Public Service

Public Service
Company of Colorado
P.O. Box 840
Denver, CO 80201 - 0840
(303) 571 - 7511

January 31, 1985
Fort St. Vrain
Unit No. 1
P-85035

Regional Administrator
Region IV
Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

Attention: Mr. E. H. Johnson

RECEIVED
FEB - 5 1985

Docket No. 50-267

SUBJECT: Safety Parameter Display System

REFERENCES: 1) PSC Letter, Warembourg to Johnson, 11/13/84 (P-84487)

2) NRC Letter, Johnson to Lee, 9/14/84 (G-84355)

Dear Mr. Johnson:

In Reference 1 above, we indicated that the following information (quoted from Reference 2) regarding the Safety Parameter Display System Isolators would be provided by 1/31/85:

NRC Request

With regards to isolation devices between the SPDS and safety systems, provide the following information:

1.) "Prior to procurement, FSV will conduct an analysis to determine the maximum credible fault (voltage and current) that the isolators will be exposed to during normal operation. The staff advised FSV that the credible fault must be applied to the output of the device in the transverse mode (between signal and return) and other faults should be considered (i.e, open and short circuits)."

2.) "The staff requested that the acceptance criteria be identified in their Safety Analysis Report, and the tests results be submitted to the NRC for confirmatory review."

H005.
1 RETURN ORIGINAL TO RIV

3.) "Define the pass/fail acceptance criteria for each type of device."

4.) "A description of the measures taken to protect the safety systems from electrical interference (i.e., Electrostatic Coupling, EMI, Common Mode and Crosstalk) that may be generated by the SPDS."

Item 1 is addresed by Attachment 1 to this letter. Items 2 and 3 are addressed by Attachment 2. Item 4 can not be supplied at this time, as we are vendor dependent regarding this information. This information will be supplied as soon as it is available, in any case it should be no later than August, 1985.

If you have any questions regarding this matter, please call Mr. M. H. Holmes at (303) 571-8409.

Very truly yours,

D. W. Warembourg

D. W. Warembourg
Manager, Nuclear
Engincering Division

DWW/MEN/ksc

Attachments

Fort St. Vrain Safety Parameter Display System Isolation Device Maximum Credible Fault Study

A Maximum Credible Fault Study was conducted to ensure the isolation devices selected for use by the SPDS System would protect associated safety related systems. As we indicated in Reference 1, test configurations and test data will be supplied when available. This is currently scheduled to be no later than August, 1985.

The study analyzed all ports in the isolating devices to ensure all faults were considered.

Isolator Input Faults

The Data Logger Inputs requiring isolation were divided into two categories:

* Current Loops - These contain potentials of up to 84 VDC with normal signals of 4 to 20 mA and 10 to 50 mA.

* Miscellaneous Circuitry - These contain potentials and outputs up to 20 VDC.

All of these categories are powered from 120 VAC sources. This value was set as a baseline minimum fault potential.

Each category was analyzed for faults (shorts, opens, component value changes) to determine the highest potential that could possibly appear on the output of the circuit and the input of the isolating devices. It was decided to determine both the largest AC and DC potential due to the use of large DC potentials in some circuitry.

The study determined the highest AC potential and current to be 120 VAC 2 amps. The highest DC fault potential was found to be in the current loop category (Ref. Fig. 2). The DC potential and current is 100 VDC 1 amp.

Isolator Cabinet Faults

The maximum fault to be isolated on the output and power ports of the isolating device will be determined by the maximum credible fault available in the isolation cabinet (see Figures 6 &7). This fault will not be tested in the input side of the isolating device as the required physical separation between IE and non IE sides of the isolating cabinet negates the credibility of this fault appearing on the isolator input.

The data logger input/output cabinets and isolation will be supplied by inverters N-9255 and N-9234 (refer to Fig. 1). These two inverters supply 120 VAC, 109 (RMS) AMPS and 120 VAC, 130 AMPS (RMS) respectively. The worst possible fault would be a direct short on the output of one of the inverters (N-9234) due to its greater current capacity. Actual data on the inverters peak current on fault is unavailable. However, an examination of data from inverters similar to N-9255 and N-9234 shows the output on fault to reach approximately 125% before the current limiting circuit in the inverter begins to control the output (ref. Fig. 3). Cable lengths between the inverters and the equipment are short; therefore, the effect of the cable impedance on the fault current is negligible. Current breakers are in the line but their response time at the current produced will allow the current through to the isolation cabinet (Reg. Fig. 4). A safety switch with Amptrap A13t-2 AMP fuses will be placed in the line to reduce the current available to the isolation cabinet from 162.5 AMPS to 5 AMPS (Ref. Fig. 5).

The maximum credible fault to be tested for at the output and power ports of the isolating device is, therefore, 120 VAC, 5 AMPS (RMS).

The maximum credible faults that are to be tested are:

Input: (1) 120 VAC, 2 AMPS
(2) 100 VDC, 1 AMP

Output and Power Supply: 120 VAC, 5 AMPS

Isolator Fault Testing Acceptance Criteria

The isolation device will be considered acceptable if the above testing meets the following criteria:

1. Fault on Input (120V, 2A & 100VDC, 1 AMP)

   a) Associated output does not exceed its normal range.

   b) No effect on the input and output of the other channels of the device (multichannel devices only)

   c) No effect on the ± 15 volt power supply voltage.

2. Fault on Output (120V, 5A)

   a) Less than 0.5% change in the associated input.

   b) No effect on the input and output of the other channels of the device (multichannel device only).

   c) No effect on the ± 15 volt power supply voltage.

3. Fault on Power Supply (120V, 5A)

   a) Output on any channel does not exceed its normal range.

   b) Less than 0.5% change in the input of any channel of the device.

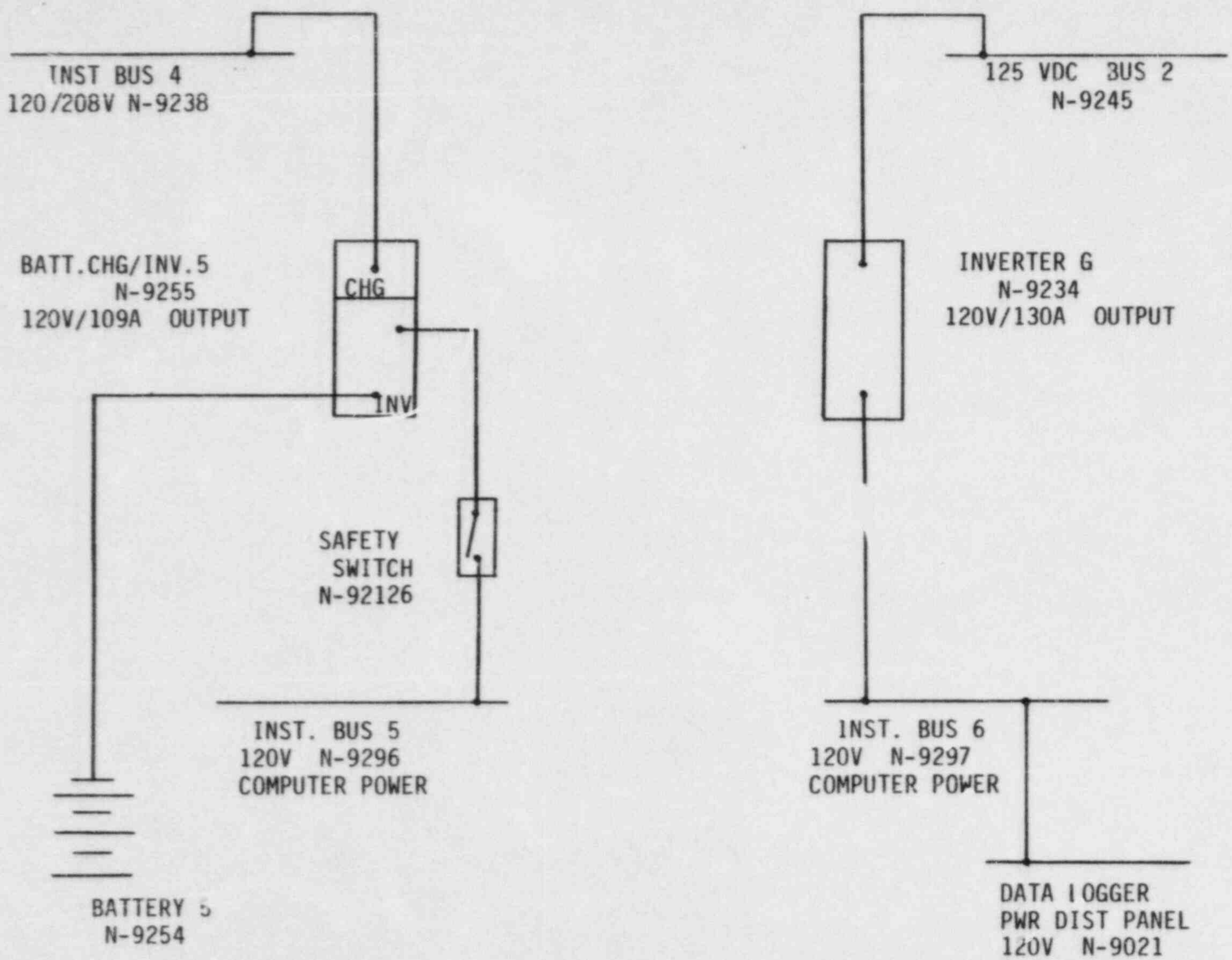
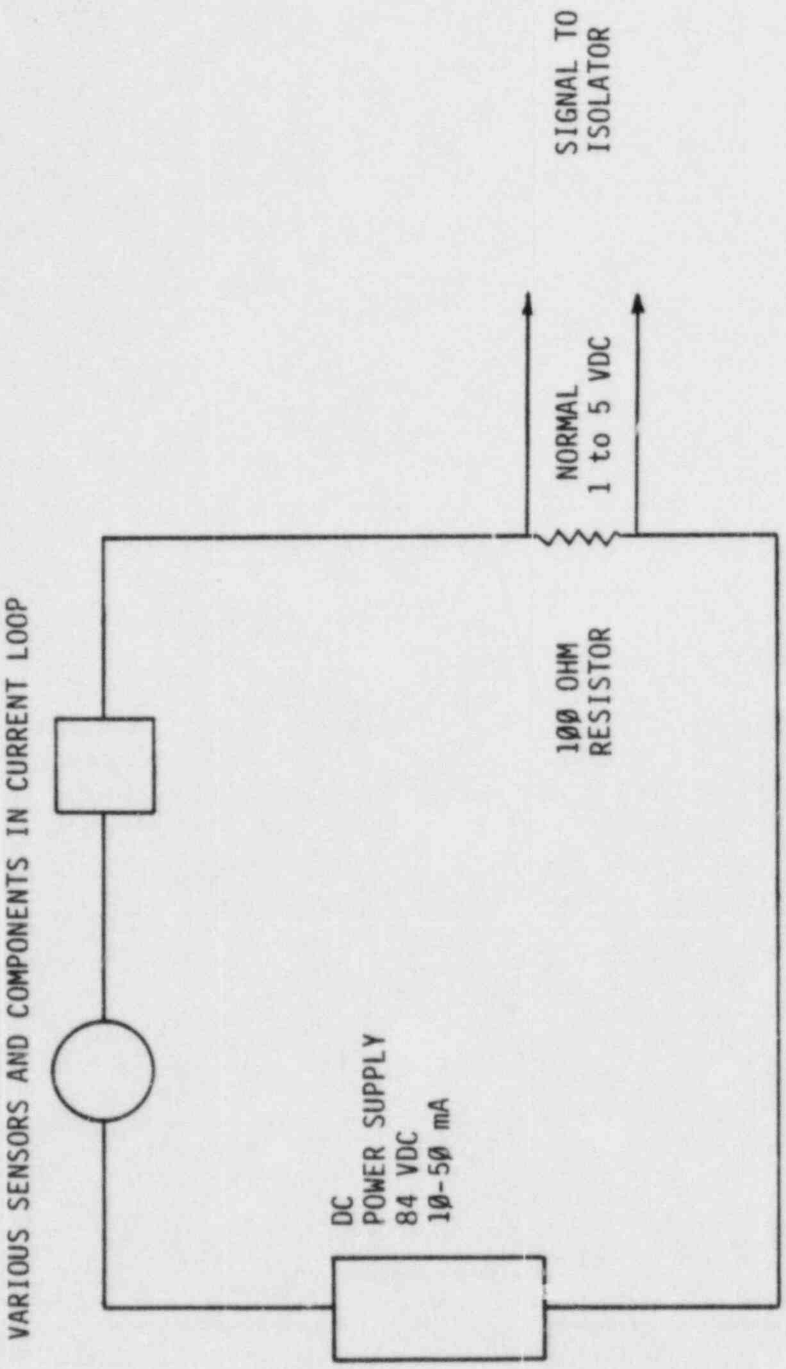


FIG. 1

ISOLATION POWER



TYPICAL CURRENT LOOP

FIG. 2

SECTION 56.05

Typical Characteristics
Static Inverters
14 to 50 KVA single phase
42.5 to 150 KVA 3 phase

STATIC UNINTERRUPTIBLE AC POWER SYSTEMS

TYPICAL CHARACTERISTICS

MODEL	INPUT BATTERY VOLTAGE	NOMINAL KVA RATING @ 0.8 P.F.	A-C OUTPUT VOLTAGE	OUTPUT PHASES	A-C OUTPUT AMPERES/PHASE @ 0.8 P.F.	CABINET SIZE SEE SEC. 56.16	I NET WT LBS.	I NO-LOAD D-C AMPS.	FULL LOAD D-C INPUT AMPS. AT MAX. KW 0.9 P.F. AND FOLLOWING VOLTS: Disch. Bat.	Float Volt.	Equal. Volt.	KVA AT FOLLOWING TEMPERATURES AND P.F.: 32° TO 104°F. CONVECTION COOLED POWER FACTOR: 0.5 LAG.	0.8 LAG.	0.9 LAG.	1.0	32° TO 122°F. CONVECTION COOLED POWER FACTOR: 0.5 LAG.	0.8 LAG.	0.9 LAG.	1.0	I FORCED AIR COOLED %: 104°F.	122°F.	I 2 MIN. RATING KVA
120/14F1	120 Nom. 105-140	14	120V or 120/240V	SINGLE	117 58	(1) W6	1800	14	138	116	108	15	14	13	10	15	14	13	10	110%	110%	15
120/17F1	120 Nom. 105-140	17	120V or 120/240V	SINGLE	142 71	(1) W6	1800	14	170	141	132	18	17	16	12	16	15	14	10.5	100%	108%	18
120/21F1	120 Nom. 105-140	21	120V	SINGLE	175	(1) W6	2000	18	202	168	153	22.5	21	19	15	18	17	15	12	110%	110%	23.5
120/25F1	120 Nom. 105-140	25	120V	SINGLE	208	(1) W6	[illegible]	24	249	203	187	26.5	25	23	18	22.5	21	20	15	110%	110%	31
120/30F1	120 Nom. 105-140	30	120 V or 120/240V	SINGLE	250 125	(1) W6	2900	30	280	234	220	31.5	30	28	21	29	28	26	19.5	110%	110%	37.5
240/30F1	240 Nom. 210-280	30	120V or 120/240V	SINGLE	250 125	(1) W6	2200	15	140	117	110	31.5	30	28	21	29	28	26	19.5	110%	110%	37.5
240/50F1	240 Nom. 210-280	50	120V or 120/240V	SINGLE	416 208	(1) W8	4600	25	249	203	187	53	50	46	36	45	42	40	30	106%	106%	62.5
120/42.5F3	120 Nom. 105-140	42.5	120/208V or 240/416V	THREE	117 58	(3) W6±	5400	42	414	348	324	45	42.5	39	30	45	42.5	39	30	110%	110%	45
120/51F3	120 Nom. 105-140	51	120/208V or 240/416V	THREE	142 71	(3) W6±	5400	42	510	423	396	54	51	48	36	48	45	42	31.5	100%	108%	54
120/63F3	120 Nom. 105-140	63	120/208V	THREE	175	(3) W6±	6000	54	606	498	459	67.5	63	57	45	54	51	45	36	110%	110%	70.5
120/75F3	120 Nom. 105-140	75	120/208V	THREE	208	(3) W6±	7500	72	747	609	561	79.5	75	69	54	67.5	63	60	45	110%	110%	93
120/90F3	120 Nom. 105-140	90	120/208V or 240/416V	THREE	250 125	(3) W6±	8700	90	840	702	660	94.5	90	84	63	87	84	78	58.5	110%	110%	112.5
240/90F3	240 Nom. 210-280	90	120/208V or 240/416V	THREE	250 125	(3) W6±	6600	45	420	351	330	94.5	90	84	63	87	84	[illegible]	58.5	110%	110%	112.5
240/100F3	240 Nom. 210-280	100	120/208V or 240/416V	THREE	278 139	(3) W6±	6750	45	466	388	366	105	100	93	70	96.5	[illegible]	85	64.5	100%	100%	112.5
240/150F3	240 Nom. 210-280	150	120/208V or 240/416V	THREE	416 208	(3) W8±	13 800	75	747	609	561	159	[illegible]	[illegible]	108	135	126	120	90	106%	106%	187.5

I Add 15% for shipping weights.
I At battery float voltage.
I Disch. battery volts 105-120-210. Float volts 129-146-258. Equalize volts 140-158-280. Values for natural convection cooling 32° to 104°F. power rating.
I Model 240/100F3 is forced air cooled.
I Rating is in % of convection cooled ratings at ambient temperatures listed.
I @ 104°F. max. without limit, and any P.F. from 0.5 lagging to unity.
I See Automatic Voltage Regulation note below.

AUTOMATIC SYNCHRONIZING:
Phase of Output Voltage is held within ±5° of sync signal source when the source is between 92 and 138 volts between 58 and 62 Hz.

AUTOMATIC VOLTAGE REGULATION:
±1% for **any one** condition, or ±2% total regulation for **any combination** of the following conditions:

a. 0-max. continuous rated load, 1.0-0.5 p.f. lagging.*
b. from discharge to equalize battery voltage (see Note above).
c. 32-122°F ambient.

DUTY: Continuous

RANGE OF ADJUSTMENTS:
Voltage ±4.2%
Frequency ±2 Hz

FREQUENCY STABILITY:
±.6 Hz, 32-122°F.
±.5 Hz, 50-100°F.

NOTE

HARMONIC DISTORTION:
5% max. (at nominal freq. & voltage)

PART LOAD EFFICIENCY, % of F.L. eff.:
½ L—90%, ¼ L—75%

START-UP PROVISIONS:
Input Circuit Breaker & Pre-charge Switch
4 second programmed start

CIRCUIT PROTECTION:
Input - D-C Input CB (per phase)
Control Circuit - fuses
Power Semiconductors - current limit fuses (+2 spares)
Output - Automatic Current Limit (can be disconnected)

SHORT CIRCUIT OUTPUT CURRENT:
Approx. 125% of unity p.f. F.L. Amperes

D-C INPUT TRANSIENT TOLERANCE:
4000V for 10 microseconds (40 ohms or greater transient source impedance).

INSTRUMENTATION:
One a-c voltmeter & One a-c ammeter per phase, 2% accuracy.
Synchronization verification light

CONSTRUCTION:
Front and rear access cabinet.
Components on vertical pans. Removable with screw driver and wrench. ASA61 Lt. Gray paint.

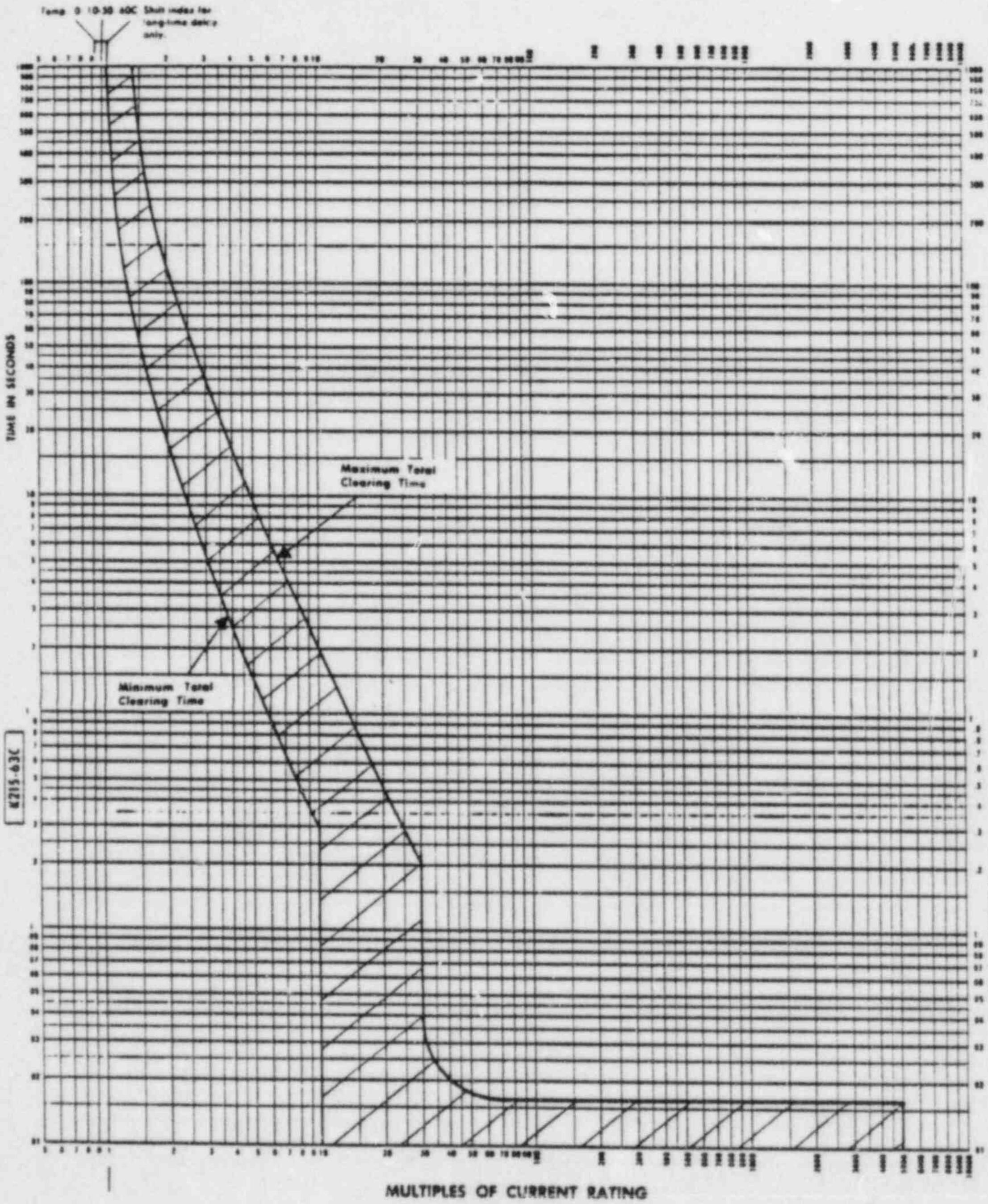
CABINET:

Type	DIMENSIONS: Width	Height	Depth	CLEARANCES: Front	Ov'rh'd	Rear
(1) W6	54"	84"	32½"	27"	24"	27"
(1) W8	64"	84"	48"	36"	30"	36"
(3) W6±	162"	84"	32½"	27"	24"	27"
(3) W8±	192"	84"	48"	36"	30"	36"

±Note: Inverter assembled and shipped in three separate W cabinets.

** Load regulation will be ±1.5% for inverters marked in A-C Output Voltage Column above, when load is 120V, 2 wire or 120/208V.*

FIG. 3



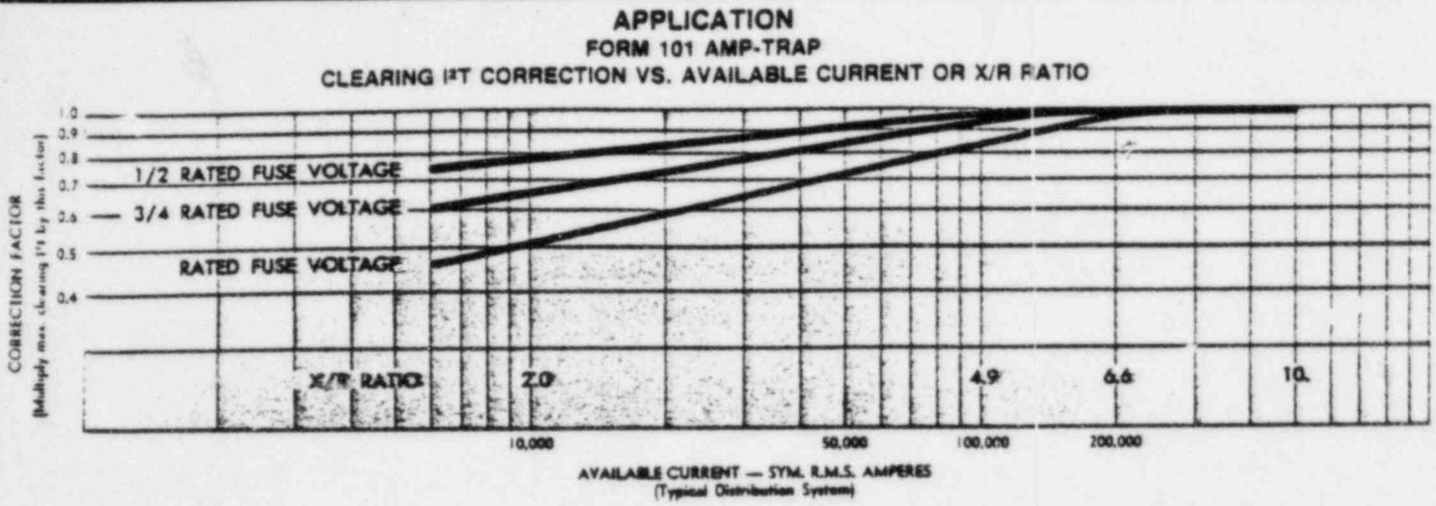
GENERAL ELECTRIC	MOLDED-CASE CIRCUIT BREAKER "Q" LINE	K215-63C
Current Ratings 15, 20 and 30 Amperes TXQL, TXQB & TXQC 15, 20, 30, 40 and 50 Amperes **Voltage Ratings** 1 and 2 Pole —120/240 Volts, A-c 2 and 3 Pole—240 Volts, A-c **Frequency Rating** 60 Cycles	**AMBIENT COMPENSATED** Types TQL-AC (2 & 3 Pole), TXQB, TXQ & TXQL (1 & 2 Pole) TQB, THQB, TQC, THQC and THQL-AC (1, 2 & 3 Pole) **Long-time Delay and Instantaneous Time-current Curve** (Curves show circuit breaker in open air, 10-50C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients use rating shift index at top of sheet.)	**Adjustments** Long-time delay thermal trip: not adjustable Instantaneous magnetic trip: not adjustable

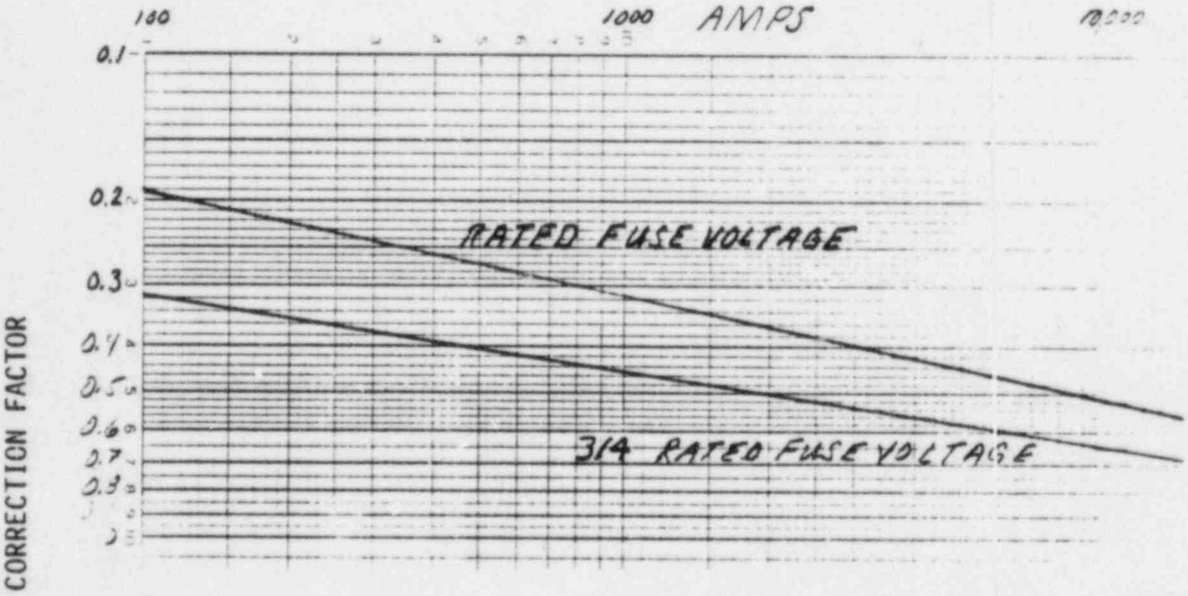
GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062

$$\frac{162.5 \text{ AMPS}}{15 \text{ AMPS}} = 10.83 \text{ MULTIPLES}$$

FIG. 4

Amp-trap® Form 101





I^2T - 130 VOLTS OR LESS			
A13X or A13Z	MELTING I^2T	CLEARING I^2T (65V CIRCUIT)	CLEARING I^2T (130V CIRCUIT)
1	[illegible]	.18	.27
2	[illegible]	[illegible]	1.5
4	2.3	4.6	6.9
5	2.9	5.8	8.7
6	3.2	6.4	9.6
7	4.2	8.4	13
8	7.8	15	24
10	13	26	39
12	18	36	54
15	20	40	60
20	36	72	110
25	56	110	170
30	81	160	240
35	170	230	340
40	220	310	460
50	390	520	780
60	570	740	1100
70	840	1700	2500
80	1000	2000	3000
100	1600	3200	4800
150	3600	7200	1.1×10^4
200	6400	1.3×10^4	1.9

FSV SUPPLY VOLTAGE = 120 VAC or 92% FUSE RATED VOLTAGE
FAULT CURRENT = 162.5 AMPS
CORRECTION FACTOR = (8/25) (0.34-0.215) + 0.215 = .255

$I^2t = 1.5\ (0.26)\ \text{Amp}^2\ \text{Sec.}$

$I^2(.0167) = 1.5\ (0.26)\ \text{Amp}^2\ \text{Sec.}$

$I^2 = \frac{0.39}{.0167}\ \text{Amp}^2$

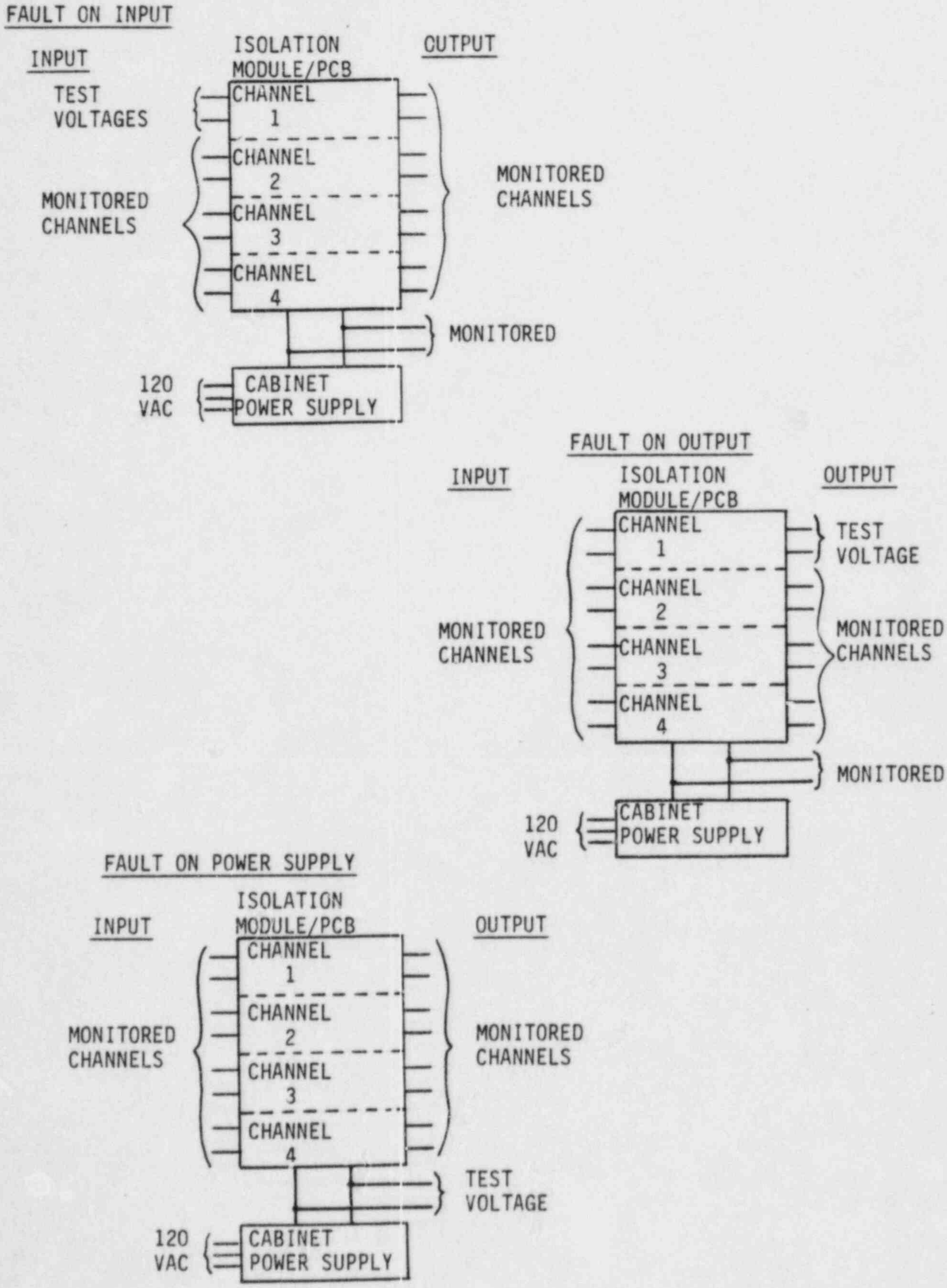
$I^2 = 23.35\ \text{Amp}^2$

$I = 4.83\ \text{Amp} \approx 5\ \text{Amp}$

PEAK LET THROUGH CURRENT = 5 AMP

NOTE: TABLES TAKEN FROM GOULD SCHAWMUT BULLETIN #AT618.

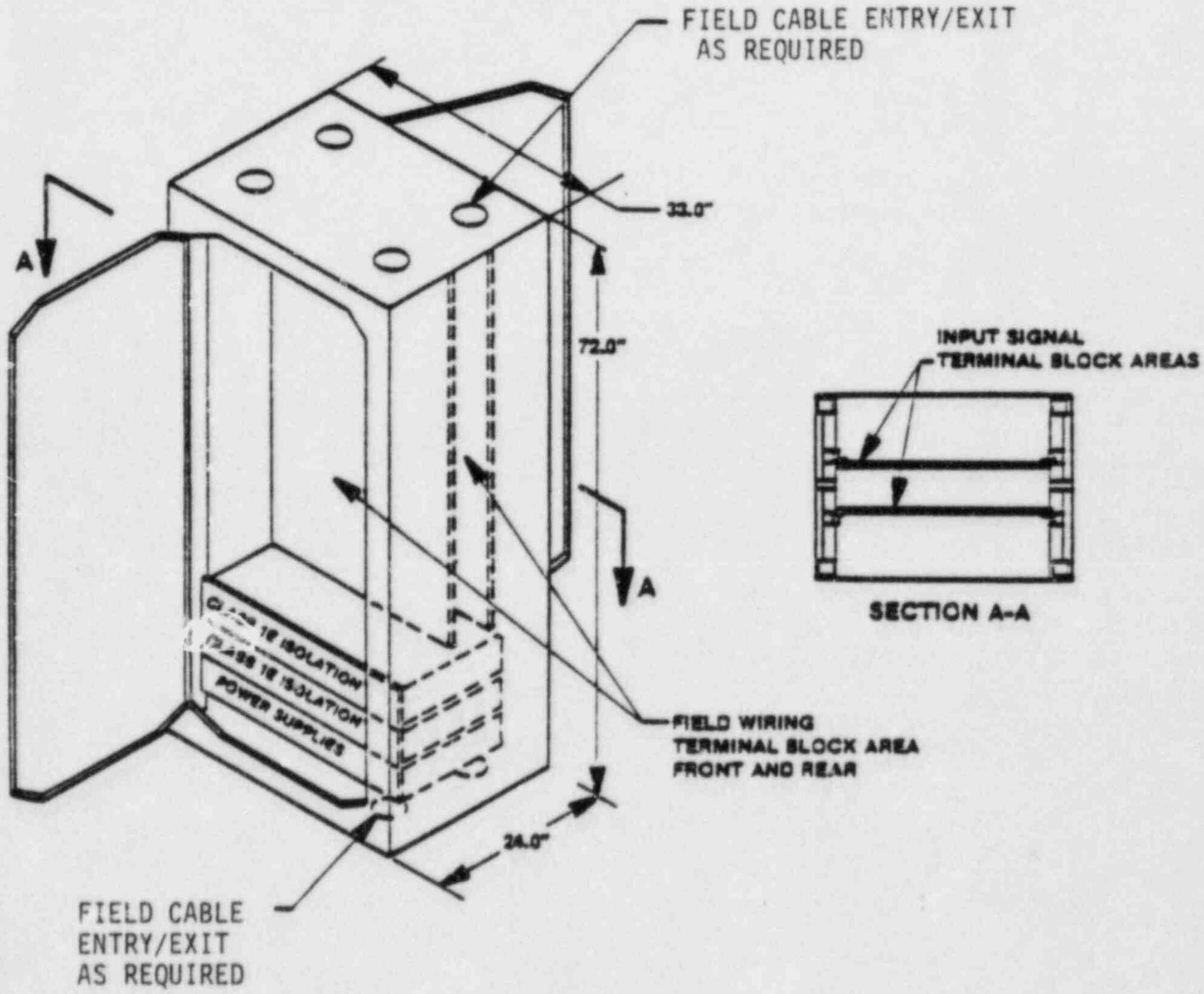
FIG. 5



ISOLATION TESTING

FIG. 6

ISOLATION SYSTEM CONFIGURATION



PRELIMINARY CABINET CONFIGURATION
NOTE: FINAL CONFIGURATION WILL BE VENDOR DEPENDENT. FINAL CONFIGURATION WILL MEET IEEE STD. 384 (1982)

FIG. 7