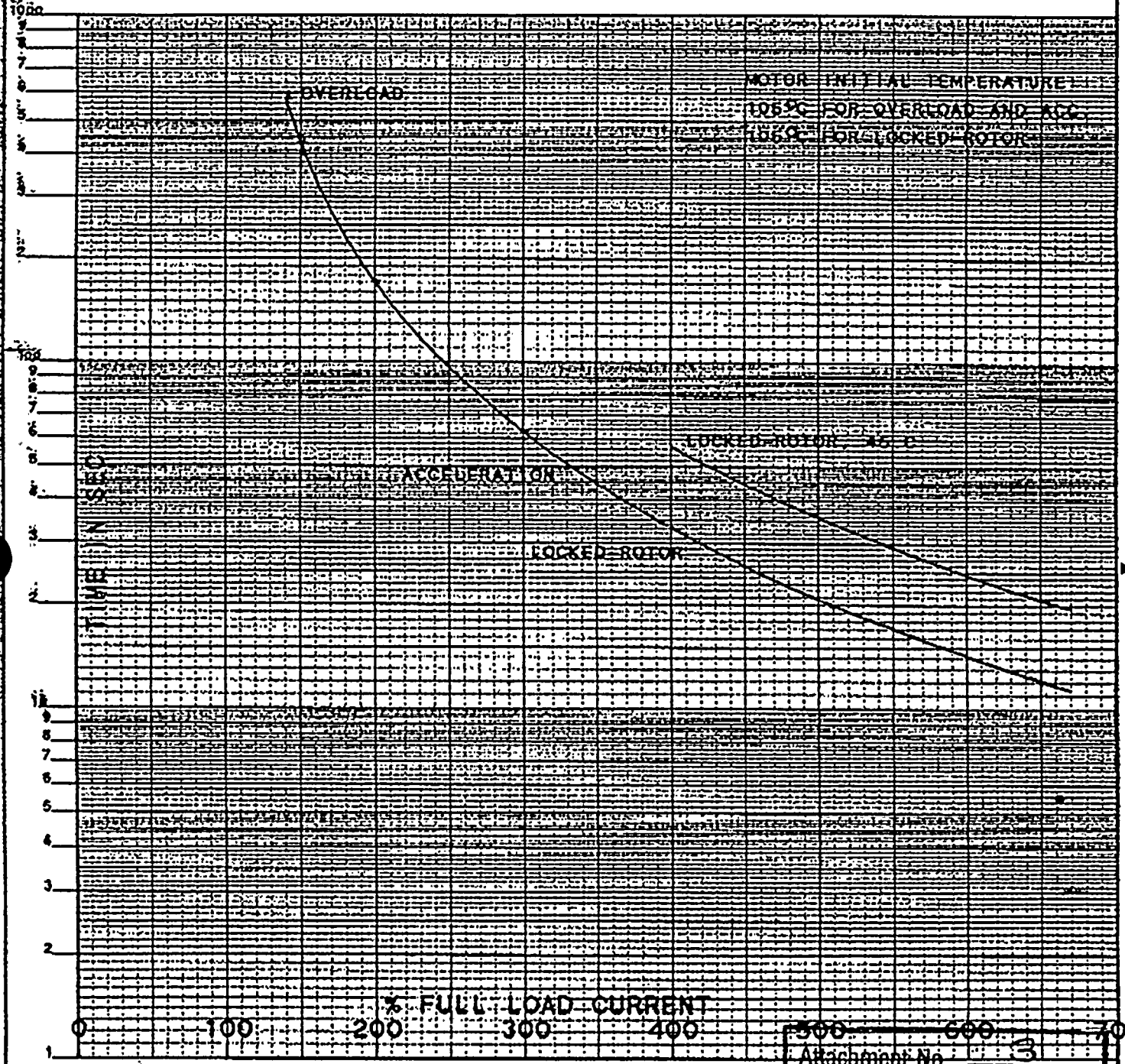
REMARKS: *TYPE RN INSULATION
P.O.# NG8812, JOY P/N 600276-7R

AMPERES SHOWN FOR 460 VOLT CONNECTION. OR OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE.

RELIANCE ELECTRIC CLEVELAND, OHIO 44117 U.S.A.	DR. BY C.D CK. BY T.ROGANO APP. BY R.W.WILSON (for) DATE 02/25/92	A-C MOTOR PERFORMANCE CURVES	E8268A-A-001 ISSUE DATE 02/25/92

File W79235

REL. S.O. SYZ-00393	RPM 1175	S.F. 1.15	ROTOR 417032-1-BPF
FRAME 364TCZ	VOLTS 460	NEMA DESIGN A	TEST S.O. TYPICAL DATA
HP 30	AMPS 39.0	CODE LETTER H	TEST DATE ---
TYPE P	DUTY CONT	ENCLOSURE TEAO	STATOR RES.@ 25°C .394
PHASE/HERTZ 3/60	AMB°C/INSUL 45/H*	E/S 591242	OHMS (BETWEEN LINES)



THERMAL LIMIT CURVE

REMARKS: *TYPE RN INSULATION

P.O. NG8339, P/N 600276-8R

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AMPERES SHOWN FOR 460 VOLT CONNECTION, OR OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE.

RELIANCE ELECTRIC
CLEVELAND, OHIO 44117 U.S.A.

DR. BY C.D.
CK. BY T.RODANO
APP. BY R.W.WILSON
DATE 02/26/92

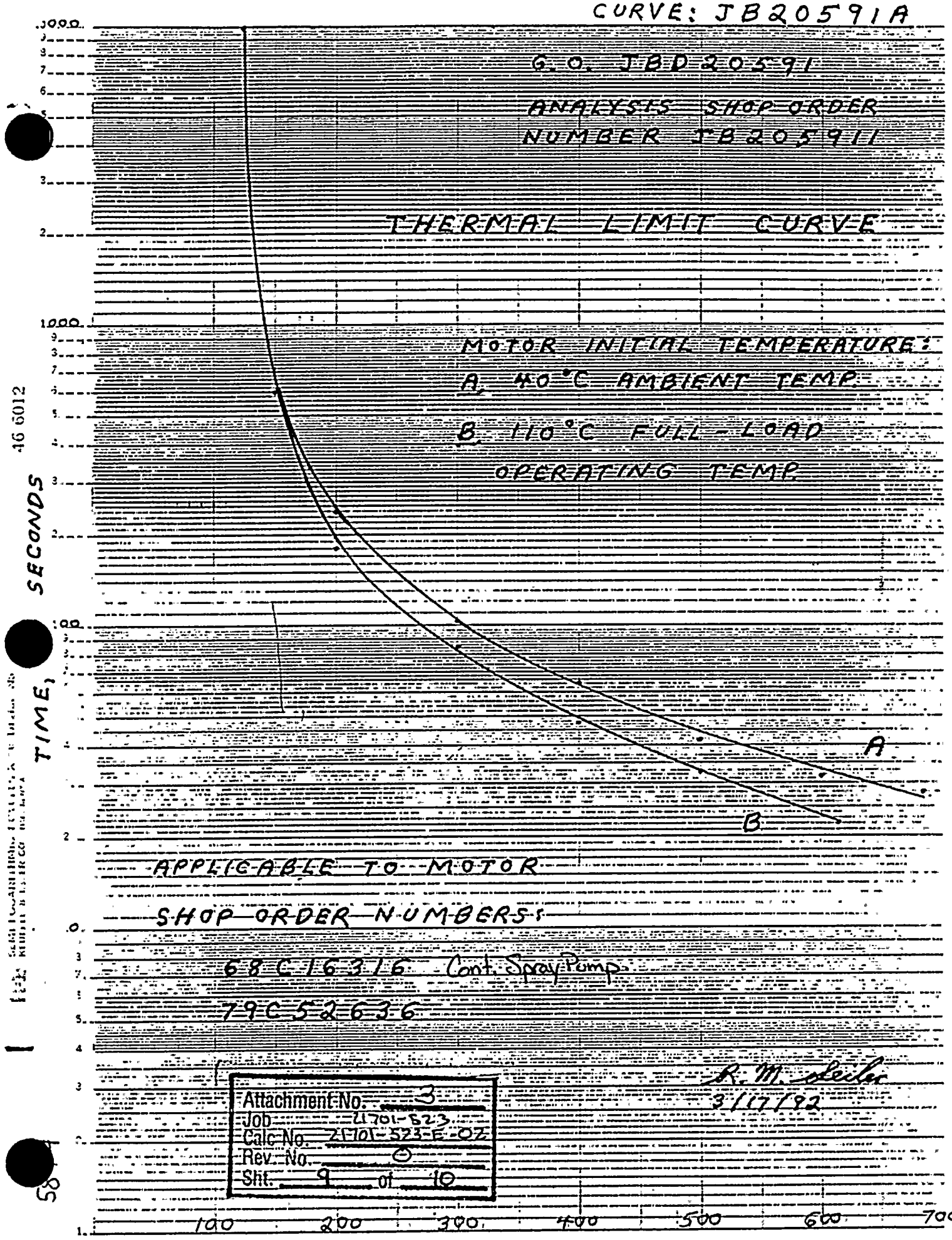
A-C MOTOR PERFORMANCE CURVES

E5237A-A-001

ISSUE DATE 02/26/92

File W79233

CURVE: JB20591A



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R. M. Leiter
3/17/82

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PCM 89-587
REV. 0
ATTACHMENT 5
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SEISMIC ANALYSIS REQUIREMENTS

Data For 3V36

EQUIPMENT QUALIFIED: ELECTRIC MOTOR

EQUIPMENT DESCRIPTION:

2.0	HP	1730	RPM
145T	FRAME	TEFC-SXT	ENCLOSURE
1.15	SERVICE FACTOR	460/3/60	Volts/Phases/Frequency
2.7	FULL LOAD AMPS	613062-14	MOTOR D/S No.
		2.4	MAX. BRAKE HP

TYPE OF ANALYSIS

Seismic analysis has been performed utilizing a proprietary computer program No. 831 and supported by a number of other proprietary computer programs and hand calculations.

COMPUTER RUNS: 2100.044; 2100.0441

FUNCTIONAL REQUIREMENTS:

The equipment is required to operate without damage to itself and surrounding equipment during and after the events specified.

EXTERNAL LOADS: Motor sheave weight, 15 lbs. Located at end of shaft. Belt pull of 111 lbs.

EVENT(s) ANALYZED:

OBE Analyzed Yes
SSE Analyzed Yes

Number of Events: One

SEISMIC LOADING: (G Level)	SSE	OBE
Horizontal E-W	6.0	4.8
Horizontal N-S	6.0	4.8
Vertical	6.0	4.8

SOURCE OF DATA: Motor Seismic Qualification - Input Data

DATA FURNISHED BY: Westinghouse Electric Corporation

ACCEPTANCE CRITERIA:

The equipment will operate without damage to itself or surrounding equipment before, during, and after the events analyzed with the safe limits of the materials and functional design.

MARGIN:

Margin is specifically given for each material in the Summary of Results found in this Section.

Report No. 89b-R-42

Attachment No. 4
Job 21701-523
Dwg. No. 21701-523-E-02
Rev. No. 0
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CLASS G 30 HEATER SELECTION TABLES

Class A20 FVNR, Class A22 Two-Speed, Class A21 Reversing

HEATER REQUIREMENTS BY OPERATING CONDITIONS			
Motor Continuous Rating °C Rise	Ambient Same At Starter And Motor	Ambient Higher At Starter Than At Motor	Ambient Higher At Starter Than At Motor
40	As specified from tables	One size larger than specified for each 15°C difference.	One size smaller than specified for each 15°C difference.
50-55	One size smaller than 40°C. above	One size smaller than 40°C above	One size smaller than 40°C above

The current at which heaters will trip the overload relay with the knob at 100% mark in an ambient of 40°C. is 1.25 times the minimum full load motor current in the table. Heaters so selected give 125% protection.

NEMA SIZE 0-1 STARTERS

HEATER CAT NO.	FULL LOAD MOTOR CURRENT			
	2 OL RELAYS		3 OL RELAYS	
	MIN.	MAX.	MIN.	MAX.
G30T6	.32	.34	.29	.31
G30T7	.35	.38	.32	.34
G30T8	.39	.42	.35	.37
G30T9	.43	.45	.38	.41
G30T10	.46	.49	.42	.45
G30T11	.50	.56	.46	.50
G30T12	.57	.61	.51	.56
G30T13	.62	.70	.57	.63
G30T14	.71	.77	.64	.70
G30T15	.78	.86	.71	.78
G30T16	.87	.96	.79	.87
G30T17	.97	1.06	.88	.96
G30T18	1.07	1.14	.97	1.04
G30T19	1.15	1.25	1.05	1.11
G30T20	1.26	1.39	1.12	1.24
G30T21	1.40	1.52	1.25	1.35
G30T22	1.53	1.64	1.36	1.46
G30T23	1.65	1.81	1.47	1.62
G30T24	1.82	2.04	1.63	1.83
G30T25	2.05	2.26	1.84	2.02
G30T26	2.27	2.47	2.03	2.20
G30T27	2.48	2.73	2.21	2.44
G30T28	2.74	3.07	2.45	2.74
G30T29	3.08	3.41	2.75	3.05

NEMA SIZE 0-1 STARTERS

HEATER CAT NO.	FULL LOAD MOTOR CURRENT			
	2 OL RELAYS		3 OL RELAYS	
	MIN.	MAX.	MIN.	MAX.
G30T30	3.42	3.84	3.06	3.47
G30T31	3.85	4.31	3.48	3.89
G30T32	4.32	4.80	3.90	4.33
G30T33	4.81	5.05	4.34	4.62
G30T34	5.06	5.55	4.63	5.03
G30T35	5.56	6.06	5.04	5.54
G30T36	6.07	6.89	5.55	6.29
G30T37	6.90	7.79	6.30	7.04
G30T38	7.80	8.71	7.05	7.85
G30T39	8.72	9.74	7.86	8.81
G30T40	9.75	10.8	8.82	9.84
G30T41	10.9	12.1	9.85	10.9
G30T42	12.2	12.7	11.0	11.6
G30T43	12.8	14.2	11.7	12.3
G30T44	14.3	15.1	12.4	13.6
G30T45	15.2	16.6	13.7	14.7
G30T46	16.7	18.7	14.8	16.7
G30T47	18.8	20.1	16.8	18.0
G30T48	20.2	22.2	18.1	19.4
G30T49	22.3	25.4	19.5	21.6
G30T50	25.5	28.2	21.7	24.3
G30T51	28.3	30.0	24.4	27.7
G30T52	-	-	27.8	30.0

MOTOR CONTROL CENTERS

CLASS G30 HEATER SELECTION TABLES

NEMA SIZE 2

HEATER CAT NO.	FULL LOAD MOTOR CURRENT			
	2 OL RELAYS		3 OL RELAYS	
	MIN.	MAX.	MIN.	MAX.
G30T36	6.42	7.22	6.16	6.94
G30T37	7.23	7.86	6.95	7.56
G30T38	7.87	8.92	7.57	8.55
G30T39	8.93	10.0	8.56	9.71
G30T40	10.1	11.5	9.72	10.6
G30T41	11.6	12.7	10.7	11.9
G30T42	12.8	13.5	12.0	13.0
G30T43	13.6	14.6	13.1	14.0
G30T44	14.7	15.2	14.1	14.7
G30T45	15.3	16.6	14.8	16.0
G30T46	16.7	18.3	16.1	17.7

NEMA SIZE 2

HEATER CAT NO.	FULL LOAD MOTOR CURRENT			
	2 OL RELAYS		3 OL RELAYS	
	MIN.	MAX.	MIN.	MAX.
G30T47	18.4	19.2	17.8	18.4
G30T48	19.3	22.2	18.5	21.3
G30T49	22.3	25.2	21.4	24.2
G30T50	25.3	28.2	24.3	27.1
G30T51	28.3	30.3	27.2	29.1
G30T52	30.4	34.1	29.2	32.4
G30T53	34.2	37.6	32.5	36.2
G30T54	37.7	41.0	36.3	39.4
G30T55	41.1	47.0	39.5	45.1
G30T56	47.1	53.5	45.2	50.3

NEMA SIZE 3

HEATER CAT NO.	FULL LOAD MOTOR CURRENT			
	2 OL RELAYS		3 OL RELAYS	
	MIN.	MAX.	MIN.	MAX.
G30T46	20.8	23.9	19.2	21.5
G30T47	24.0	26.3	21.6	24.7
G30T48	26.4	27.9	24.8	25.3
G30T49	28.0	32.7	25.4	30.3
G30T50	32.8	35.1	30.4	32.7
G30T51	35.2	39.9	32.8	37.6
G30T52	40.0	45.5	37.7	40.7
G30T53	45.6	50.3	40.8	46.4
G30T54	50.4	52.7	46.5	49.6
G30T55	52.8	61.5	49.7	57.4
G30T56	61.6	68.7	57.5	63.9
G30T57	68.8	75.1	64.0	70.4
G30T58	75.2	83.3	70.5	78.4
G30T59	83.4	89.9	78.5	85.5
G30T60	90.0	100.0	85.6	95.1
G30T61	•	•	95.2	100.0

NEMA SIZE 4

HEATER CAT NO.	FULL LOAD MOTOR CURRENT			
	2 OL RELAYS		3 OL RELAYS	
	MIN.	MAX.	MIN.	MAX.
G30T51	35.2	39.9	32.8	37.6
G30T52	40.0	45.5	37.7	40.7
G30T53	45.6	50.3	40.8	46.4
G30T54	50.4	52.6	46.5	49.6
G30T55	52.7	61.5	49.7	57.4
G30T56	61.6	68.7	57.5	64.7
G30T57	68.8	75.1	64.8	71.1
G30T58	75.2	83.3	71.2	79.9
G30T59	83.4	89.9	80.0	85.5
G30T60	90.0	101.0	85.6	95.2
G30T61	102.0	113.0	95.3	103.0
G30T62	114.0	124.0	104.0	114.0
G30T63	125.0	132.0	115.0	129.0
G30T64	133.0	150.0	130.0	133.0
G30T65	•	•	133.0	150.0

NEMA SIZE 5

HEATER CAT NO.	HEATER CODE MARKING	HEATER RATING 2 or 3 OL	MOTOR CURRENT	
			MIN.	MAX.
1597771	CA	93	74.4	83.9
1597772	CB	105	84.0	93.4
1597773	CC	117	93.5	104
1597774	CD	133	105	120
1597775	CE	152	121	136
1597776	CF	172	137	152
1597777	CG	192	153	168
1597778	CH	212	169	185
1597779	CI	233	186	199
1597780	CJ	250	200	211
1745083	CG - CG	265	212	239
1745084	CH - CH	300	240	259

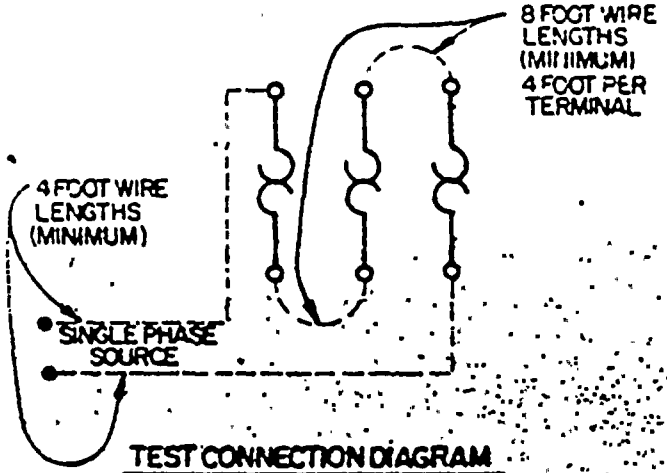
Attachment No. 4
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 2 of 4

MULTIPLES OF OVERLOAD RELAY CURRENT ELEMENT RATING

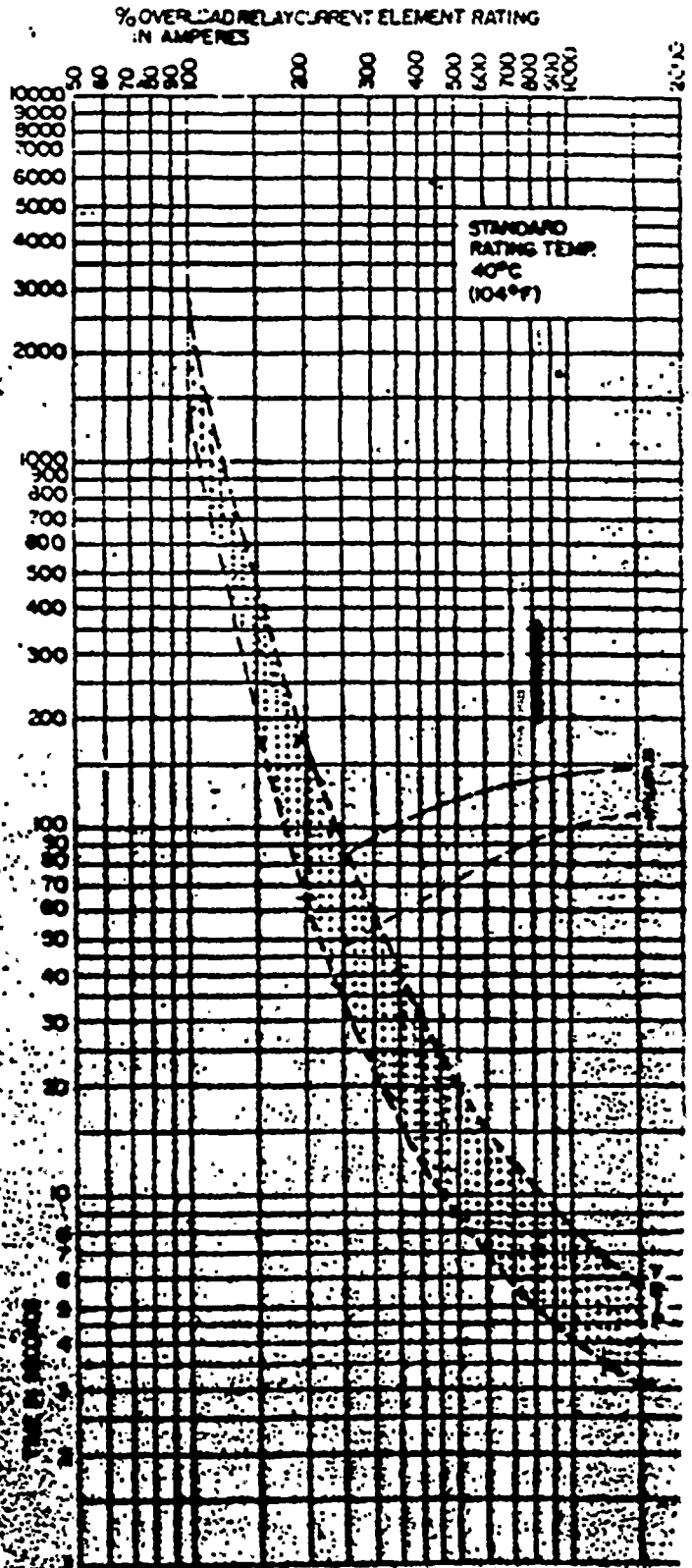
(REF. TEST REQUIREMENT #3)

TEST REQUIREMENTS

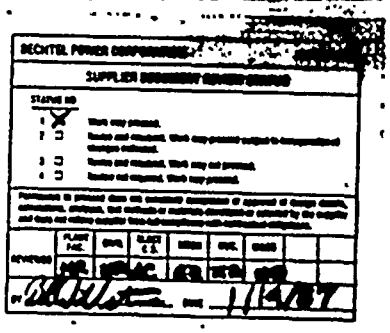
1. OVERLOAD RELAY TIME-CURRENT CHARACTERISTICS AT 40°C (104°F).
2. 3 POLES IN SERIES TEST.
3. CURRENT ELEMENT RATING-125% OF MINIMUM HEATER CURRENT VALUE.
4. DURING FIELD TESTS EMPLOY THE 300% TO 600% TEST RANGES. REFER TO NEMA I.C.S. 2-222 DESIGN & TEST PROCEDURES.
5. DISCONNECT POWER SOURCE IMMEDIATELY AFTER OVERLOAD RELAY TRIPS.



TEST CONNECTION DIAGRAM



ADJUSTABLE NON-COMPENSATED TYPE NEMA SIZE 0, 1 & 2 OVERLOAD RELAYS L10/E20 STYLE (2 PIECE BIMETAL CONSTRUCTION, BLUE ADJUSTMENT KNOB)



Attachment No. 4
Job 21701-523
Calc No. 21701-S23-E-02
Rev. No. 0
Sh. No. 3 of 4

5177-349-E-818-10-1

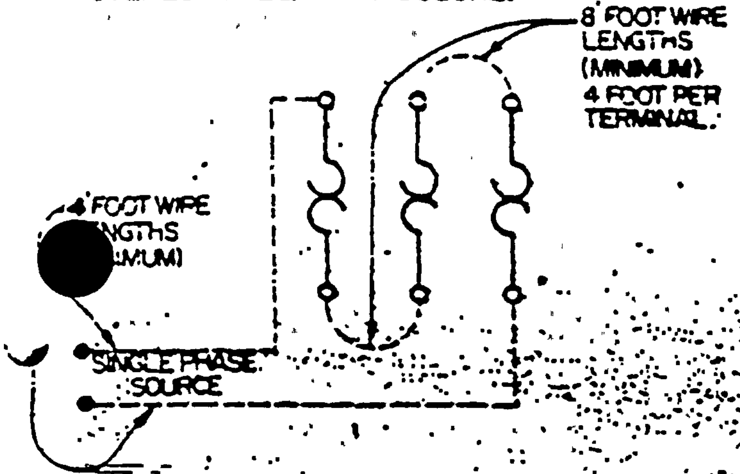
PC. NO. 4089024

MULTIPLES OF OVERLOAD RELAY CURRENT ELEMENT RATING

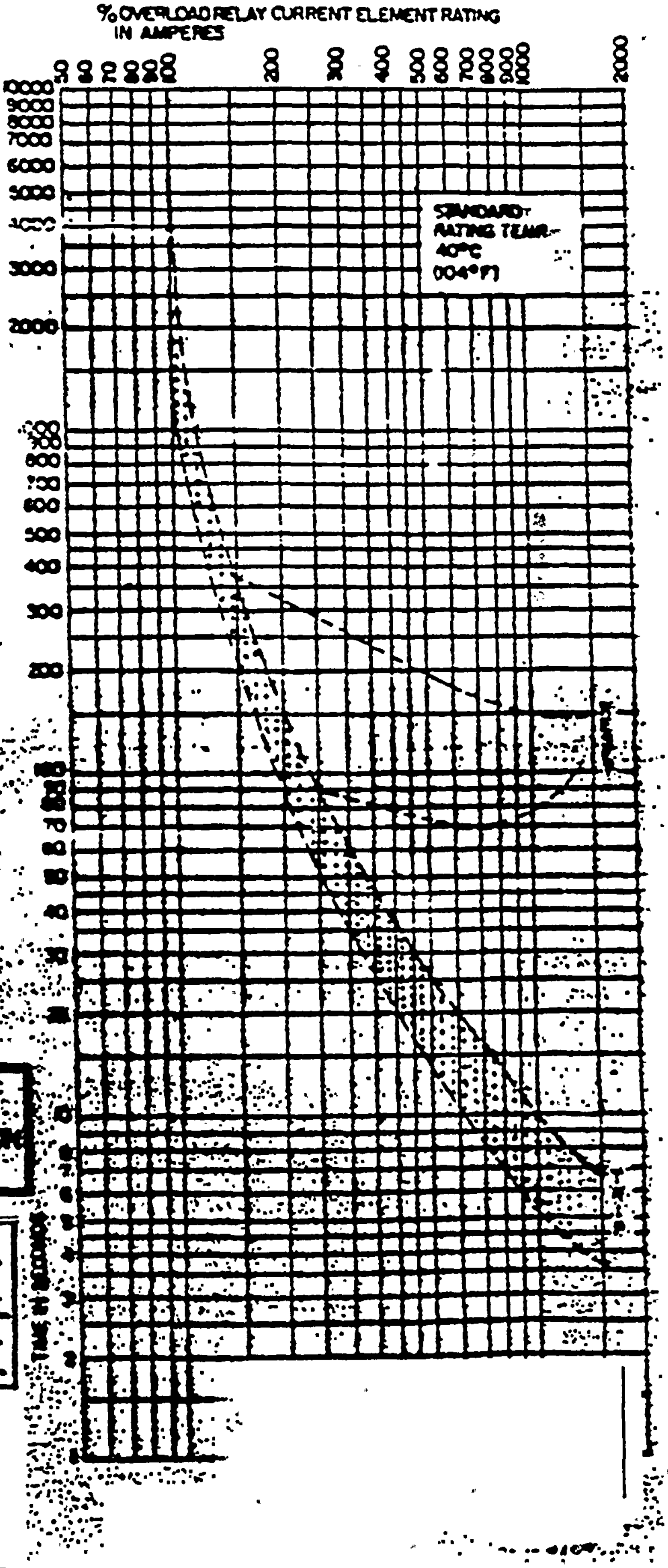
(REF TEST REQUIREMENT #3)

TEST REQUIREMENTS

1. OVERLOAD RELAY TIME–CURRENT CHARACTERISTICS AT 40°C (104°F).
2. 3 POLES IN SERIES TEST.
3. CURRENT ELEMENT RATING–125% OF MINIMUM HEATER CURRENT VALUE.
4. DURING FIELD TEST EMPLOY THE. 300% TO 600% TEST RANGES. REFER TO NEMA I.C.S. 2-222 DESIGN & TEST PROCEDURES.
5. DISCONNECT POWER SOURCE IMMEDIATELY AFTER OVERLOAD RELAY TRIP OCCURS.



TEST CONNECTION DIAGRAM



ADJUSTABLE NON-COMPENSATED TYPE
NEMA SIZE 3 & 4 OVERLOAD RELAYS
L10/E20 STYLE. (3 PIECE BIMETAL CONSTRUCTION
BLACK ADJUSTMENT KNOB).

BECHTEL POWER CORPORATION JOB NO. 5177
SUPPLIER DOCUMENT REVIEW STATUS

NR	NR	NR	NR	NR	

Attachment No. 4
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 34 of 4
[initials] 3/20/12

5177-349-E-818-8-1

~~5177-349-E-818-8~~ JSG 1/14/87

1/14/87

HEATERS

Heaters are not included with the overload relay and must be ordered separately per the heater selection table and the information listed below. When installing heaters be sure that connecting surfaces are clean and heaters are attached securely to the relay in the proper location with the screws provided. The trip rating of a heater in a 40°C Ambient is 125% of the minimum full load current shown in Table V. When tested at 600 percent of its trip rating, the relay will trip in 20 seconds or less (class 20).

Heaters should be selected on the basis of the actual full load current and service factor as shown on the motor nameplate or in the manufacturer's published literature. When the service factor of the motor is 1.15 to 1.25, select heaters from the heater application table. If the service factor of the motor is 1.0, or there is no service factor shown, or a maximum of 115% protection is desired, select one size smaller heater than indicated. When motor and overload relay are in different ambients and when using non-compensated overload relays, select heaters from the table using adjusted motor currents as follows: decrease rated motor current 1% for each °C motor ambient exceeds controller ambient. Increase rated motor current 1% for each °C controller ambient exceeds motor ambient. For ambient compensated overload relays no adjustment in heater selection is necessary for normal variations in ambient temperatures.

SHORT CIRCUIT PROTECTION

The relay will provide protection against abnormal load conditions to current values exceeding normal locked rotor current; however, to protect the relay from short circuit currents, branch circuit protection must be provided per the National Electric Code. Protective-device ratings should not exceed the maximum values listed in the heater application table. The relays, as protected, are suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 600 volts maximum.

MAINTENANCE

Other than the normal tightening of all wire and heater connections, no maintenance should be attempted on the unit. Complete replacement of the unit must be made in the event of damage.

WARNING: To provide continued protection against fire and shock hazard, the complete overload relay must be replaced if burnout of a current element occurs. See Table I.

TABLE V — F SERIES HEATER SELECTION

For compensated OLR's in any size enclosure; and non-compensated OLR's in enclosures with volume not less than 5500 cu. in. Wire with 75°C wire.
For Use With Three Heaters Only

Code Marking	Full Load Current of Motor (Amperes) (40°C Ambient)	Max. Protective Device* (Amp)	Load Wire Size
FH03	.25 — .27	1*	#14
FH04	.28 — .31	1*	#14
FH05	.32 — .34	1*	#14
FH06	.35 — .38	1*	#14
FH07	.39 — .42	1*	#14
FH08	.43 — .46	2*	#14
FH09	.47 — .50	2*	#14
FH10	.51 — .55	2*	#14
FH11	.56 — .62	3*	#14
FH12	.63 — .68	3*	#14
FH13	.69 — .75	3*	#14
FH14	.76 — .83	3*	#14
FH15	.84 — .91	3*	#14
FH16	.92 — 1.00	3*	#14
FH17	1.01 — 1.11	3*	#14
FH18	1.12 — 1.22	3*	#14
FH19	1.23 — 1.34	5*	#14
FH20	1.35 — 1.47	6*	#14
FH21	1.48 — 1.62	6*	#14
FH22	1.63 — 1.78	6*	#14
FH23	1.79 — 1.96	6*	#14
FH24	1.96 — 2.15	6*	#14
FH25	2.16 — 2.35	10*	#14
FH26	2.36 — 2.58	10*	#14
FH27	2.59 — 2.83	10*	#14
FH28	2.84 — 3.11	15	#14
FH29	3.12 — 3.42	15	#14
FH30	3.43 — 3.73	15	#14
FH31	3.74 — 4.07	15	#14
FH32	4.08 — 4.39	15	#14
FH33	4.40 — 4.87	15	#14
FH34	4.88 — 5.3	20	#14
FH35	5.4 — 5.9	20	#14
FH36	6.0 — 6.4	20	#14
FH37	6.5 — 7.1	25	#14
FH38	7.2 — 7.8	25	#14
FH39	7.9 — 8.5	30	#14
FH40	8.6 — 9.4	30	#14
FH41	9.5 — 10.3	35	#14
FH42	10.4 — 11.3	35	#14
FH43	11.4 — 12.4	40	#14
FH44	12.5 — 13.5	45	#14
FH45	13.6 — 14.9	45	#14
FH46	15.0 — 16.3	50	#12
FH47	16.4 — 18.0	60	#12
FH48	18.1 — 19.8	60	#12
FH49	19.9 — 21.7	70	#10
FH50	21.8 — 23.9	80	#10
FH51	24.0 — 26.2	80	#10
Above Heaters for use on Size 1			
FH52	26.3 — 28.7	90	#8
FH53	28.8 — 31.4	100	#8
FH54	31.5 — 34.5	125	#8
FH55	34.6 — 37.9	125	#8
FH56	38.0 — 41.5	125	#6
FH57	41.6 — 46.0	150	#6
Above Heaters for use on Size 2			

*15 ampere protective device is permitted by NEC. Fuse size shown in table limits fault current.

Attachment No. 5
Job 21701-523
Calc No. 21701-523-E-02
Rev. 0
SHT. 1 of 2

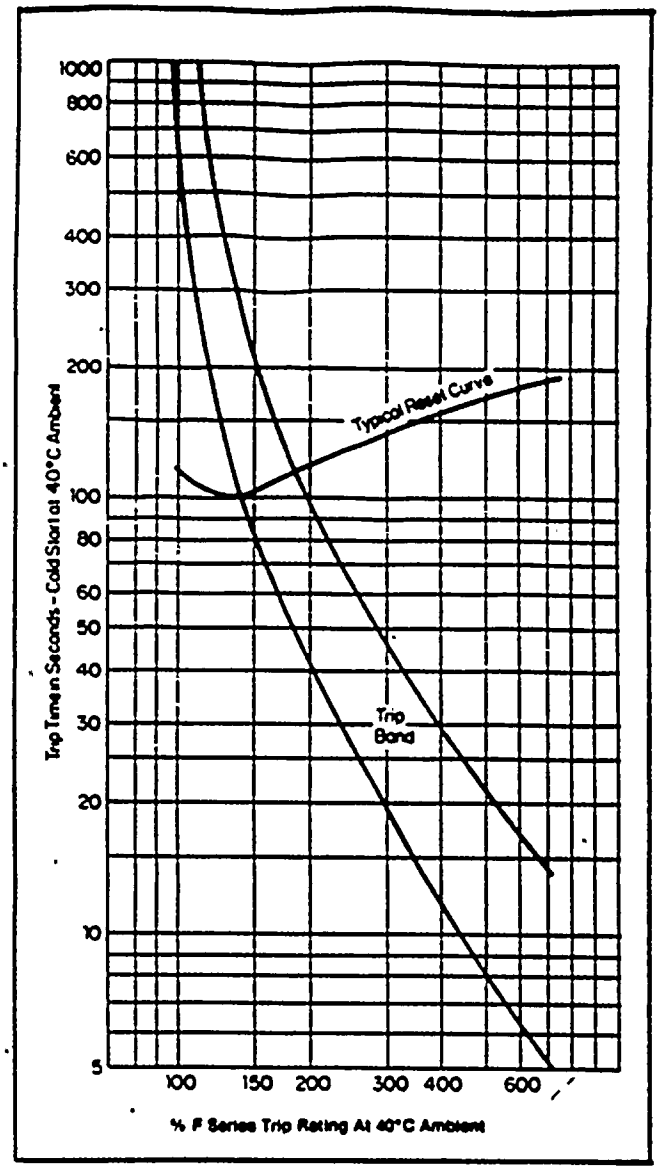


Fig. 4 Time/Current Trip and Reset Curves

The trip rating of a heater in a 40°C ambient is 1.25 times the minimum value of full load current listed for each heater.

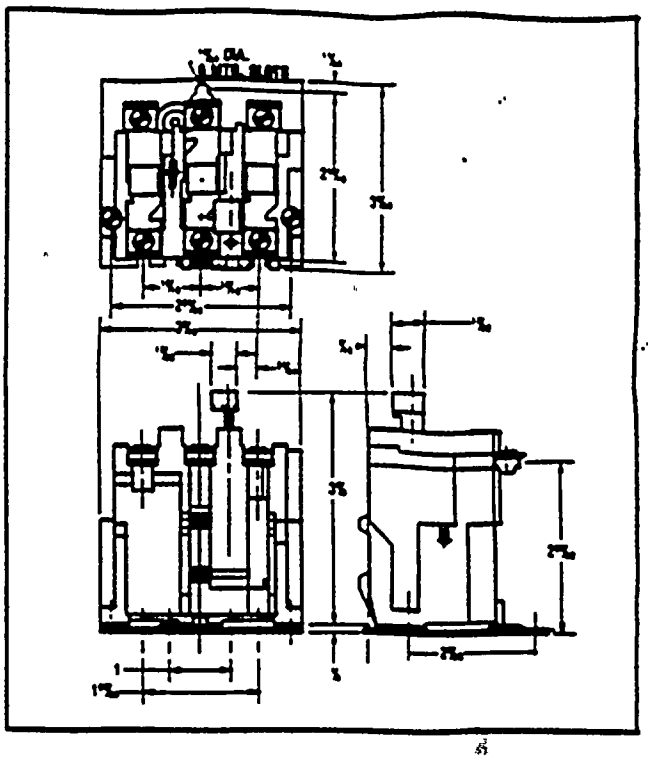


Fig. 5 Dimension Drawings (Dim. in Inches)

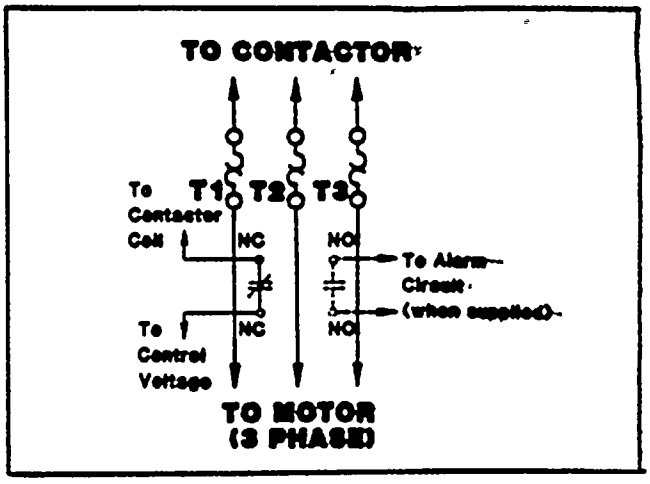


Fig. 6 Connection Diagram

Attachment No. 5
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 2 of 7

Effective 4/84
Supercedes I.L. 16954 (11/83)

Westinghouse Electric Corporation
Control Division
Asheville, N.C. U.S.A. 28813

Printed in U.S.A.

Tim Sweeney

Attachment No.	6
Job	21701-523
Calc No.	21701-523-E-02
Rev. No.	0
Sht.	1 of 3

ASEA BROWN BOVERI

913-286-1285

FAX TRANSMITTAL SHEET

ABB Power Distribution
Circuit Breaker Division
P.O. Box 100524
I-95 & Mechanicsville Highway
Florence, S.C. 29501
Phone (803) 665 - 4144
Fax (803) 667 - 5109 - Marketing
(803) 664 - 0520 - Eng., Purch., Acct, QC

TO: DON HAMROCK

FROM: DEAN SIGMON

OF PAGES(Incl. Cover Page): 2

DATE: 1-24-92

Tim

attached TD-6695 IS THE CURVE USED FOR OD-20/OD-61

OD-61

LONG TIME PICKUPS - 1.25, 1.55, 1.90, 2.20, 2.50 X

OD-20

LONG TIME PICKUPS .8, 1.0, 1.2, 1.4, 1.6 X

INSTANTANEOUS PICKUP FOR BOTH:

5, 10, 15 X

3 Pages total
Don Hamrock
1-27-91

Dean Sigmon
1-24-92

If there are any problems with this fax transmittal, please call and speak to the Operator.

=4

→ Jim Sweeney

OD-61c

OD-20c

COIL TURNS D-MC	LONG TIME PICKUP POINTS (TRIP) CENTER PHASE 1	2	3	4	5	LONG TIME CALIBRATION SPRING
	125%	155%	190%	220%	250%	
200	6	8	10	11	13	450 A33
68	19	23	29	33	38	A33
39	25	31	38	44	50	A31
39	38	47	57	66	75	A34
18	50	62	76	88	100	A31
18	63	78	95	110	125	A32
11	88	109	133	154	175	A31
11	113	140	171	198	225	A33
6	125	155	190	220	250	A28
6	156	194	238	275	313	A31
6	188	233	285	330	375	A32
4	219	271	333	385	438	A31
4	250	310	380	440	500	A31
4	281	349	428	495	563	A31
4	313	388	475	550	625	A33
2	375	465	570	660	750	A28
2	438	543	665	770	875	A31
2	500	620	760	880	1000	A31
2	563	698	855	990	1125	A31
2	625	775	950	1100	1250	A35
1 (KKK)	750	930	1140	1320	1500	A28
1	1000	1240	1520	1760	2000	A31
1	1250	1550	1900	2200	2500	A33
1	1500	1860	2280	2640	3000	A34
1	2000	2480	3040	3520	4000	A44
1 (KKK)	750	930	1140	1320	1500	A33
1	2500	3100	3800	4400	5000	A44

COIL TURNS OD-20	LONG TIME PICKUP POINTS (ALARM) R.H. PHASE 1	2	3	4	5	LONG TIME CALIBRATION SPRING
	80%	100%	120%	140%	160%	
200	4	5	6	7	8	450 216 A33
68	12	15	18	21	24	A33
68	16	20	24	28	32	A31
39	24	30	36	42	48	A34
39	32	40	48	56	64	A31
18	40	50	60	70	80	A32
18	56	70	84	98	112	A31
11	72	90	108	126	144	A33
11	80	100	120	140	160	A28
11	100	125	150	175	200	A31
6	120	150	180	210	240	A32
6	140	175	210	245	280	A31
6	160	200	240	280	320	A31
6	180	225	270	315	360	A31
4	200	250	300	350	400	A33
3	240	300	360	420	480	A28
3	280	350	420	490	560	A31
3	320	400	480	560	640	A31
3	360	450	540	630	720	A31
2	400	500	600	700	800	A35
2	480	600	720	840	960	A31
2	640	800	960	1120	1280	A33
1	800	1000	1200	1400	1600	A33
1	960	1200	1440	1680	1920	A34
1	1280	1600	1920	2240	2560	A44
1 (KKK)	480	600	720	840	960	A33
1	1600	2000	2400	2800	3200	A44

MAGNETIC PLATE #	INSTANTANEOUS PICKUP POINTS ALL 5X	10X	15
A	25	50	75
B	75	150	22
C	100	250	80
D	150	300	45
E	200	400	6
F	250	500	75
G	350	700	105
H	450	900	185
J	500	1000	150
A1	625	1250	187
A2	750	1500	22
A3	875	1750	262
A4	1000	2000	3
A5	1125	2250	33
A6	1250	2500	37
A7	1500	3000	45
A8	1750	3500	52
A9	2000	4000	60
A10	2250	4500	67
A11	2500	5000	75
A12	3000	6000	90
A13	4000	8000	12
A14	5000	10000	15
A15	6000	12000	18
A16	8000	16000	24
A17	10000	20000	30

RESTRICTED

OD61 → ← OD-20

USE	209102 FOR T
&	209108 FOR A

LONG TIME AIR GAP .217

INST. AIR GAP .246/.256

SHIPPING SETTINGS	L.H. PHASE (TRIP)	R.H. PHASE (ALARM)	
LONG TIME PICKUP	250%	100%	X
DISTANT. PICKUP	1000%	1000%	X
LONG TIME DELAY	MIN.	INTER.	X

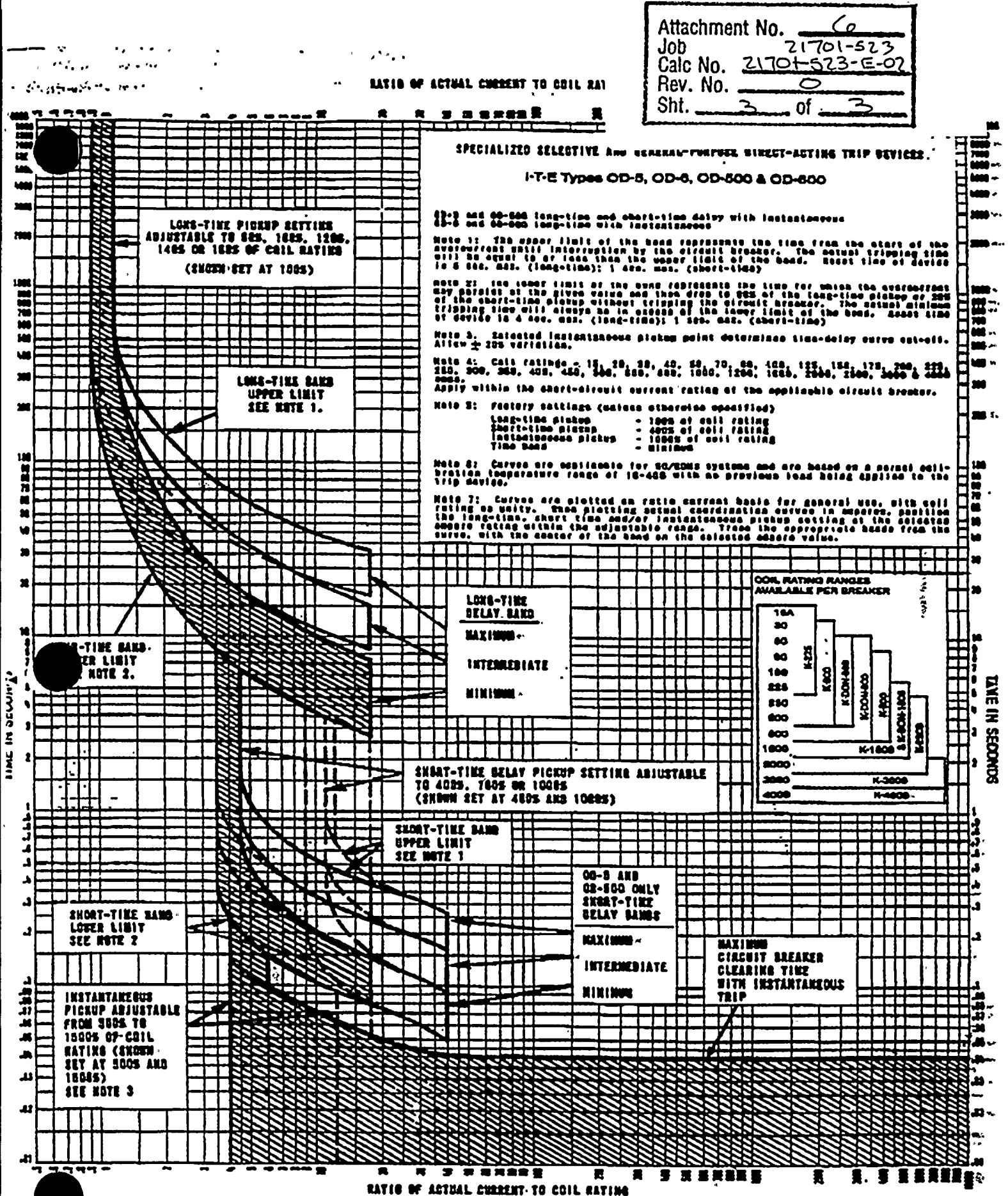
1. CHECK WITH C.B. ENG. BEFORE SPECIFYING SPEC. CAL. PTS. NOT SHOWN.
2. MARK INTERMEDIATE INSTANTANEOUS POINT ONLY IF SPECIFIED ON S/M

TIME BANDS	CAL. PT. THESE AT 250% PICK
MIN.	12-22
INTER.	55-42

Attachment No. 6
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 2 of 3

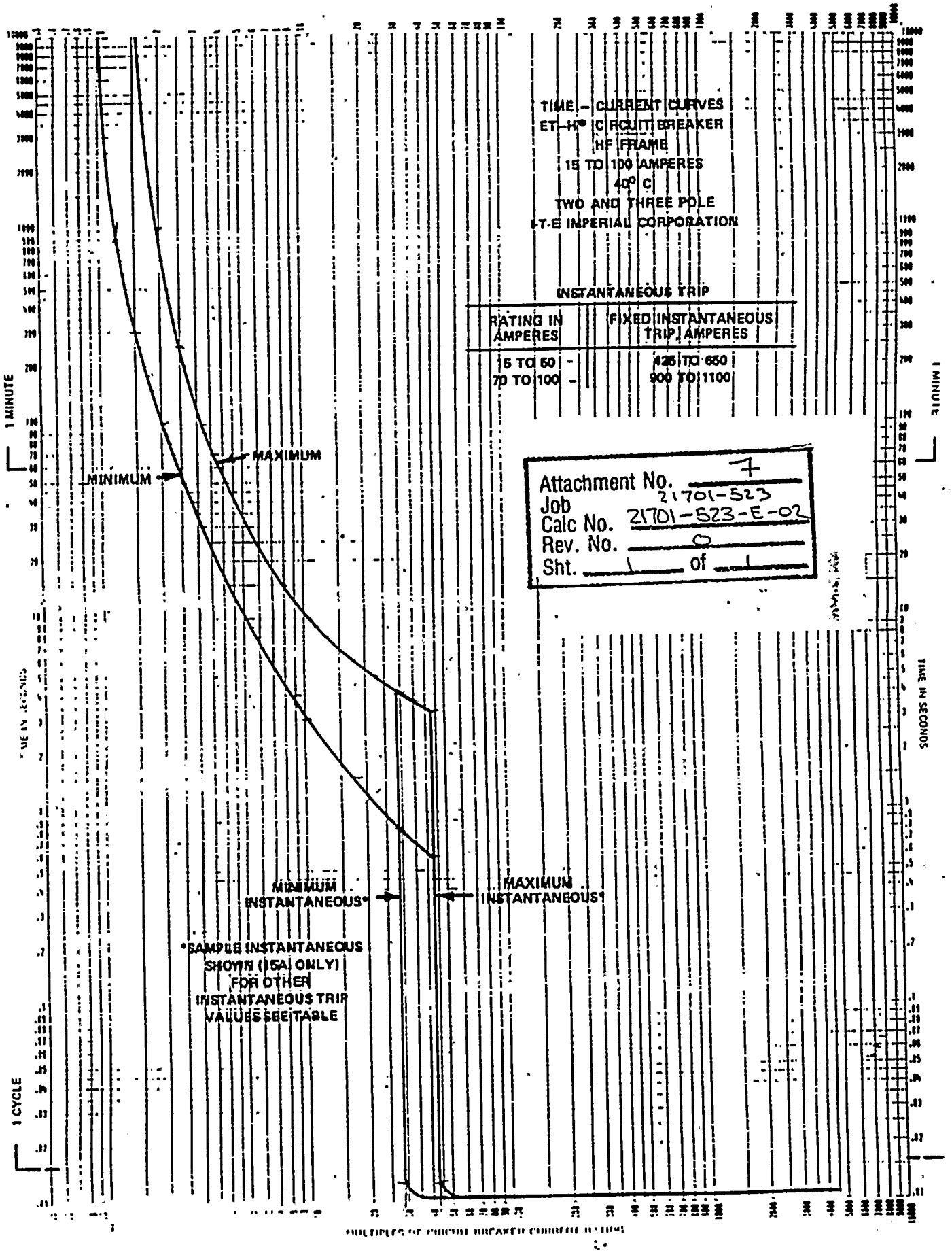
PHASE 1992 JAN 27 12:11:14 VE 35 6

Attachment No. 6
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 3 of 3



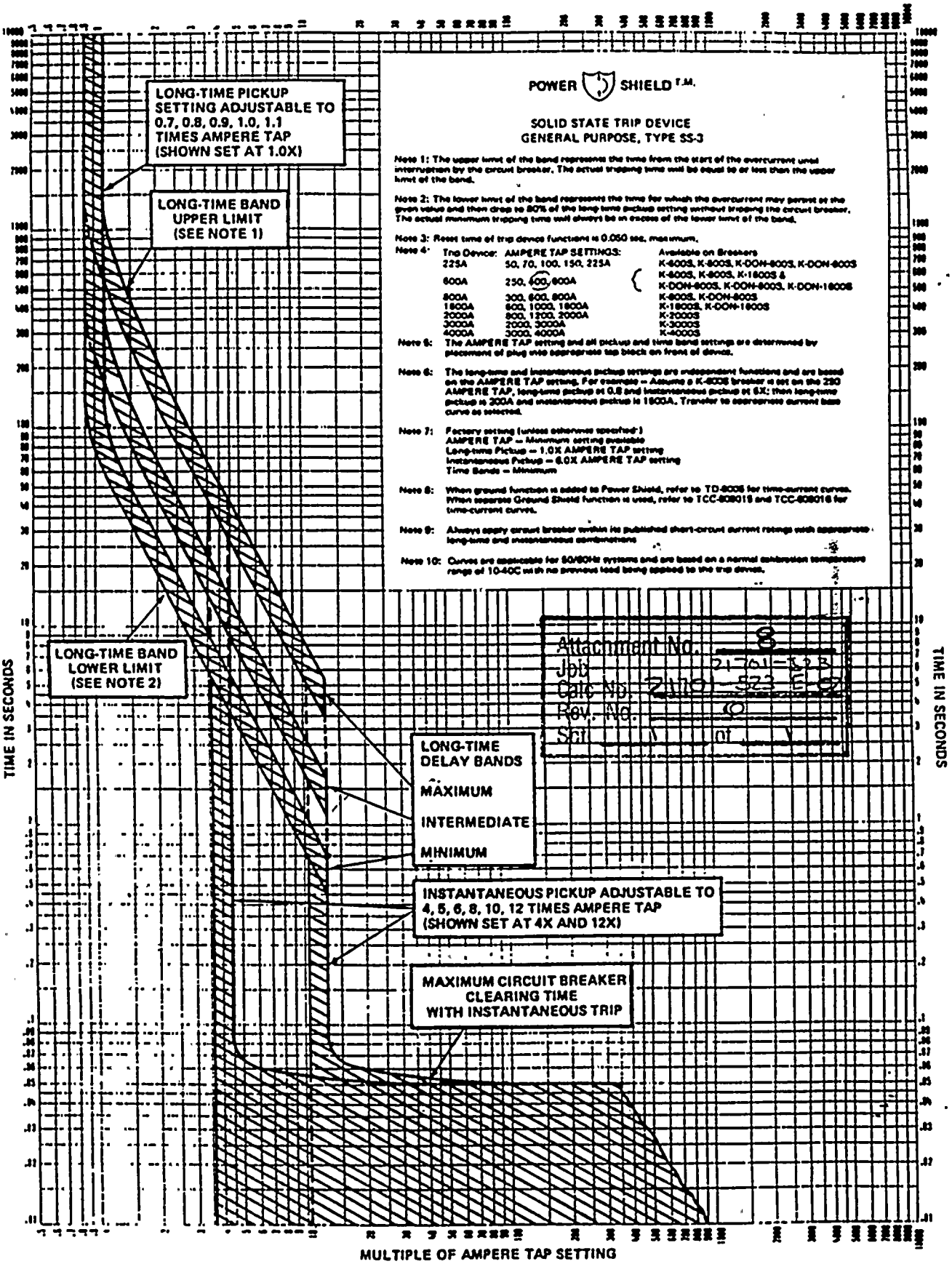
-CURRENT CHARACTERISTIC CURVES FOR K-LINE & K-OON CIRCUIT BREAKERS
I-T-E TYPES OD-5 AND OD-500 - LONG-TIME - SHORT-TIME - INSTANTANEOUS DIRECT-ACTING TRIP DEVICES. FOR SPECIAL SELECTIVE TRIPPING APPLICATIONS
TYPES OD-6 AND OD-600 - LONG-TIME AND INSTANTANEOUS DIRECT-ACTING TRIP DEVICES FOR 85-160% CALIBRATION REQUIREMENTS

BBC
DWN. BY F.C. TWOMEY DATE 11-17-75
NO. TD-6695 REV. 8



FOR APPLICATION AND COORDINATION PURPOSES ONLY. BASED ON 40°C AMBIENT COLD START. 600 VOLTS 60 HZ. 250 VOLTS DC.

MULTIPLE OF AMPERE TAP SETTING



POWER SHIELD T.M.

SOLID STATE TRIP DEVICE
GENERAL PURPOSE, TYPE SS-3

Note 1: The upper limit of the band represents the time from the start of the overcurrent until interruption by the circuit breaker. The actual tripping time will be equal to or less than the upper limit of the band.

Note 2: The lower limit of the band represents the time for which the overcurrent may persist at the given value and then drop to 80% of the long time pickup setting without tripping the circuit breaker. The actual minimum tripping time will always be in excess of the lower limit of the band.

Note 3: Reset time of trip device functions is 0.050 sec. maximum.

Note 4:

Trip Device:	AMPERE TAP SETTINGS:	Available on Breakers
225A	50, 70, 100, 150, 225A	K-600S, K-800S, K-DON-800S, K-DON-1600S
600A	250, 400, 600A	K-600S, K-800S, K-1600S & K-DON-800S, K-DON-800S, K-DON-1600S
800A	300, 600, 800A	K-800S, K-DON-800S
1600A	600, 1000, 1600A	K-1600S, K-DON-1600S
2000A	800, 1200, 2000A	K-2000S
3000A	2000, 3000A	K-3000S
4000A	3000, 4000A	K-4000S

Note 5: The AMPERE TAP setting and all pickup and time band settings are determined by placement of plug into appropriate tap block on front of device.

Note 6: The long-time and instantaneous pickup settings are independent functions and are based on the AMPERE TAP setting. For example – Assume a K-800S breaker is set on the 250 AMPERE TAP, long-time pickup at 0.8 and instantaneous pickup at 6X; then long-time pickup is 200A and instantaneous pickup is 1600A. Transfer to appropriate current base curve as selected.

Note 7: Factory setting (unless otherwise specified)
AMPERE TAP – Minimum setting available
Long-time Pickup – 1.0X AMPERE TAP setting
Instantaneous Pickup – 6.0X AMPERE TAP setting
Time Bands – Minimum

Note 8: When ground function is added to Power Shield, refer to TD-800S for time-current curves. When separate Ground Shield function is used, refer to TCC-808018 and TCC-808016 for time-current curves.

Note 9: Always apply circuit breaker within its published short-circuit current ratings with appropriate long-time and instantaneous combinations.

Note 10: Curves are applicable for 50/60Hz systems and are based on a normal calibration temperature range of 10-40C with no previous load being applied to the trip device.

Attachment No. 8
Job Calc No. 21101-523 Sht 2
Rev. No. 0
Sht 1 of

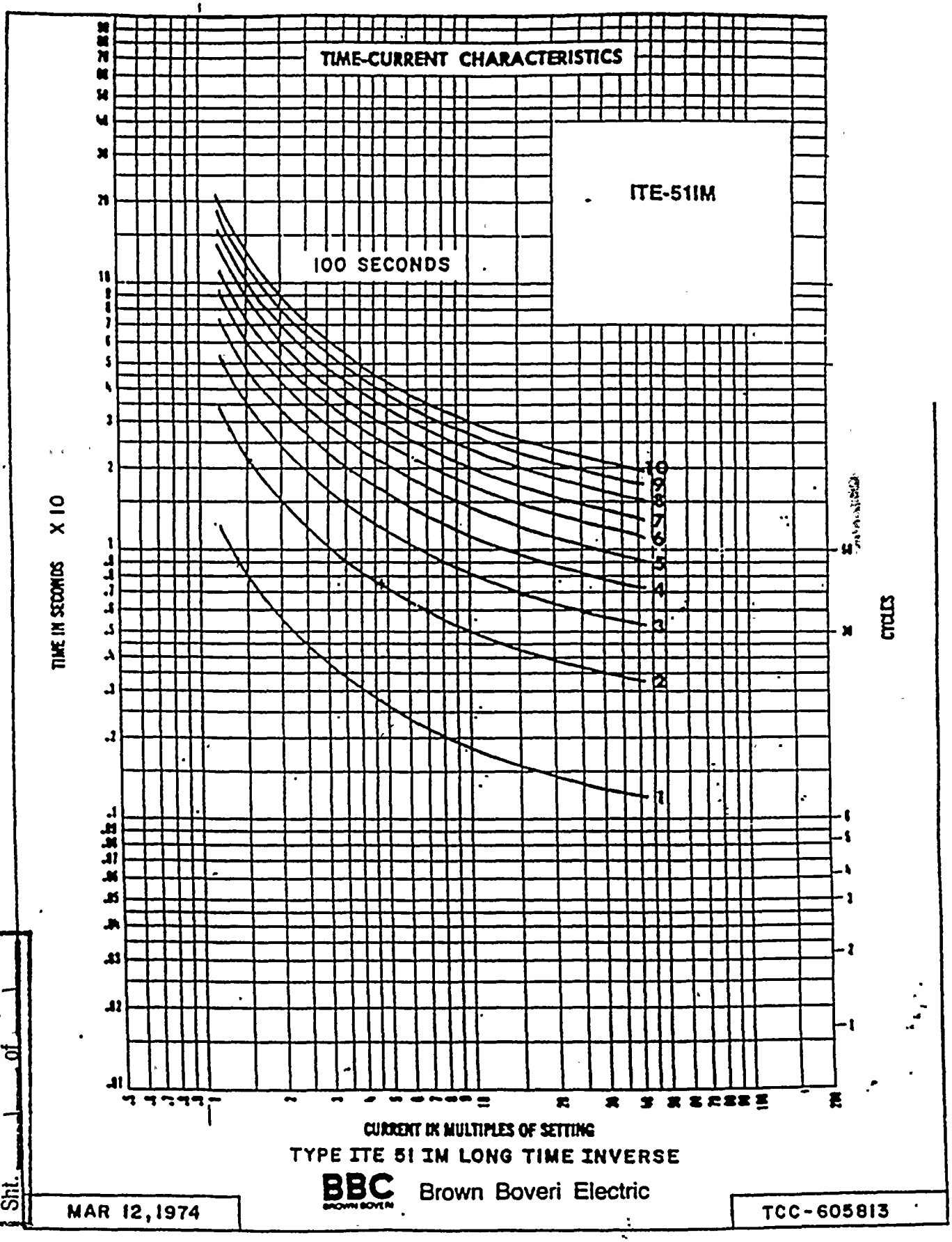
TIME-CURRENT CHARACTERISTIC CURVES: SOLID-STATE TRIP DEVICE
I-T-E TYPE SS-3; LONG-TIME AND INSTANTANEOUS, GENERAL PURPOSE

FOR K-LINE AND K-DON CIRCUIT BREAKERS MODEL 1 GRAY

BBC

DWN. BY F C Teufel DATE 11-17-78

NO. TD-9001 REV. 2



TYPE ITE 51 IM LONG TIME INVERSE

BBC Brown Boveri Electric

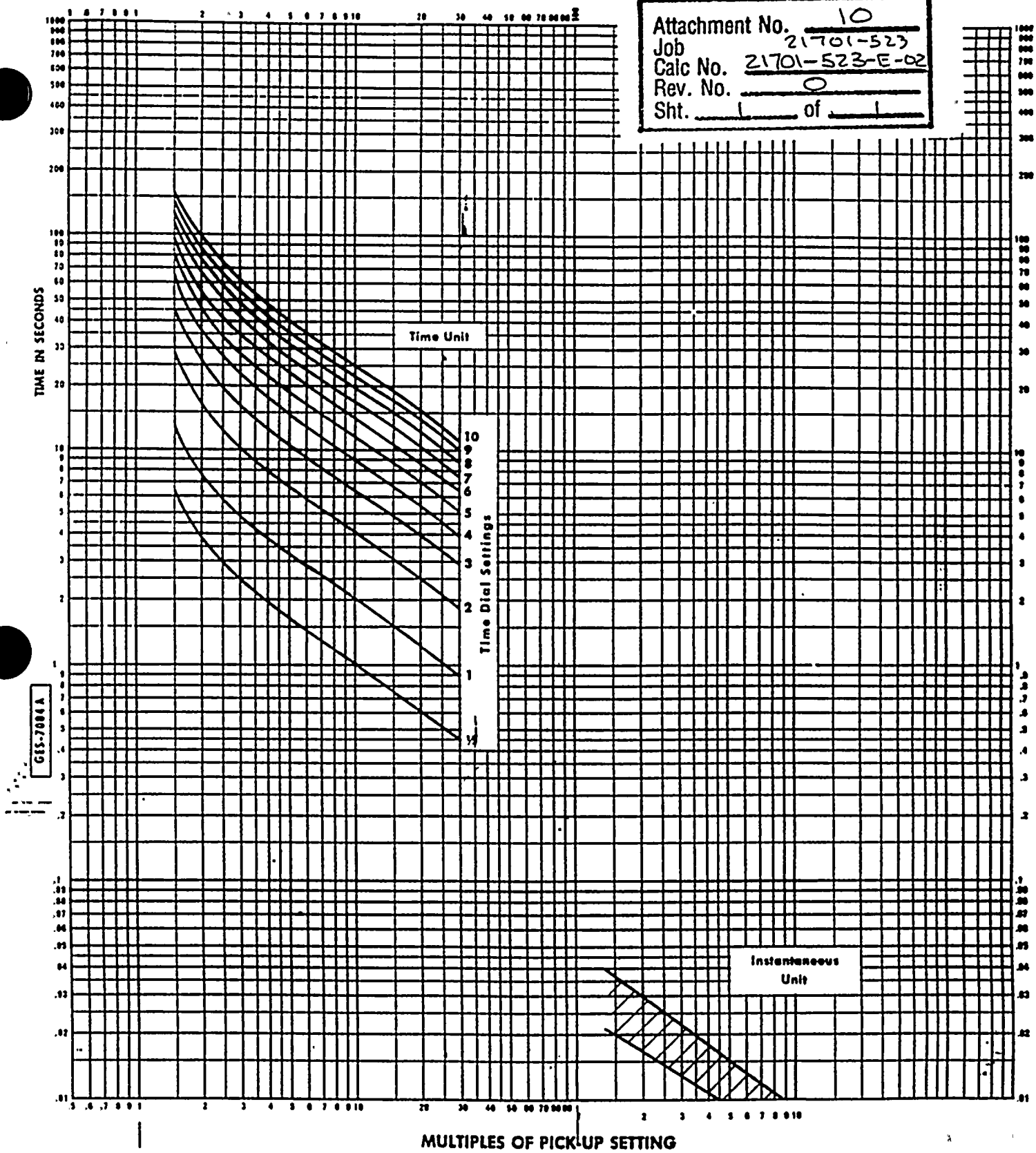
MAR 12, 1974

TCC-605813

Attachment No. 9
Job 21701-533
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 1 of 1

MULTIPL OF PICK-UP SETTING

Attachment No. 10
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 1 of 1



GENERAL ELECTRIC	TIME OVERCURRENT RELAY IAC 66 RELAY Inverse Long Time Time-Current Curves	GES-7004 A

Ratings (Amperes)

Time Unit	Instantaneous Unit
2.5–5 4.0–8	2–8 4–16 10–40 20–80 40–160

(Other relays with duplicate time delay characteristics
IAC70)

Settings

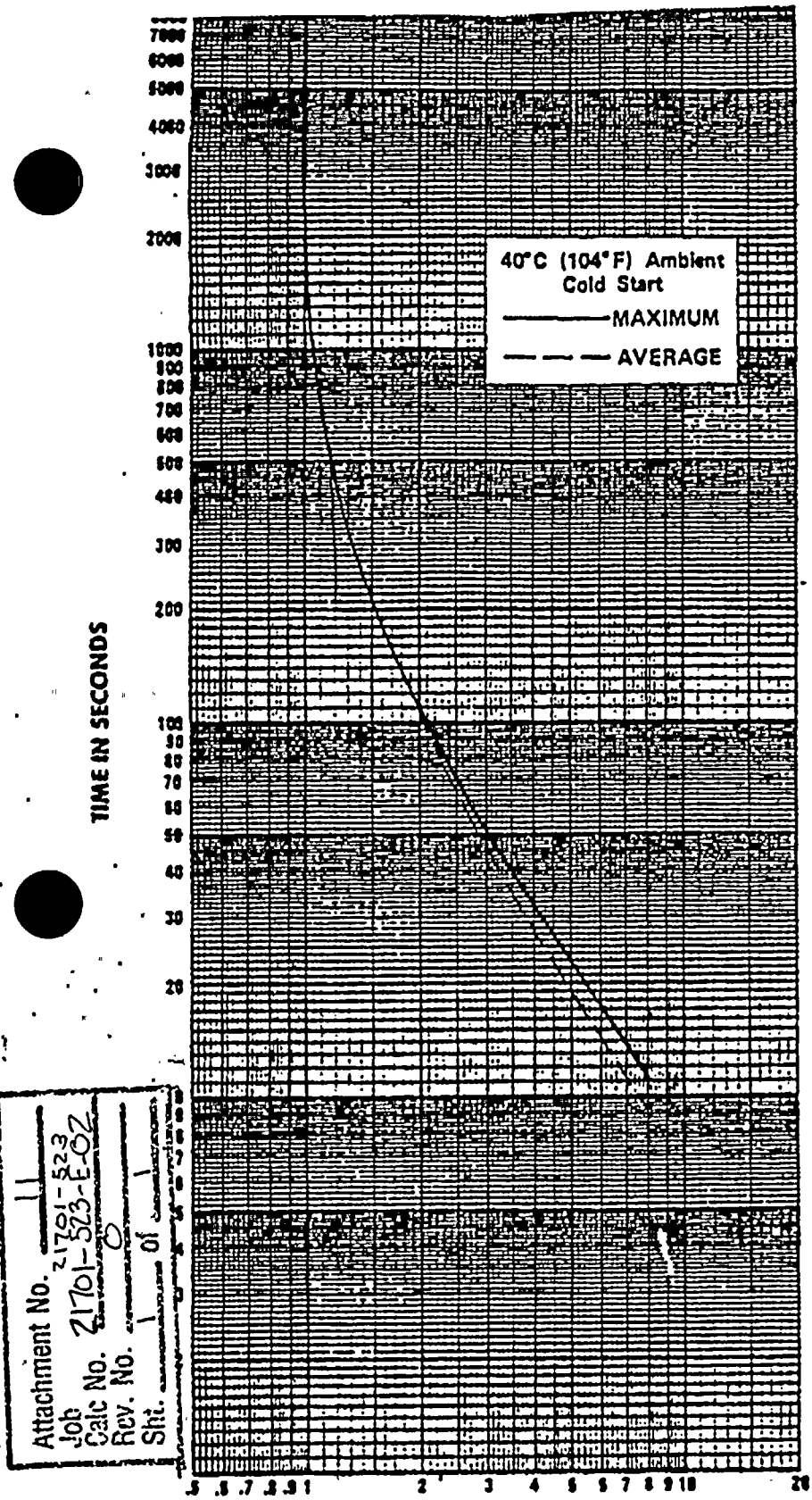
Time Unit (Taps)	Inst. Unit
2.5, 2.8, 3.1, 3.5, 4.0, 4.5, 5.0 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0	Continuously Adjustable

1130 (1M)

POWER SYSTEMS MANAGEMENT DEPT., PHILADELPHIA, PA.

PAUL SNIZEK P.1/1

OVERLOAD RELAY TIME-CURRENT CHARACTERISTICS



RELAY DESIGN:
- [X] Melting Alloy
- [ ] Bimetallic
- [ ] Temperature-Compensated

THERMAL UNIT TYPE(S): B0.44-B50

Curves apply only for equipment indicated below:

- [X] AC Magnetic Starter
- [ ] AC Manual Starter
- [ ] Separate Overload Relay
- [ ] _____

Size 0 & 1 Type SB. SC

Form _____ Series A

With (qty.) 3 Thermal Unit(s)

When installed in:

- [X] Small Enclosure (Class 8536 Only)
- [ ] Motor Control Center (Class 8998, 8999, QMB, I-Line)
- [ ] All Other (Larger) Enclosures
- [X] QMB, I-LINE

(Based on table B30068-389, rev. _____, and test R0103.06-L2)

Attachment No. 11
Job 21701-523
Calc No. 21701-523-E02
Rev. No. 0
Sht. 1 of 1

Trip current rating can be determined from instructions given with appropriate thermal unit selection table. Characteristics shown do not necessarily apply to equipment manufactured before date of drawing.

REV.	DATE	DRN. BY	CHKD. BY	APPD. BY	DATE
	11-28-73	FWP	FWP		1/31/75

SQUARE D COMPANY
MILWAUKEE 12, WISCONSIN, U.S.A.

A30068-407

ASH	TOR	MEX	EA-2	EC-2	UK	SC 2	AUS	ITA		

MASTER B30068-268

NEMA Rated Motor Starter Heaters

MAGNETIC STARTERS — Full Voltage (Cont'd)

NEMA SIZES 00, 0 AND 1

Max. Motor Full-load Amperes				Heater Cat. No. CR123
A	B	C	D	
0.48	0.46	0.45	0.43	C054A
0.55	0.50	0.49	0.48	C060A
0.57	0.57	0.53	0.53	C066A
0.65	0.62	0.59	0.58	C071A
0.69	0.68	0.65	0.64	C078A
0.83	0.80	0.76	0.74	C087A
0.97	0.91	0.84	0.84	C097A
1.03	0.99	0.93	0.92	C109A
1.12	1.09	1.04	1.02	C118A
1.26	1.22	1.15	1.10	C131A
1.40	1.31	1.27	1.23	C148A
1.46	1.46	1.39	1.38	C163A
1.63	1.59	1.55	1.49	C184A
1.79	1.74	1.73	1.67	C196A
1.97	1.93	1.89	1.79	C220A
2.25	2.13	2.05	1.98	C239A
2.43	2.37	2.28	2.24	C268A
2.60	2.52	2.47	2.43	C301A
2.96	2.87	2.79	2.75	C326A
3.57	3.39	3.31	3.25	C356A
3.86	3.59	3.70	3.43	C379A
4.43	4.31	4.06	4.03	C419A
4.87	4.57	4.47	4.43	C466A
5.37	5.31	4.95	4.94	C526A
5.99	5.86	5.49	5.36	C592A
	6.19	5.91	5.77	C630A
	6.61	6.47	6.35	C695A
7..	7.61	7.20	6.92	C778A
8.72	8.46	8.22	7.99	C867A
9.50	9.35	8.72	8.47	C955A
10.5	10.4	9.67	9.19	C104B
11.7	11.3	10.4	10.0	C113B
12.2	11.9	11.0	10.7	C125B
13.5	13.0	12.4	12.0	C137B
15.1	14.5	13.2	12.9	C151B
17.5	17.4	15.4	15.1	C163B
18.9	18.6	17.1	16.3	C180B
20.8	20.5	18.1	17.9	C198B
22.4	22.3	20.0	19.7	C214B
25.5	24.7	21.5	21.2	C228B
26.2	25.7	22.5	22.3	C250B
27.0	27.0	23.9	23.5	C273B
...	...	26.3	25.5	C303B
...	...	27.0	27.0	C330B

NEMA SIZE 1P

Max. Motor Full-load Amperes		Heater Cat. No. CR123
A	B	
14.2	14.2	C151B
17.3	17.3	C163B
18.7	18.7	C180B
20.6	20.6	C198B
22.5	22.5	C214B
24.7	24.7	C228B
25.5	25.5	C250B
26.7	26.7	C273B
27.9	27.9	C303B
32.1	32.1	C330B
36.0	36.0	C366B

PRICING INFORMATION

Catalog Number	List Price/Pkg. of 3, GO-10G
CR123C (All)	$18

All CR123C and 123F heaters are packaged three to a carton. Items of these heaters, being ordered for customer's stock, are to be specified in multiples of three (such as 3, 6, 9, 12, 15, etc.). Minimum order quantity is three.

NEMA SIZE 2

Max. Motor Full-load Amperes				Heater Cat. No. CR123
A	B	C	D	
5.92	5.79	—	—	C592A
6.23	6.12	5.85	5.72	C630A
6.63	6.49	6.47	6.30	C695A
7.72	7.59	7.35	7.04	C778A
8.96	8.71	8.06	7.91	C867A
9.92	9.19	9.03	8.80	C955A
10.4	10.1	9.61	9.27	C104B
11.7	11.2	10.5	9.99	C113B
12.1	11.9	11.6	11.1	C125B
13.5	12.6	12.5	12.1	C137B
14.7	14.5	13.6	13.1	C151B
18.3	17.7	16.7	15.5	C163B
20.1	19.1	17.9	16.8	C180B
22.3	21.4	18.7	18.0	C198B
25.0	22.9	20.4	19.7	C214B
27.7	24.7	22.7	21.6	C228B
29.3	25.9	24.7	23.9	C250B
30.7	27.1	26.3	25.5	C273B
32.7	30.2	29.5	28.2	C303B
35.6	34.8	32.5	31.6	C330B
39.4	38.7	36.7	34.7	C366B
45.0	45.0	41.9	37.8	C400B
—	—	43.2	40.6	C440B
—	—	45.0	45.0	C460B

NEMA SIZE 3

Max. Motor Full-load Amperes		Heater Cat. No. CR123
A	B	
19.3	18.4	F233B
22.1	21.1	F243B
23.4	22.1	F270B
27.0	26.1	F300B
29.1	28.0	F327B
31.8	31.3	F357B
33.9	33.3	F395B
37.6	34.3	F430B
41.9	40.9	F487B
47.7	44.7	F567B
52.1	51.1	F614B
55.8	52.0	F658B
59.7	55.4	F719B
68.1	63.3	F772B
71.5	66.1	F848B
78.2	73.5	F914B
87.5	82.2	F104C
90.0	90.0	F114C

NEMA SIZE 4

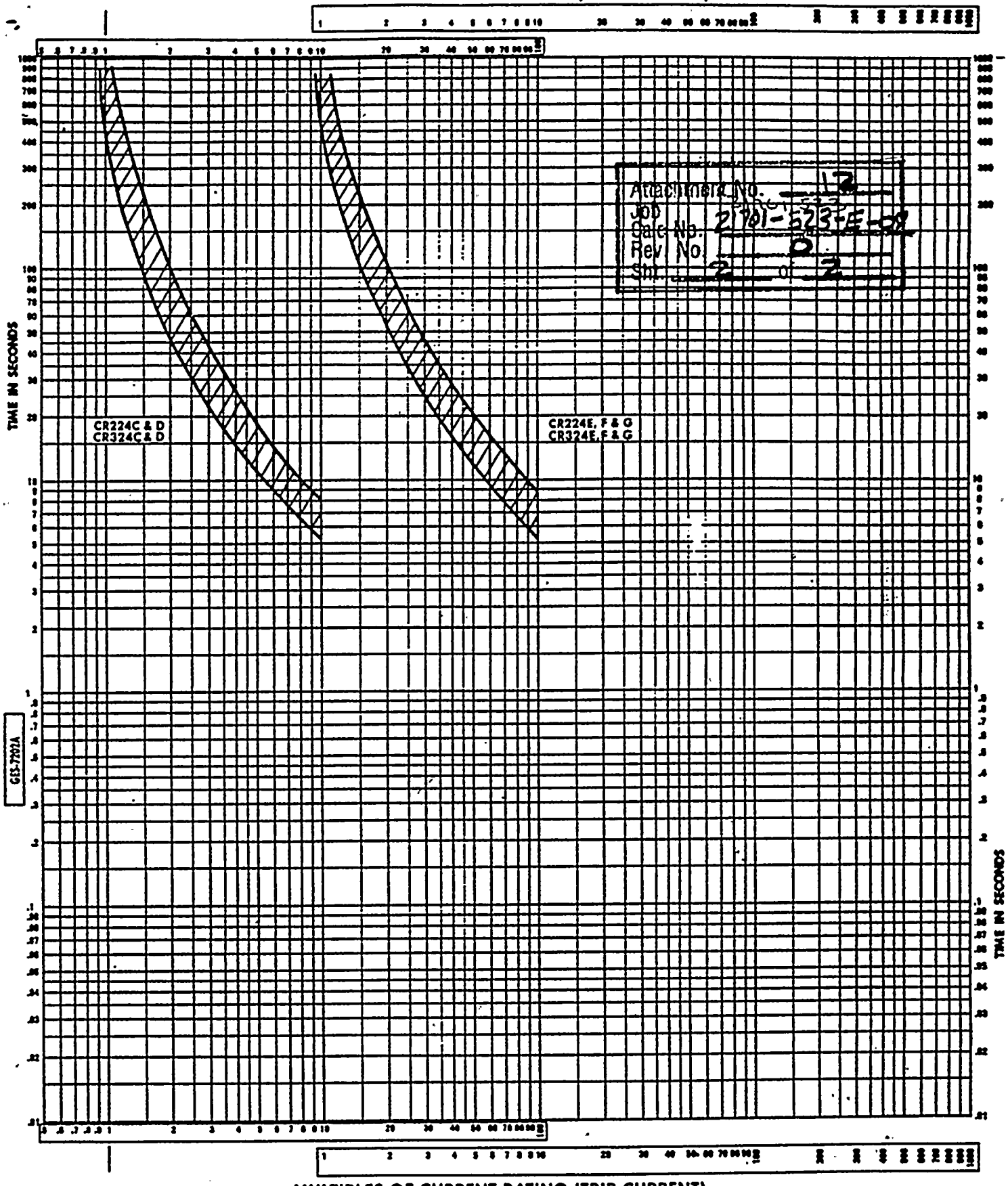
Max. Motor Full-load Amperes			Heater Cat. No. CR123
C	D	E	
32.2	32.0	32.0	F357B
34.0	34.2	34.0	F395B
36.8	36.7	36.7	F430B
44.6	43.9	43.9	F487B
48.4	46.6	46.6	F567B
53.9	52.6	52.6	F614B
57.4	55.6	55.6	F658B
60.0	58.7	58.7	F719B
69.5	67.1	67.1	F772B
71.7	70.6	70.6	F848B
79.9	76.3	76.3	F914B
92.3	88.7	88.7	F104C
97.0	93.4	93.4	F114C
108.0	102.0	105.0	F118C
118.0	110.0	114.0	F133C
131.0	122.0	128.0	F149C
135.0	131.0	131.0	F161C
...	135.0	135.0	F174C

NEMA SIZE 5

Max. Motor Full-load Amperes		Heater Cat. No. CR123
C	D	
118	115	C592A
128	125	C630A
138	135	C695A
155	151	C778A
168	164	C867A
184	179	C955A
200	195	C104B
221	215	C113B
237	231	C125B
262	255	C137B
270	270	C151B

Attachment No. 12
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 1 of 2

MULTIPLES OF CURRENT RATING (TRIP CURRENT)



Attachment No. 12
Job
Calc No. 21701-523-E-02
Rev No. D
Sht 2 of 2

MULTIPLES OF CURRENT RATING (TRIP CURRENT)

GENERAL ELECTRIC

THERMAL OVERLOAD RELAYS

TYPE CR224, CR324

CR224C, D, E, F and G
CR324C, D, E, F and G
Time-current Curves

(Curves show relay in 40 C ambient)

GES-7202A

Current Ratings—
0.41 to 270 amperes

Frequency Rating
25 to 60 Hertz

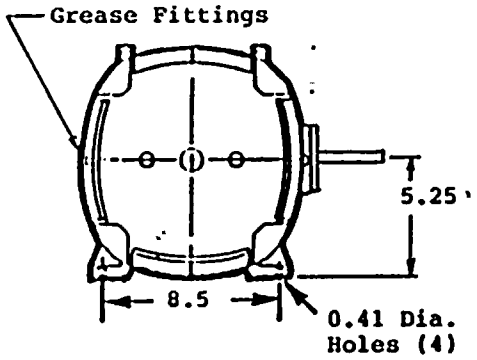
Adjustments—

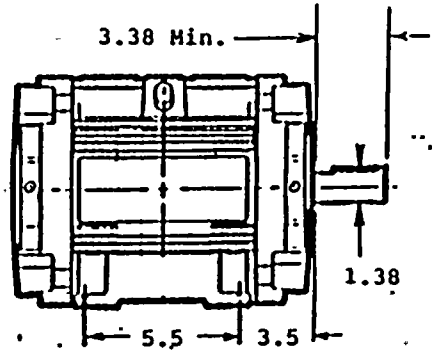
Current setting: 90 to 110% of heater current rating. Curves shown at 100%.

7.0 MANUFACTURER'S DRAWINGS

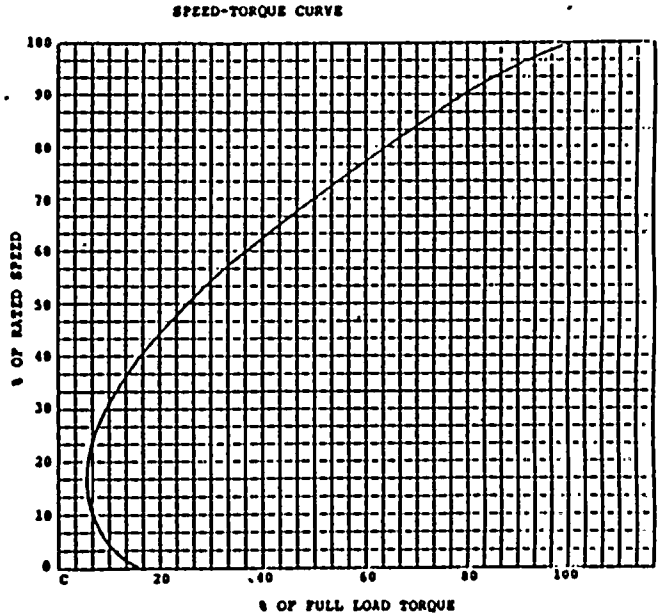
DRAWING DESCRIPTION	DRAWING NUMBER
OUTLINE VIEWS: CONDENSING UNIT	89C402-001
OUTLINE VIEWS: AIR HANDLING UNIT	89C402-002
OUTLINE VIEWS: THERMOSTAT	89B402-007
REFRIGERANT PIPING SCHEMATIC	89C402-003
REFRIGERANT PIPING INTERFACE DETAIL	89B402-006
ELEMENTARY DIAGRAM	89C402-004
ELECTRICAL WIRING INTERFACE DIAGRAM	89B402-256
CONTROL PANEL DETAIL	89C402-008
FINAL ASSEMBLY: CONDENSING UNIT	89C402-167
FINAL ASSEMBLY: AIR HANDLING UNIT	89C402-168
FINAL ASSEMBLY: THERMOSTAT	89C402-115
FINAL ASSEMBLY / WIRING DIAGRAM: CONTROL ENCLOSURE	89C402-114
DETAIL: AHU FAN MOTOR	89C402-037
DETAIL: CONDENSER FAN MOTOR	89C402-036
DETAIL: AIR FILTER	89A402-124
DETAIL: SOLENOID VALVE COIL	89A402-192
DETAIL: CRANKCASE HEATER	89A402-255

Attachment No. 13
Job 21701-523
Calc No. 21701-523-E-02
Rev. No. 0
Sht. 1 of 4





FOOT MOUNTED



Attachment No. 13
Job 21701-523-E-02
Calc No.
Rev. No.
Sht. 2 of 4

HP: 7-1/2

RPM: 1800 (Nominal)

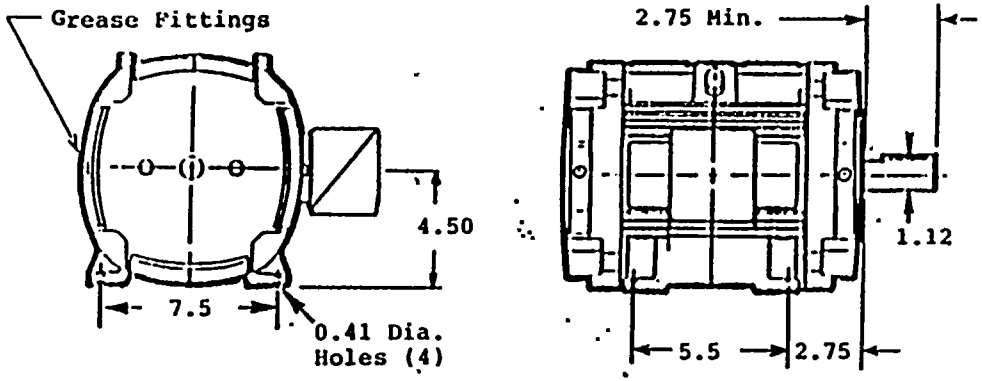
POWER: 460V/3PH/60HZ

MODIFIED FROM GE PART NO. 5KS213BD05

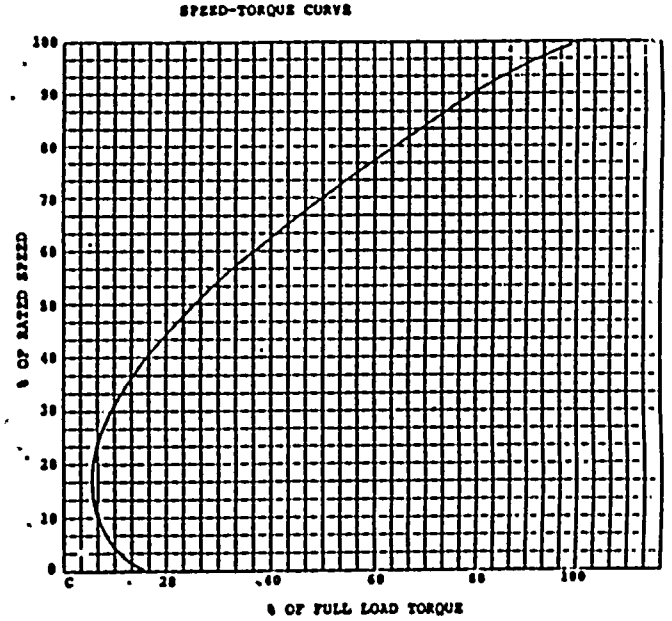
QUALIFIED AIR CORPORATION
P.O. BOX 44099 CINCINNATI, OHIO 45244

7-1/2 HP MOTOR AND DATA

CUSTOMER: FP&L Turkey Point Plant	DRAWN BY: A.Bellino / DATE: 1-23-91		DRAWING NO.: 89A402-037
	CHECKED BY: [signature] / DATE: 1-23-91		REVISION: Ø 1-23-91
CONTRACT NO.: B-89536-80061	QA: Leslie Stenk / DATE: 1-23-91		SCALE: None / SHEET: 1 OF 1
SPECIFICATION NO.: FLO89-069.2002	QAC PROJECT NO: 89J402		



FOOT MOUNTED



Attachment No. 13
Job
Calc No. 21701-523-E-02
Rev. No.
Sht. 3 of 4

HP: 5

RPM: 1800 (Nominal)

POWER: 460V/3PH/60HZ

MODIFIED FROM GE PART NO. 5KS184SE208

QUALIFIED AIR CORPORATION
P.O. BOX 44099 CINCINNATI, OHIO 45244

5 HP MOTOR AND DATA

CUSTOMER: FP&L Turkey Point Plant	DRAWN BY: A.BERLING	DATE: 1-23-91	DRAWING NO.: 89A402-036
	CHECKED BY: [signature]	DATE: 1-23-91	REVISION: Ø 1-23-91
CONTRACT NO.: B-89536-80061	QA: [signature]	DATE: 1-23-91	SCALE: None / SHEET: 1 OF 1
SPECIFICATION NO.: FLO89-069.2002	QAC PROJECT NO: 89J402		

PERFORMANCE DATA

PAUL SNIZEK

3-Phase Production Designs: 182-286 Frames, 230/460V, 1.15 SF

Horse-power	Full-load RPM	Amperes Full-load @ 460v	Amperes Full-load @ 200v	NEMA Locked Rotor (max.)	NEMA Code Letter	Torque Full-load Lb.-ft.	Torque ST %FL (avg.)	Torque BD %FL (avg.)	Efficiency Full Load Nom.	Efficiency Full Load Guar. Min.	Efficiency 3/4-load	Efficiency 1/2-load	Power Factor Full load	Power Factor 3/4-load	Power Factor 1/2-load	Max. KVAR
Type KS, TEFC Extra $evere Duty																
1	885	2.1	4.0	15.0	N	6.1	175	240	75.5	74.0	75.9	71.4	60.5	53.7	41.9	1.2
1.5	1170	2.3	4.8	20.0	M	6.7	248	347	87.5	86.5	88.4	86.4	72.0	66.2	53.5	1.0
	865	3.0	5.9	20.0	M	9.1	193	253	80.0	78.5	80.8	77.4	60.0	53.1	41.1	1.7
2	1165	2.9	6.3	25.0	L	9.0	242	336	87.5	86.5	88.6	87.2	74.0	68.4	55.8	1.3
	875	3.6	7.5	25.0	L	12.0	175	249	82.5	81.5	83.4	80.4	64.0	57.4	45.0	2.0
3	3520	3.7	8.2	32.0	K	4.5	218	335	88.5	87.5	90.4	89.2	87.0	86.6	78.8	0.9
	1765	4.0	8.7	32.0	K	8.9	267	382	89.5	88.5	90.3	88.8	80.0	75.8	64.6	1.5
	1175	4.3	9.1	32.0	K	13.4	243	333	89.5	88.5	91.0	89.3	74.5	69.2	57.1	1.8
	875	5.2	10.9	32.0	K	18.0	188	251	84.0	82.5	85.4	83.0	64.5	58.3	45.8	2.8
5	3515	6.0	13.9	46.0	J	7.5	210	330	89.5	88.5	90.2	88.9	88.0	87.9	81.2	1.4
	1755	6.3	14.3	46.0	J	15.0	247	335	90.2	89.5	91.3	90.7	83.0	70.1	70.7	2.0
	1170	7.0	15.1	46.0	J	22.4	261	352	89.5	88.5	91.6	90.5	75.0	70.8	58.3	2.9
	885	9.9	19.6	46.0	J	29.7	223	234	85.5	84.0	86.5	83.3	55.5	49.1	38.0	5.9
7.5	3530	8.7	20.2	63.5	H	11.2	152	273	91.7	91.0	93.1	92.4	88.0	89.1	83.9	1.7
	1765	9.3	21.9	63.5	H	22.3	212	252	91.7	91.0	92.4	91.6	82.5	81.0	73.4	2.5
	1180	10.7	23.5	63.5	H	33.4	202	244	91.7	91.0	92.3	91.0	72.0	67.6	56.2	4.4
	885	14.2	28.5	63.5	H	44.5	216	225	86.5	85.5	87.8	85.1	57.5	51.8	40.3	7.9
10	3525	11.6	26.8	81.0	H	14.9	161	284	91.7	91.0	93.3	92.9	88.5	89.1	83.7	2.3
	1760	12.7	29.4	81.0	H	29.8	216	252	91.7	91.0	92.6	92.1	81.0	79.6	71.7	3.6
	1175	14.3	31.4	81.0	H	44.6	207	245	91.7	91.0	92.4	91.4	71.5	67.3	56.0	5.9
15	3545	17.3	39.6	116.0	G	22.2	169	298	91.7	91.0	92.8	91.6	88.5	88.8	83.2	3.6
	1770	18.7	43.6	116.0	G	44.5	183	230	92.4	91.7	93.4	92.7	81.5	80.2	72.3	5.3
	1180	20.1	45.8	116.0	G	66.9	169	195	91.7	91.0	92.1	91.3	76.5	74.8	65.7	6.6
20	3540	22.5	52.1	145.0	G	29.7	181	292	92.4	91.7	93.8	92.9	90.0	91.2	87.4	3.7
	1765	24.4	58.5	145.0	G	59.5	178	211	93.0	92.4	93.9	93.6	82.5	82.1	75.7	6.0
	1175	26.7	63.1	145.0	G	89.5	156	186	92.4	91.7	93.4	93.3	76.0	75.2	67.4	8.2
25	3560	27.9	64.8	217.5	G	36.9	197	279	92.4	91.7	93.2	92.1	91.0	91.8	88.2	4.6
	1770	30.0	70.7	182.5	G	74.2	162	205	93.6	93.0	94.4	94.1	83.5	83.6	78.0	6.9
30	3555	33.4	77.8	182.5	G	44.3	194	274	92.4	91.7	93.4	92.6	91.0	91.8	88.0	5.6
	1765	36.0	85.6	217.5	G	89.1	165	206	93.6	93.0	94.4	94.3	83.5	83.6	78.1	8.2

NOTE: Starting and breakdown torques are average expected values.

6/89, rev. 3/90
I/5.01

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GE Motors

INSTRUCTIONS

UNDERVOLTAGE RELAYS

TYPES:

IAV54E IAV55C
IAV54F IAV55F
IAV54H IAV55H
IAV55J

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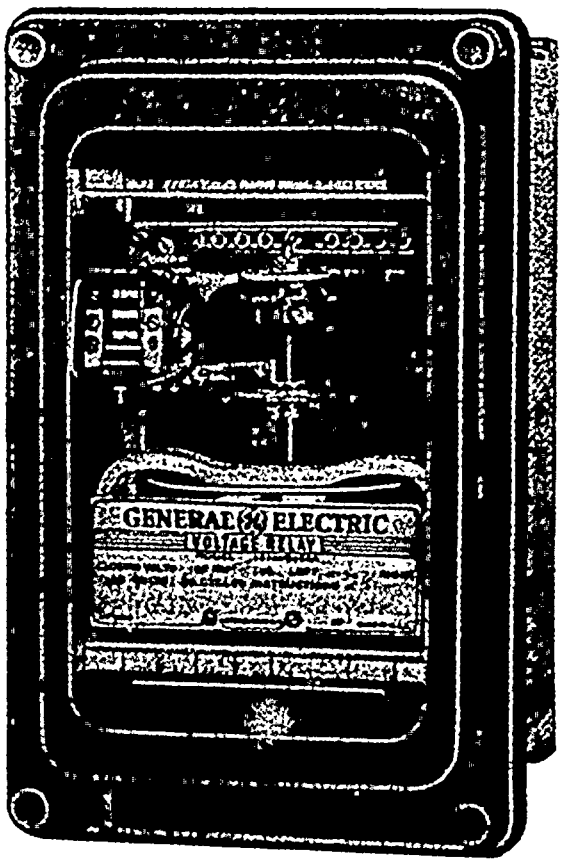

GE Meter and Control
205 Great Valley Parkway
Malvern, PA 19355-0715

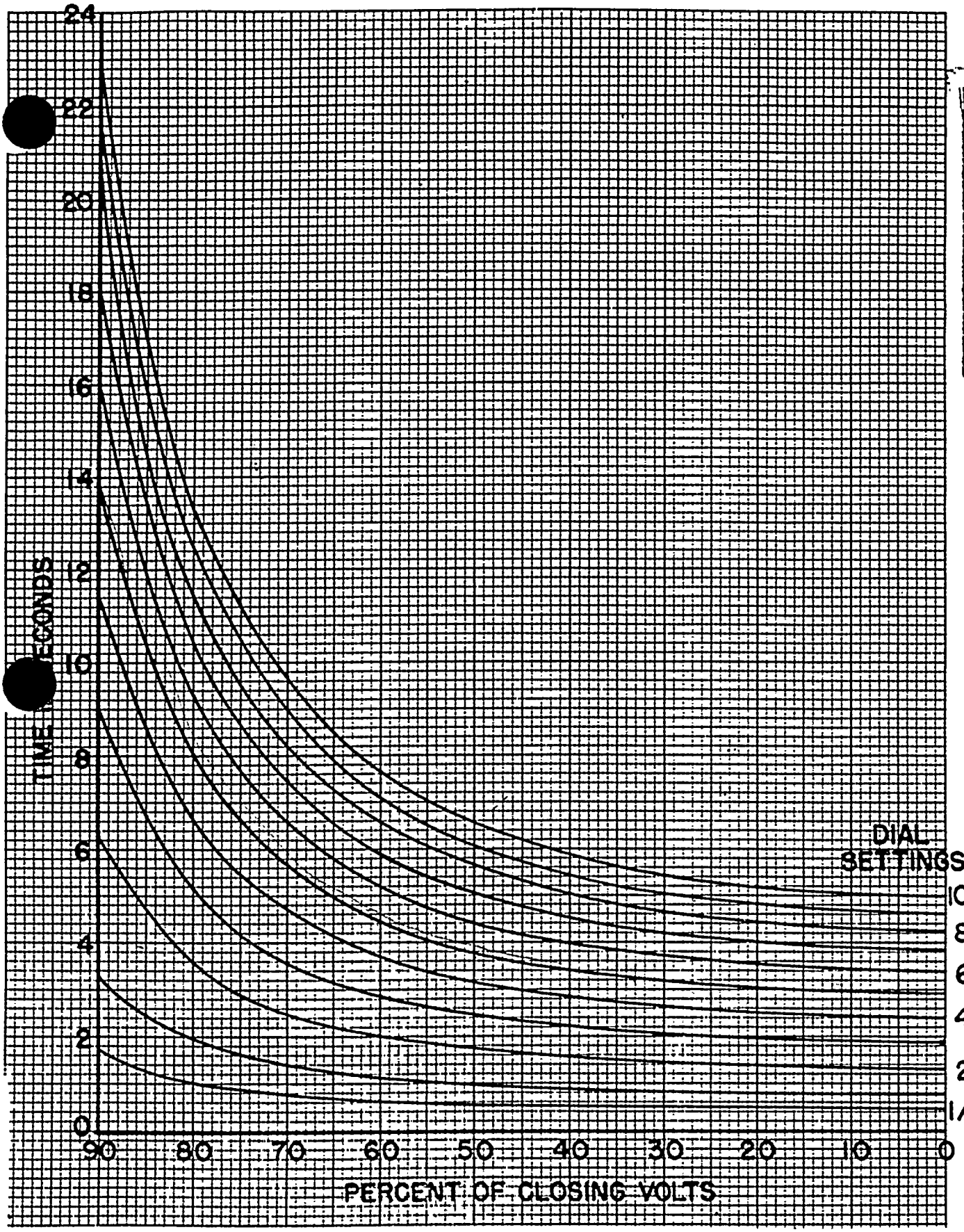

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Figure 2 (0362A0648-2) Time-Voltage Curves for Type IAV54E and IAV55C Relays

* Revised since last issue

Copeland

Attachment No.	15
Job	21701-523
Calc No.	21701-523-E-02
Rev. No.	0
Sht.	1 of 2

March 25, 1992

Mr. T.C. Higgins
Florida Power and Light Co.
P.O. Box 3088
Florida City, FL 33034

Dear Mr. Higgins:

Enclosed is the data on the 3DS3-1000 series compressor. This compressor has the same motor as unloaded version 3DP3-1000.

Sincerely,

Steve Garstang
Manager, Adv.
Application Engineering

SG:dw

cc: fax #407-694-0549

*** COPELAND ELECTRIC CORP. ***

HUMBOLDT, TN 38343

DATE 2/13/86 SIGNED Billy Smith APPROVED JBB HCI 3675

FRAME 90 STACK 5.25 HP 10 POLE 4 PH 3 HZ 60 VOLTS 460

STATOR NO. 131931-03 ROTOR NO. 131934-01 SPEC. 31874

LR AMPS 105 ST TORQ 112 MAX TORQ 114 AT 1502 RPM

LR RT/RISE DEG F/SEC:STAT 7 ROT 11 L-L RES@25C 1.137 ± 7%

REFERENCE LAB TEST NO. 4306

DESCRIPTION-- 131931-03 XD-543 ROTOR

PERFORMANCE AT 25C AND 460 VOLTS

TORQUE	RPM	AMPS	EFF	P.F.	KWIN	KWOUT
100	1656	42	78.9	89.2	29.83	23.524
95	1667	39.9	80	88.5	28.129	22.507
90	1678	37.7	81.1	88	26.457	21.464
85	1689	35.6	82.2	87.6	24.812	20.398
80	1699	33.3	83.3	87.3	23.194	19.309
75	1708	31.1	84.3	87.2	21.602	18.201
70	1717	28.9	85.2	87.1	20.035	17.074
65	1725	26.7	86.1	87.1	18.492	15.93
60	1733	24.5	87	87	16.974	14.77
55	1740	22.4	87.8	86.9	15.478	13.596
50	1747	20.3	88.6	86.5	14.006	12.409
45	1753	18.3	89.3	85.9	12.555	11.209
40	1759	16.5	89.9	84.8	11.126	9.999
35	1765	14.7	90.3	82.9	9.717 -5%	8.778
30	1771	13.1	90.6	79.8	8.328	7.547
25	1776	11.6	90.7	75.1	6.958	6.308
20	1781	10.3	90.3	68.2	5.607	5.061
15	1786	9.2	89.1	58.3	4.273	3.806
10	1790	8.3	86	44.9	2.957	2.544
5	1795	7.5	76.9	27.6	1.658	1.275
0	1800	7.1	0	6.6	.374	0

THESE DATA REPRESENT PERFORMANCE OF ONE MOTOR AND MUST NOT BE CONSIDERED AS REPRESENTING AVERAGE OR GUARANTEED VALUES FOR PRODUCTION MOTORS.

Attachment No. 15
Job 21701-523
Calc No. 21701-523-E-02
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REQUEST FOR ENGINEERING ASSISTANCE

REA No. 91-269
SYS No. 006
I/S No. _____

SPONSOR

1. Project Title: 480 VOLTS LOAD CENTER BREAKER OVERCURRENT TRIP SETTING

PTN Unit No. ☐ 3 ☐ 4 ☒ Common WA No. _____ PWO No. _____

2. Job Category Code: 6 Commitment Source: (Document No.) _____

Licensing Category Code: B4 Tracking No. FM-91-10-049 (CTRAC, etc.)

3. Expedited work ☒ Yes ☐ No Outage Work ☐ Yes ☒ No Desired Completion Date: 12-31-91

4. Problem Description and Proposed Solution: (Attach documentation for background and necessity.)
- CURRENTLY THERE ARE NO CONTROLLED ENGINEERING DOCUMENTS SPECIFYING THE OVER CURRENT TRIP SETTINGS FOR SAFETY AND ON SAFETY RELATED 480 VOLTS LOAD CENTER BREAKERS. ENCLOSED ATTACHMENT 1 SHOWS DETAILS FOR SOME OF THE BREAKERS BUT NOT FOR ALL BREAKERS. ATTACHMENT 2 SHOWS THE RESULTS OF TESTS DONE BY ABB DURING DUAL UNIT STAGE.
ENGINEERING IS REQUESTED TO EVALUATE THE DETAILS IN ATTACHMENT 1 AND PROVIDE CORRECT TRIP SETTINGS FOR ALL LOAD CENTER BKRS. ALSO PLEASE EVALUATE THE TEST RESULTS TEST IN ATTACHMENT 2 AND CONFIRM ACCEPTABILITY OF TEST RESULTS
NRC IS REQUIRED TO BE PREPARED FOR EDSFI AUDIT BY NRC

Attachments/sketches attached ☒ Yes ☐ No Dwg No. _____ Vendor Manual No. _____ P.O. No. _____

Attachment No. 16
Job No. 21701-523
Calc No. 21701-523-E-02
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Department: ELECTRICAL MAINTENANCE

Submitted by: _____ R.V. RAJAN 10-24-91
Sponsor's Signature / Print / Date

Approved by: _____ J.B. Sharpe 10-24-91
Sponsor's Supervisor Signature / Print / Date

MAINT

7. Work Force Can Support Implementation ☑ Yes ☐ No (If No, provide reason) N/A
ENG & DOCUMENT EVALUATION / CHANGES ONLY

_____ M.D. PEARCE 10/25/91
Maintenance Dept Head Signature / Print / Date

TECH DEPT

8. Priority Code 3 Approved Modification List ☐ Yes ☑ N/A DOC ONLY

Approved by: _____ M.L. LACAL 10/25/91
Design Control Supervisor Signature / Print / Date

9 Approval Potential Operability Concerns ☐ Yes ☒ No (Provide basis.)

This REA is a document only engineering analysis. The currently installed Load Center Breakers do not have any known deficiencies that would declare them inoperable, therefore no nuclear safety operability concerns exist.

_____ Ron Gullen 10/29/91
System Engineer Signature / Print / Date

FOR _____ J.M. Davis 10/29/91
Operations Support Supervisor Signature / Print / Date

10. Approved by: _____ A. ZELONKA 10/30/91
Tech Dept. Supervisor Signature / Print / Date

*F-123/1:2/date*10/1/91)

REQUEST FOR ENGINEERING ASSISTANCE
SUB. LOAD CENTER BREAKER C/L SETTING

REA: 91-289

ATTACHMENT 2

Attachment No. 16
Job 21701-523
Calc No. 21701-523-E-02
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TEST RESULTS OF LOAD CENTER BREAKERS

BREAKERS TESTED BY ABB AT FACTORY
DURING DUAL UNIT OUTAGE.

UNIT 3

30102
30105
30107
30108
30109
30203
30204
30210
30302
30307
30308, 30312, 30401
30403
30404
30408
30410

UNIT

40102
40105
40107
40108
40109
40204
40203
40210
40302
40307
40308
40312
40401
40403
40408
~~40410~~

DWA 845514

30105
CHP.

BROWN BOVERI

CIRCUIT BREAKER TEST SHEET

CUSTOMER Florida Power Light-Turkey Point JOB NO. 34-02417-C

BREAKER TYPE K600 SERIAL NO. 42503-AB23-5-8C

TRIP UNIT TYPE OD 61/20 TRIP COIL RATING 225A

TRIP UNIT SETTINGS (AS FOUND)

LONG DELAY 428/225 SHORT DELAY NA

INSTANTANEOUS 2250 GROUND NA

PRIMARY INJECTION TEST

Reduced Rating

	TEST AMPS	TIME BAND	A	B	C
LONG DELAY @ 425 % 300	1284A	26-52	40	40	
SHORT DELAY @ NA %					
INSTANTANEOUS 2250	2250A	0-0.25	.05	.05	.05
GROUND					

SECONDARY CONTROL TESTS

DEVICE	RATING	PART NO.	OPERATION CHECK
CHARGING MOTOR	125VDC		X
CLOSE COIL	125VDC		X
TRIP COIL	125VDC		X
UNDERVOLTAGE COIL	NA		
CONTROL RELAY	125VDC		X

MICROHMS
CONTACT RESISTANCE A. 110 B. 100 C. 210

MEGGAR. TEST @1000 VOLTS	BREAKER OPEN			BREAKER CLOSED					
	A	B	C	A-GRN	B-GRN	C-GRN	AB	BC	CA
MEGOHMS	2000+	2000+	2000+	2000+	2000+	2000+	2000+	2000+	2000+
HI POT TEST. @ KV	A	B	C	A-GRN	B-GRN	C-GRN	AB	BC	CA
1 MIN	NA								

CONTACT OPENING TIME NA CONTACT CLOSING TIME NA

REMARKS: Hi pot leakage current recorded in microamps

TESTED BY R. Simonelli DATE 05/28/91

30105

Attachment No. 16
Job 21701-523
Calc No. 21701-523-E-02
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ASEA BROWN BOVERI

BWA 845513

30109
CSP

CIRCUIT BREAKER TEST SHEET

CUSTOMER Florida Power Light - Turkey Point JOB NO. 34-02417-C

BREAKER TYPE K600 SERIAL NO. 42503-AB26-3-6D

TRIP UNIT TYPE OD 61/20 TRIP COIL RATING 300A

TRIP UNIT SETTINGS (AS FOUND)

LONG DELAY 660 / 270 Int. SHORT DELAY NA

INSTANTANEOUS 3750 / Int. GROUND NA

PRIMARY INJECTION TEST

	TEST AMPS	TIME BAND	A	B	C
LONG DELAY @ 660 % 300	1380A	27-52 sec	24.93	47.42	28.07
SHORT DELAY @ NA %					
INSTANTANEOUS 3750 x 150%	5625	0-0.25	.07	.05	.05
GROUND NA					

SECONDARY CONTROL TESTS

DEVICE	RATING	PART NO.	OPERATION CHECK
CHARGING MOTOR	125VDC		X
CLOSE COIL	125VDC		X
TRIP COIL	125VDC		X
UNDERVOLTAGE COIL	NA		
CONTROL RELAY	125VDC		

MICROHMS
CONTACT RESISTANCE A. 29.7 B. 30.5 C. 30.4

MEGGAR TEST @1000 VOLTS	BREAKER OPEN			BREAKER CLOSED					
	A	B	C	A-GRN	B-GRN	C-GRN	AB	BC	CA
MEGOHMS	100000	100000	100000	100000	100000	100000	100000	100000	100000
HI POT TEST @ KV	A	B	C	A-GRN	B-GRN	C-GRN	AB	BC	CA
1 MIN	NA								

CONTACT OPENING TIME NA CONTACT CLOSING TIME NA

REMARKS: Hi pot leakage current recorded in microamps

TESTED BY Shannon Hightower DATE 05/16/01

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Job 21701-523
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30109

ABB ABB BROWN BOVERI

DWA 845514 A

30203
CHP

CIRCUIT BREAKER TEST SHEET

CUSTOMER FPL- Turkey Point

JOB NO. 34-02417-C

BREAKER TYPE K600

SERIAL NO. 42503-AB23-1-8C

TRIP UNIT TYPE OD 61/20

TRIP COIL RATING 225 Amps

TRIP UNIT SETTINGS (AS FOUND)

LONG DELAY 349/225

SHORT DELAY NA

INSTANTANEOUS 2250

GROUND NA

PRIMARY INJECTION TEST

	TEST AMPS	TIME BAND	A	B	C
LONG DELAY @ 349 % 300	1047	65-75	72.73	74.24	75.21
SHORT DELAY @ NA %					
INSTANTANEOUS 2250 @ 100%	2250	0.-.25	.07	.08	.06
GROUND NA					

SECONDARY CONTROL TESTS

DEVICE	RATING	PART NO.	OPERATION CHECK
CHARGING MOTOR	125VDC		X
CLOSE COIL	125VDC		X
TRIP COIL	125VDC		X
UNDERVOLTAGE COIL	NA		
CONTROL RELAY	125VDC		X

MICROHMS CONTACT RESISTANCE A. 117 B. 118 C. 117

MEGGAR TEST @1000 VOLTS	BREAKER OPEN A	B	C	BREAKER CLOSED A-GRN	B-GRN	C-GRN	AB	BC	CA
MEGOHMS	100000	100000	100000	4000	3000	4000	100000	3000	100000

HI POT TEST @ KV	A	B	C	A-GRN	B-GRN	C-GRN	AB	BC	CA
1 MIN	NA								

CONTACT OPENING TIME NA

REMARKS: Hi pot leakage current recorded in

TESTED BY Shannon Highrower

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Rev. No. 0
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30203

SEA BROWN BOVERI

DWA 690772

30403
CSP

CIRCUIT BREAKER TEST SHEET

CUSTOMER FPL/Turkey Point — JOB NO. 34-02417-C

BREAKER TYPE K600 — SERIAL NO. 42503-AB26-1-8C

TRIP UNIT TYPE OD61/OD20 — TRIP COIL RATING 300 Amps

TRIP UNIT SETTINGS (AS FOUND)

LONG DELAY 750 Int 2.5 × 300 INTER DELAY — SHORT DELAY NA

INSTANTANEOUS 3000 — GROUND NA

PRIMARY INJECTION TEST

	TEST AMPS	TIME BAND	A	B	C
LONG DELAY @ 300 % 750	2250	27-47Sec	38.34Sec	41.85 Sec	40.20 Sec
SHORT DELAY @ NA %					
INSTANTANEOUS 3000	3000	0 - 0.25 Sec	2970A	3060A	2980A
GROUND NA					

SECONDARY CONTROL TESTS

DEVICE	RATING	PART NO.	OPERATION CHECK
CHARGING MOTOR	125 VDC		X
CLOSE COIL	125 VDC		X
TRIP COIL	125 VDC		X
UNDERVOLTAGE COIL	NA		NA
CONTROL RELAY	125 VDC		X

MICROHMS
CONTACT RESISTANCE A. 74 B. 68 C. 84

MEGGAR TEST @1000 VOLTS	BREAKER OPEN A	B	C	BREAKER CLOSED A-GRN	B-GRN	C-GRN	AB	BC	CA
MEGOHMS	100,000+	100,000+	100,000+	100,000+	100,000+	100,000+	100,000+	100,000+	100,000+

HI POT TEST @ KV	A	B	C	A-GRN	B-GRN	C-GRN	AB	BC	CA
1 MIN	NA	NA	NA	NA	NA	NA	NA	NA	NA

CONTACT OPENING TIME NA — CONTACT CLOSING TIME NA

REMARKS: Hi pot leakage current recorded in microamps

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