NSP

Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401
Telephone (612) 330-5500

August 17, 1982

Director
Office of Nuclear Reactor Regulation
U S Nuclear Regulatory Commission
Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 License Nos. DPR-42
50-306 DPR-60

Additional Information Related to Station Electric Distribution System Voltage Study

On June 3, 1982 our NRC Project Manager in the Division of Licensing transmitted to us seven additional questions related to our July 17, 1981 Station Voltage Distribution System Voltage Study and our April 13, 1982 submittal of additional information. The purpose of this letter is to provide responses to the June 3, 1982 questions.

Responses to the seven items contained in the June 3, 1982 request are attached. Please contact us if you have any questions related to the information we have provided.

As noted in the attached responses, we believe we have resolved all NRC Staff questions concerning adequacy of station auxiliary distribution system voltages at Prairie Island. Installation of a second startup transformer during 1982 will provide a distribution system which is extremely flexible and reliable. Additional modifications to the CT11 source are under study to permit extended outages of the 1R/No. 10 source.

David Musolf

David Musolf
Manager Nuclear Support Services

A015

DMM/bd

cc: Regional Administrator-III
NRR Project Manager, NRC
NRC Resident Inspector
G Charnoff

Attachment

8208200084 820817
PDR ADOCK 05000282
P PDR

Response to Request for Additional Information
Prairie Island Nuclear Generating Plant, Units 1 and 2
June 2, 1982

1. Please submit a one-line diagram showing the feeders for transformer 2R and the buses it is energizing.

   Response
   See attached Figure 1.

2. Following the installation of transformer 2R, what will be the preferred source for bus 16 and bus 26? What will be the alternate source for bus 15, bus 25, and bus 26? Could there be more than one alternate source? If so, would transfer to a second alternate source be automatic?

   Response

Bus No.	Preferred Source	1st Alt Source	2nd Alt Source	Other Source
15	1R	Bus tie to 26	-	1M
16	1R	CT11	Bus tie to 25	-
25	2R	Bus tie to 16	-	-
26	2R	CT12	Bus tie to 15	-

Buses 16 and 26 will have two alternate sources. Transfer will be automatic. Supply from 1R or 2R will be by manual transfer only for these buses.

It should be noted that no changes to the basic voltage restoring scheme have been made.

3. The analysis submitted in Ref. 2 indicates that when transformer 10 is down certain conditions are required for the Spring Creek Line to be an adequate source. Is the transfer to the Spring Creek Line automatic. If so, LCO's should be submitted for use of the Spring Creek Line or transformer 1R should not be considered a preferred source when transformer 10 is down. Please provide the required LCO's or the necessary circuit changes that will prevent transformer 1R from being a preferred source when it is on an inadequate source.

   Response

   Prairie Island Technical Specification 3.7 (attached) does not require the operability of any specific offsite source. Specification 3.7 does require, however, two offsite power sources with a permissible period of inoperability of up to seven days for one of these sources. The Basis section discusses specific sources available to meet these requirements.

   We do not consider a source operable in the sense of Specification 3.7 unless it can provide adequate voltage for safeguards loads. It would be extremely difficult to write a Technical Specification covering all possible plant operating conditions and substations equipment outages.

When the plant offsite sources are not in their normal configuration due to plant or substation equipment outages, an evaluation must be done to confirm that the requirements of the Technical Specifications are met or what actions are necessary (e.g. shut down one unit and back feed through the main generator transformer) to assure that two adequate offsite sources are available to each operating unit.

4. The analysis of Ref. 2, Table 11 indicates that some 480-volt motors could be starting at 73% of nameplate voltage. Have tests been conducted to show that these motors will start at the degraded value? Provide the results of these tests or provide the manufacturer's motor curves. What is the service factor of the motors that will be operated below nameplate rating? Table 11 also indicates that the voltages could drop to 70% of 480 volts on bus 120. Page 2 of Rev. 4 states that the maximum drop out voltage for motor starters is 340 volts or 71% of 480 volts. Verify that this difference will not cause the possibility of a motor starter spuriously dropping out.

Response

At 70% (case b) credit is taken for reaching breakdown torque on the motor only in three cases:

1) Air compressor
2) Fan Coil Unit (FCU)
3) Control Room (CR) Chiller

The Compressor and CR Chiller are unloaded during starting. The FCU has a maximum accident load of 25 HP or 150 ft-lbs. The FCU motor has breakdown torque of 900 Ft-lbs. Based on starting circuit design and manufacture's data, these are capable of starting with 50% voltage. Refer to the attached data sheet and curves.

At 77.3% (case c) voltage the general purpose motors are capable of starting and reaching breakdown torque. This is based on the attached "Standard Specification" and starting time data. These calculations were based on loads equal to motor nameplate. Ampere readings have shown that the motors are generally oversized for their application, especially the motor valves. During the Integrated SI Test the bus voltage dips below 77% and has never caused a problem with equipment overloading.

Table 11 was originally calculated using the "Transformer with load sequencing" computer program. Cases "b" thru "d" have been re-analyzed using the "Transformer with dynamic load" computer program. Case "b" corresponds to TIM = 0 and case "d" corresponds to TIM = 18.4 sec.

This dynamic analysis shows that these motors are capable of starting under these conditions. Starting time and currents are indicated on the attached computer print outs. We have no way of testing installed equipment with low voltage and manufacturing data is not available.

The motors have class B insulation with S.F. = 1.15.

Drop out of a starter at point "b" is not a concern since the condition is temporary, and the S signal will restart the equipment.

It may be helpful to recall that the original analysis results presented in Tables 9, 10, and 11 of Reference (2) were based on the 4160 volt buses at 88%. This was done because the undervoltage protection logic setpoint could conceivable be as low as 90% (nominal setting) - 2% (allowable deviation). This was an extremaly conservative assumption since the analysis showed that 4160 volt bus voltage would not fall below 92% in steady state (again with the extremely conservative assumptions of an accident in one unit, a trip of the other unit, and the 345 KV bus at 100% - a grid condition which has happened perhaps once or twice in the last ten years).

For purposes of this question, the 480 volt load voltage calculations have been repeated assuming 4160 volt bus voltage of 92%. Copies of Tables 9 and 10 with the new voltage calculations are attached. Results indicate Bus 120 at 87.5% (instead of 83.3%) and all motors with greater than 89% of nameplate voltage available.

As noted in earlier correspondence, 4160 volt bus voltage is monitored by computer alarms set at 92%.

5. Ref. 2 refers to the use of interposing relays. Please expand on how the interposing relays function in the circuitry.

Response

Refer to Figure 2. The interposing relay reduces the current (and resulting losses) in control wiring.

6. Ref. 3, Page 3, Item 5, provided "test verifications." These verifications were based on actual meter deflection versus computed meter deflection for a change of load. To verify actual calculation, a measurement of the bus voltages with the buses loaded to at least 30% of all full load needs to be compared with the calculated values for that loading for both steady state transient conditions.

Response

The load changes on the buses were greater than 30% of full load. The technique used achieved greater accuracy and greater control of variables contributing to error. Refer to Table 3 on page 19.

	Low Load Test Condition	Heavy Load Test Condition
1R	1.3 MW	10.2 MW
CT11	1.7 MW	9.7 MW
CT12	0.7 MW	9.8 MW

The base case noted in Table 3 was a lighly loaded condition prior to the test. Results indicate good agreement between measured and computed voltages.

For the 1R testing, 4160 v measured voltages were for all practical purposes the voltages on the safeguards buses (bus duct losses are negligable under these conditions). For the CT-11 and CT-12 testing, the voltages are those on the cooling tower buses and the test did not fully confirm all elements of the model down to the 4160 v buses (feeders from the cooling tower substation to the plant buses and not taken into account). However, the SI pump start testing that was conducted (page 4 of reference 3) confirms modeling down to the 4160 v bus level (CT-11 was the source for the SI pump start tests - this is our weakest source).

7. Ref. 3, Page 3, Item 3.c mentions bus CT11 circuitry modifications. Under what conditions will the modifications be imposed (under all conditions, under certain conditions, or under SI conditions, etc.)? Please provide additional details for these modifications.

Response

The auto transfer of Bus CT12 to Bus CT11 on undervoltage was defeated (under all plant conditions) at the end of the last Unit 2 refueling outage. No actual modification work was required since this was accomplished through control switches and equipment control tags. This prevents overloading of the CT11 source.

Other plant modifications are now being considered which would permit CT11 to be an adequate source under accident conditions for both cooling tower buses. This modification would provide additional plant flexibility for removing 1R or No. 10 transformer from service for extended periods of time since CT11 would be a fully adequate source for two units (along with 2R). Note that this modification is not needed to assure adequate station distribution system voltages at the safeguards buses unless one of the other sources (1R, 2R, or CT12) is unavailable for more than seven days.

Alternatives now being considered include a larger CT-1 transformer or load shedding circuitry which would remove the cooling tower loads (if running) prior to closing the cooling tower bus tie breaker on loss of voltage to CT-12. A decision will be made in 1982 concerning this modification. Upon adoption of one of these modifications, the automatic transfer of CT12 to CT11 will be reinstated.

References:

REF. 1: NRC Generic Letter to All Power Reactor Licensees, dated August 8, 1979

REF. 2: Northern States Power Company letter (L O Mayer) to the NRC (Director of Nuclear Reactor Regulation), dated July 17, 1981

REF. 3: Northern States Power Company letter (L O Mayer) to the NRC (Director of Nuclear Reactor Regulation), dated April 13, 1982

REF. 4: Northern States Power Company letter (L O Mayer) to the NRC (Director of Nuclear Reactor Regulation) dated November 20, 1981

TEMPERATURE TEST DATA
G.O. MP76141-AR67
546-GXM-91326-VN
S.O. 70C63535
449T RCFC MOTOR NSP-RCMOCF-03

	1800 RPM			900 RPM	
	63 HP	76 HP	86.2 HP	25 HP	15.3 HP
Amps	73	86.4	97	67.2	62.7
KW Input	50.2	60.8	69.3	20.3	12.8
KW Loss	3.214	4.124	5.004	1.814	1.520
Stator T/C 1	56	64	70.5	60.5	55
2	54	61	67	58	53
3	54	61	67	57.5	52.5
(°C) 4	53	59	65.5	57	52
5	56	63	70	60.5	55
6	53	60	65.5	57	52
F. Brg.	29.5	29.5	30	26.5	25.5
R. Brg.	35.5	37	39	35	32.5
Air In	27	27	27	24.5	24
Air Out	36.5	38.5	40.5	36.5	34
Amb. Air	28	28	28.5	26	25
Frame Fr.	33	34	35.5	32	30
Frame Rr.	36.5	38.5	40.5	37.5	35
Cu Rise T/C	26	33	39	33	28
Cu Rise Res.	23.5	29.5	35	30.5	26.5
Air Rise	9.5	11.5	13.5	12	10

L J Krawczyk
L. J. Krawczyk
etm
12/28/70

Table 1 - Fan Coil Unit Data

S= % sync speed

A = % full load current

		Running	Motor Valves (MV)	Waste Gas Comp	All others (3 sec)	All others (4.5 sec)	Aux Bldg Spec Fan
I	WS	428.2	250.0	44.0	295.5	295.5	44.0
II	VS	707.5	316.0	135.6	449.0	449.0	135.0
III	WR	214.1	56.8	21.2	78.65	78.65	21.2
IV	VR	103.8	27.5	10.3	38.2	38.2	10.3
V	TS	[illegible]	0.8	0.8	0.8	0.8	0.8
VI	TH	2.0	2.6	2.0	2.6	2.0	2.0
VII	IR	1.0	1.0	1.0	1.0	1.0	1.0
VIII	ID	1	1	2	4	1	1
IX	WK	71	71	172	215	323	645
X	[illegible]	1200	1200	1200	1200	1200	1200
XI	SP	60	60	60	60	60	60

TIME	V1	V2	KW	KVAR	S	A	S	A	S	A	S	A	S	A	S	A
0.0	80	701	895	855	0	140	0	447	0	444	0	444	0	444	0	444
0.2	80	702	895	844	29	139	12	440	5	442	4	442	3	443	1	444
0.4	80	703	895	838	52	138	23	434	10	439	8	441	5	442	3	444
0.6	80	704	896	828	70	137	35	428	15	437	11	439	8	441	4	444
0.8	80	706	898	819	81	135	42	423	20	434	15	437	10	441	5	444
1.0	80	707	900	801	89	133	49	420	25	432	19	436	13	440	6	444
1.2	80	710	904	781	93	130	54	413	30	430	23	435	15	440	8	443
1.4	80	709	900	786	96	132	59	406	35	426	26	432	18	438	9	443
1.6	80	707	891	807	97	138	62	399	40	421	30	429	20	435	10	441
1.8	80	706	887	816	98	141	65	394	46	417	33	426	23	433	11	440
[illegible]	80	706	884	811	98	139	67	391	51	413	36	424	25	432	13	439
[illegible]	80	707	883	808	98	139	68	389	56	404	39	423	27	430	14	435
[illegible]	80	707	882	804	98	139	69	388	62	395	41	421	29	429	15	439
[illegible]	80	708	882	801	98	139	70	387	68	385	44	420	32	428	16	438
[illegible]	80	708	881	796	98	139	70	386	75	367	46	419	34	427	18	437
[illegible]	80	709	880	791	98	138	71	384	81	339	48	418	36	426	19	437
[illegible]	80	710	878	781	98	138	71	383	90	291	50	417	38	425	20	437
[illegible]	80	713	878	754	98	138	72	383	98	136	52	416	39	426	21	438
[illegible]	80	714	878	751	98	138	72	382	98	138	54	413	41	425	23	437
[illegible]	80	714	877	748	98	137	73	380	98	137	56	410	43	424	24	437
[illegible]	98	786	1041	903	99	151	73	417	98	151	57	449	45	466	25	483
[illegible]	88	789	1015	877	98	125	77	405	98	125	60	446	47	466	26	481
4.4	88	796	1012	874	98	125	80	393	98	125	62	443	47	465	28	480
[illegible]	88	791	[illegible]	858	98	125	83	367	98	125	64	440	51	463	29	480
[illegible]	88	793	[illegible]	[illegible]	98	125	87	326	98	125	66	437	53	461	31	480
[illegible]	88	[illegible]	980	[illegible]	98	124	[illegible]	[illegible]	98	[illegible]	68	[illegible]	55	459	32	480
[illegible]	88	803	[illegible]	[illegible]	98	123	88	125	98	123	69	436	57	460	34	484
5.4	88	804	[illegible]	[illegible]	98	123	98	123	98	123	71	431	[illegible]	457	35	483
[illegible]	88	804	[illegible]	759	98	123	98	123	98	123	73	426	60	454	36	482
[illegible]	88	805	951	754	98	123	98	123	98	123	74	420	62	451	38	[illegible]
6.0	88	805	950	[illegible]	98	[illegible]	98	123	98	123	76	415	63	447	39	[illegible]
[illegible]	88	806	[illegible]	[illegible]	98	[illegible]	[illegible]	[illegible]	98	[illegible]	77	[illegible]	[illegible]	444	[illegible]	[illegible]
[illegible]	[illegible]	806	[illegible]	[illegible]	98	123	[illegible]	[illegible]	[illegible]	123	78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	807	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	98	[illegible]	80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	808	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	98	[illegible]	81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	88	809	[illegible]	[illegible]	[illegible]	[illegible]	98	[illegible]	98	123	84	[illegible]	74	[illegible]	[illegible]	[illegible]

Table 2 480V Motor Starting

[illegible]	88	848	930	583	98	122	98	122	98	122	85	355	72	430	48	477
.6	88	847	925	571	98	122	98	122	98	122	87	340	73	427	49	477
[illegible]	88	857	920	560	99	122	99	122	99	122	89	324	74	423	50	477
.0	88	918	911	535	99	121	99	121	99	122	92	283	75	420	51	476
.2	88	827	897	583	99	121	99	121	99	121	95	217	77	419	52	477
.4	88	827	882	518	99	120	99	120	99	120	98	131	78	417	54	479
[illegible]	88	828	874	512	99	120	99	120	99	120	99	120	79	413	55	477
.8	88	829	873	509	99	120	99	120	99	120	99	120	80	409	56	475
.0	88	829	870	503	99	120	99	120	99	120	99	120	81	400	57	473
.2	88	829	867	497	99	120	99	120	99	120	99	120	82	391	58	472
.4	88	830	864	490	99	119	99	119	99	119	99	119	83	380	59	470
.6	88	831	860	483	99	119	99	119	99	119	99	119	85	368	60	469
.8	88	831	856	475	99	119	99	119	99	119	99	119	86	356	61	467
.0	88	832	852	467	99	119	99	119	99	119	99	119	88	343	62	466
.2	88	833	848	458	99	119	99	119	99	119	99	119	90	329	63	464
.4	88	836	840	437	99	119	99	119	99	119	99	119	91	291	64	464
.6	88	859	828	393	99	118	99	118	99	118	99	118	94	236	64	464
.8	88	844	[illegible]	341	99	118	99	118	99	118	99	118	97	182	65	465
.0	[illegible]	848	[illegible]	306	99	117	99	117	99	117	99	117	99	112	66	465
.2	[illegible]	848	795	305	99	117	99	117	99	117	99	117	99	117	67	464
.4	88	848	795	304	99	117	99	117	99	117	99	117	99	117	68	462
.6	88	848	795	304	99	117	99	117	99	117	99	117	99	117	69	460
.8	88	848	795	304	99	117	99	117	99	117	99	117	99	117	70	459
.0	88	848	795	303	99	117	99	117	99	117	99	117	99	117	70	456
[illegible]	[illegible]	848	795	303	99	117	99	117	99	117	99	117	99	117	71	453
.4	88	848	795	302	99	117	99	117	99	117	99	117	99	117	72	450
.6	88	848	795	302	99	117	99	117	99	117	99	117	99	117	73	447
.8	88	848	795	301	99	117	99	117	99	117	99	117	99	117	73	444
.0	88	848	795	300	99	117	99	117	99	117	99	117	99	117	74	441
[illegible]	88	848	795	300	99	117	99	117	99	117	99	117	99	117	75	438
.4	88	848	794	299	99	117	99	117	99	117	99	117	99	117	76	435
.6	88	849	794	299	99	117	99	117	99	117	99	117	99	117	76	432
.8	88	849	794	298	99	117	99	117	99	117	99	117	99	117	77	430
.0	88	849	794	297	99	117	99	117	99	117	99	117	99	117	78	427
.2	88	849	794	297	99	117	99	117	99	117	99	117	99	117	79	424
.4	88	849	794	296	99	117	99	117	99	117	99	117	99	117	79	421
.6	88	849	794	296	99	117	99	117	99	117	99	117	99	117	80	419
.8	88	849	794	295	99	117	99	117	99	117	99	117	99	117	81	413
.0	88	849	793	294	99	117	99	117	99	117	99	117	99	117	81	408
.2	88	849	793	293	99	117	99	117	99	117	99	117	99	117	82	402
.4	88	849	793	291	99	117	99	117	99	117	99	117	99	117	83	395
.6	88	849	792	290	99	117	99	117	99	117	99	117	99	117	84	389
.8	88	849	792	289	99	117	99	117	99	117	99	117	99	117	84	382
.0	[illegible]	850	792	287	99	117	99	117	99	117	99	117	99	117	85	375
[illegible]	[illegible]	[illegible]	[illegible]	286	99	117	99	117	99	117	99	117	99	117	86	368
[illegible]	88	[illegible]	[illegible]	285	99	117	99	117	99	117	99	117	99	117	87	360
[illegible]	88	850	791	283	99	117	99	117	99	117	99	117	99	117	88	352
[illegible]	88	[illegible]	[illegible]	281	99	117	99	117	99	117	99	117	99	117	89	344
.0	[illegible]	[illegible]	[illegible]	[illegible]	99	117	99	117	99	117	99	117	99	117	90	336
.2	88	[illegible]	[illegible]	[illegible]	99	117	99	117	99	117	99	117	99	117	91	311
.4	88	[illegible]	[illegible]	[illegible]	99	117	99	117	99	117	99	117	99	117	92	282
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99	117	99	117	99	117	99	117	99	117	94	250
[illegible]	88	[illegible]	[illegible]	[illegible]	99	116	99	116	99	116	99	116	99	116	95	215
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99	116	99	116	99	116	99	116	99	116	97	185
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99	116	99	116	99	116	99	116	99	116	98	155
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99	116	99	116	99	116	99	116	99	116	99	118
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99	116	99	116	99	116	99	116	99	116	99	116
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99	116	99	116	99	116	99	116	99	116	99	116
.6	[illegible]	[illegible]	[illegible]	[illegible]	99	116	99	116	99	116	99	116	99	116	99	116

Table 2 480V Motor Starting (contd)

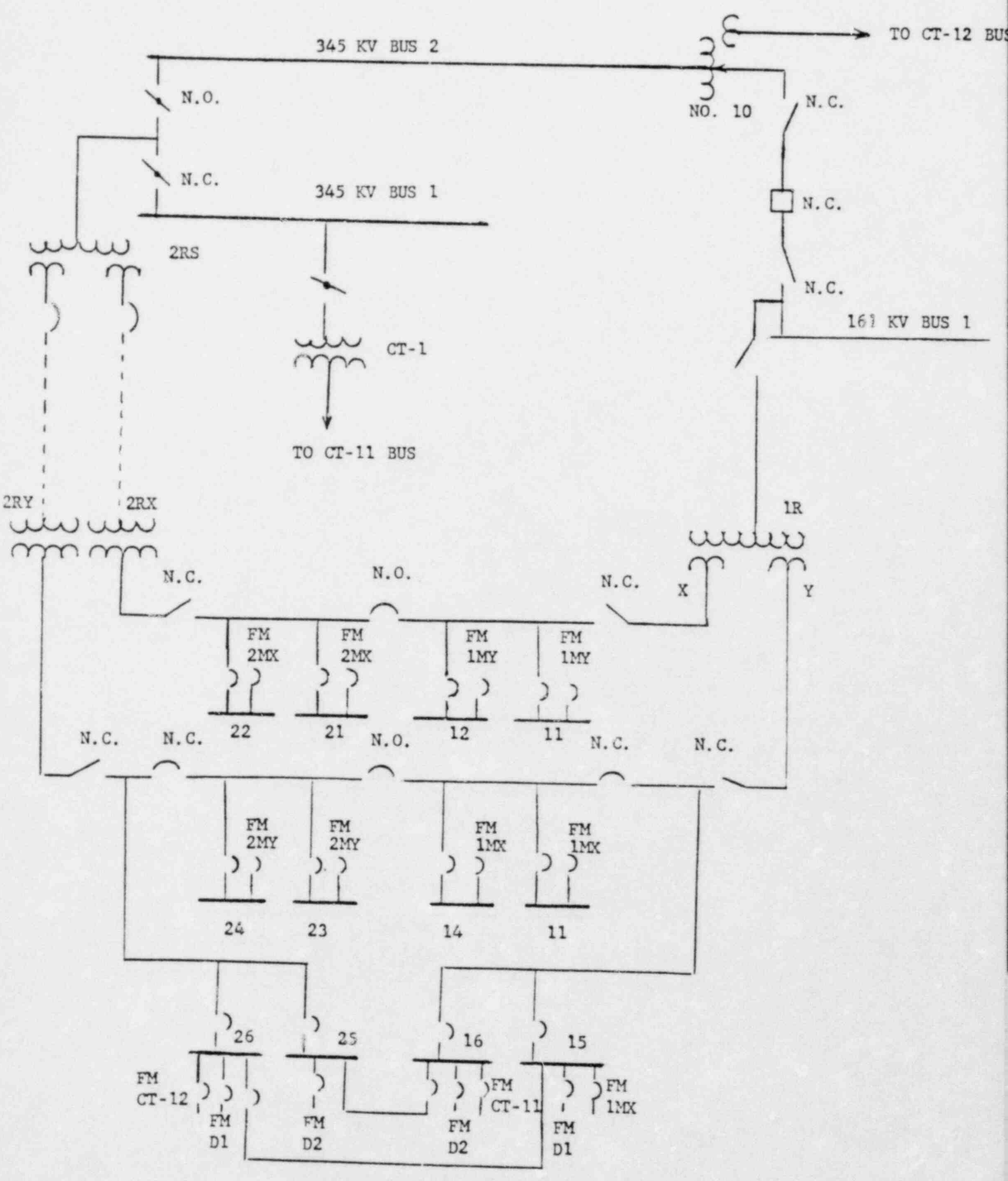


Figure 1 Bus Configuration With Completion of 2R Installation

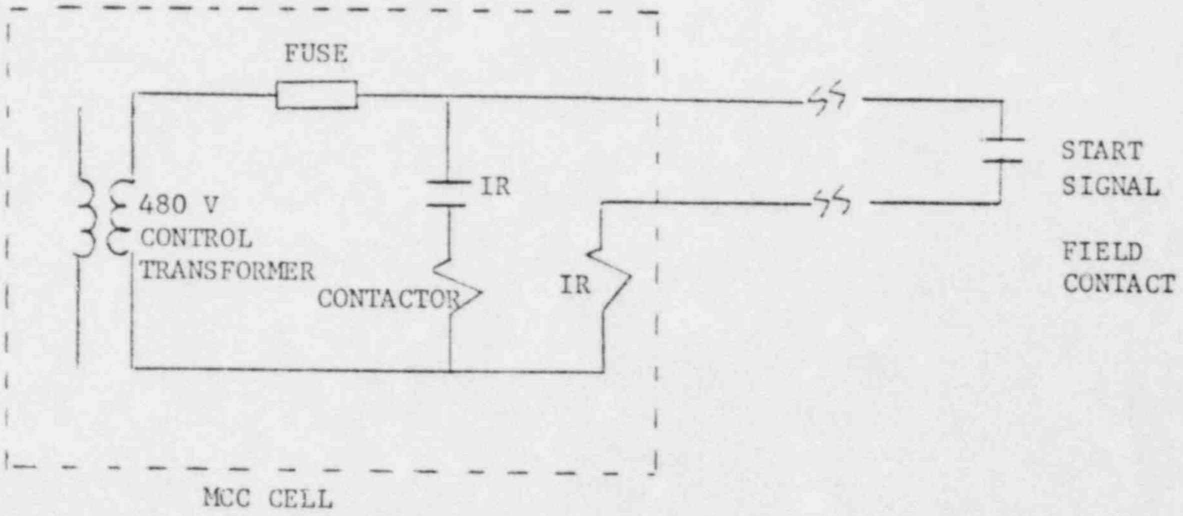
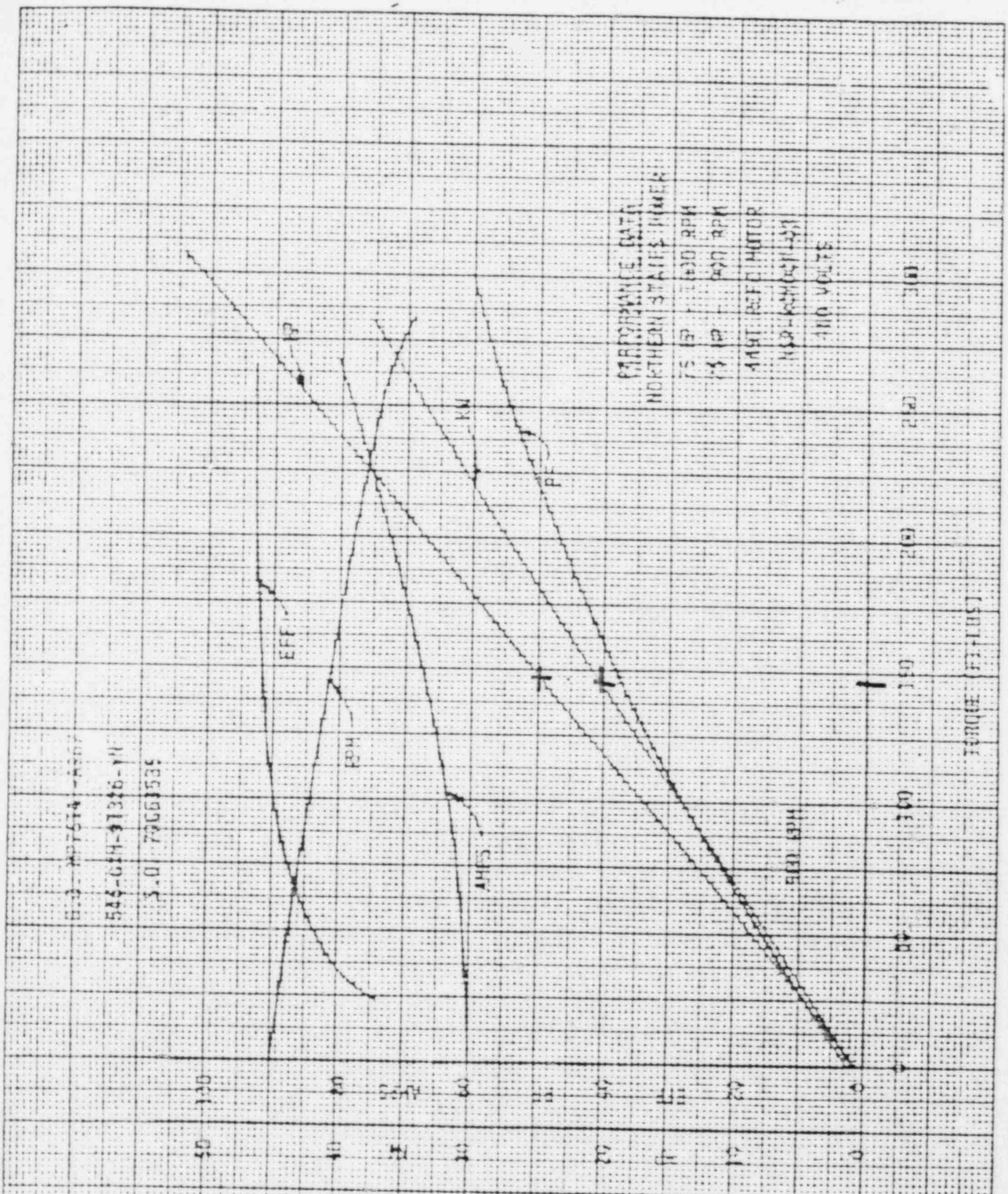


Figure 2 Interposing Relay (IR) Circuit

WESTINGHOUSE ELECTRIC CORPORATION

CURVE NO. 558399

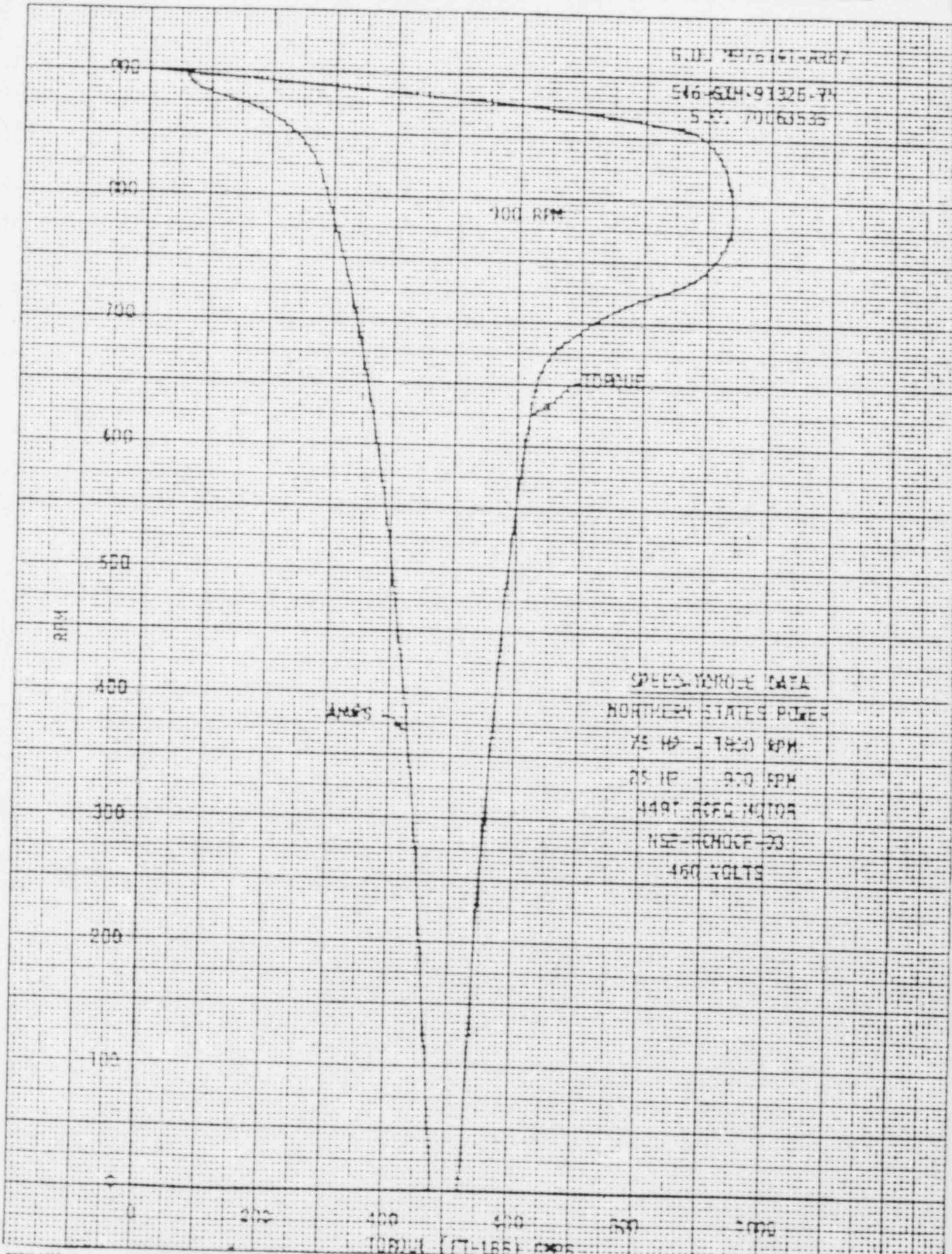


SIGNATURE DATE 12/21/70 CURVE NO. 558399

Figure 3 Fan Coil Unit Performance Data

WESTINGHOUSE ELECTRIC CORPORATION

CURVE NO. 558337



SIGNATURE ______ DATE 12/19/70 CURVE NO. 558337

Figure 4 Fan Coil Unit Speed-Torque Data

FLUOR PIONEER INC.

Std [illegible]
SS - [illegible]
Sheet 1 of [illegible]

STANDARD SPECIFICATION
FOR
ALTERNATING CURRENT MOTORS
SQUIRREL CAGE TYPE
FULL VOLTAGE STARTING

1.0 ALTERNATING CURRENT MOTORS

.1 All motors and tests applied thereto shall conform to this Standard Specification and, unless otherwise stated herein, to the applicable USAS, NEMA and IEEE Standard

.2 Motors shall be fully rated to fit the driven load within their nameplate ratings and their service factor shall be applied only with the specific consent of the Engineer.

.3 Motors shall be squirrel cage induction motors designed for full voltage starting and shall be capable of continuously delivering their rated horsepower within safe temperature limits when the supply voltage is varied plus or minus ten percent.

.4 Motors up to and including 200 horsepower shall be of Design "B" and when operating at rated voltage shall develop a breakdown torque of not less than 200 percent of normal running torque. Unless otherwise stated in the Specific Specification their locked rotor KVA shall not exceed limits set by USAS Code "G" (5.6-6.3 KVA/HP).

.5 Motors above 200 horsepower shall be of Design "B" and when operating at rated voltage shall develop a breakdown torque of not less than 190 percent of normal running torque. Unless otherwise stated in the Specific Specification their locked rotor KVA shall not exceed limits set by USAS Code "G" (5.6-6.3 KVA/HP).

.6 Motors operating at 75 percent rated voltage for infrequent one minute intervals shall deliver their rated full load torque without injury.

.7 Temperature rise shall be as stated in the Specific Specification and shall comply with the particular USAS, NEMA and IEEE Standards applicable. All temperature rise measurements shall be made by thermometer.

.8 Unless otherwise stated in the Specific Specification all motors shall have Class B insulation.

.9 Unless otherwise stated in the Specific Specification the manufacturer shall specify in his proposal the name of the supplier who normally furnishes his motors. The Engineer reserves the right to reject any supplier whose product is not deemed acceptable.

.10 Unless otherwise stated in the Specific Specification and in compliance with minimum USAS Standards, motors rated 250 horsepower and above shall be equipped with at least six (two per phase) 10 OHM imbedded resistance type temperature detectors. The temperature detector leads shall be terminated on barrier type terminal blocks equipped with marking strips and located in a separate metal enclosure.

.11 All motors shall be equipped with oversized terminal boxes and these shall be designed to permit cable or conduit entrance from top or bottom.

Prairie Island Standard Spec for AC Motors

3.7 AUXILIARY ELECTRICAL SYSTEMS

Applicability

Applies to the availability of electrical power for the operation of plant auxiliaries.

Objectives

To define those conditions of electrical power availability necessary to assure safe reactor operation and continuing availability of engineered safeguards.

Specification

A. A reactor shall not be made or maintained critical nor shall it be heated or maintained above 200°F unless all of the following requirements are satisfied for the applicable unit.

1. At least two separate paths from the transmission grid to the plant 4kv safety buses, each capable of providing adequate power to minimum safety related equipment consisting of transmission lines, associated switchgear, and transformers that are fully operational and energized.
2. The 4160 volt safeguards buses of that unit, 15 and 16 or 25 and 26, and their safeguards motor control centers are both energized.
3. The 480 volt safeguards buses for that unit, 110 and 120 or 210 and 220, and their safeguards motor control centers are both energized.
4. Reactor protection instrument AC buses for that unit are energized: 111,112,113,and 114 or 211,212,213,and 214.
5. Both diesel generators are operable, and a fuel supply of 70,000 gallons is available in the interconnected storage tanks for the diesel generators and the cooling water pump diesel engines.
6. Both batteries with their associated chargers and both d-c safeguard systems are operable.
7. No more than one of the inverter supply buses 111, 112, 113, and 114, or 211, 212, 213, and 214, is powered from each of Panels 117 and 217.

B. A reactor shall be placed in the cold shutdown condition if the requirements of Specification TS.3.7A cease to be satisfied. During startup operation or power operation, any of the following conditions of inoperability may exist for the times specified provided startup operation is discontinued until operability is restored.

1. One path from the grid to the plant 4kv bus may be inoperable for a period not to exceed seven days provided (a) both diesel generators and their associated diesel driven cooling water pumps are operable, and (b) all engineered safety features are operable.

2. One diesel generator may be out of service for a period not to exceed seven days (total for both diesel generators during any consecutive 30 day period) provided (a) the operability of the other diesel generator and its associated diesel driven cooling water pump are demonstrated immediately and at least once every 24 hours thereafter, (b) all engineered safety features are operable, and (c) both paths from the grid to the plant 4kv bus are operable.

3. One 4kv, 480V bus, or one battery charger may be out of service on each unit for a period not to exceed 8 hours provided its redundant counterpart is demonstrated to be operable and the safeguards equipment associated with its counterpart are operable, both diesel generators are operable, and both paths from the grid to the 4kv bus are operable.

4. One battery may be out of service for a period not exceeding 8 hours provided that the other battery and both battery chargers remain operable.

Basis

The intent of this specification is to provide assurance that at least one external source and one standby source of electrical power is always available to accomplish safe shutdown and containment isolation and to operate required engineered safeguards equipment following an accident.

Plant auxiliary power is normally supplied by the main auxiliary transformers backed up by three separate external power sources which have multiple off-site network connections: the reserve transformer from the 161kv portion of the plant substation; and the two cooling tower transformers, one of which is supplied from a tertiary winding on the substation auto transformer, and the other directly from the 345kv switchboard. Any one of the three sources is sufficient to supply all necessary accident and post-accident load requirements for one reactor, from any one of four network connections which will be augmented by an additional line by the time the second unit is completed.

Each source separately supplies the safeguards buses in such manner that items of equipment which are redundant to each other are supplied by separate sources and buses.

Each diesel generator is connected to one 4160 volt safeguards bus in each of the two reactors and has sufficient capacity to start sequentially and operate the safeguards equipment supplied by one bus. The set of safeguards equipment items supplied by each bus is, alone, sufficient to maintain adequate cooling of the fuel and to maintain containment pressure within the design value in the event of a loss-of-coolant accident.

Each diesel starts automatically upon low voltage on its associated bus in either unit and both diesel generators start in the event of a safety injection signal for either reactor. The minimum fuel supply of 70,000 gallons will supply one diesel cooling water pump and one diesel generator (loaded per FSAR Table 8.4-1) for greater than 14 days. Additional diesel fuel can normally be obtained within a few hours. This assures an adequate supply even in the event of the probably maximum flood.

The plant 125 volt d-c power is normally supplied by two batteries for each plant, each of which will have a battery charger in service to maintain full charge and to assure adequate power for starting the diesel generators and supplying other emergency loads.

The arrangement of the auxiliary power sources and equipment and this specification assure that no single fault condition will deactivate more than one redundant set of safeguard equipment items in one reactor and will therefore not result in failure of the plant protection system to respond adequately to a loss-of-coolant accident.

Reference

(1) FSAR, Section 8
(2) FSAR, Figure 8.2-2

TABLE 9 ANALYSIS OF 480 VOLT MCC'S AND STARTERS

Bus 120 at

SIZE 1 STARTERS

		83.3%	87.5%		
Motor Number	MCC	MCC Voltage		Control Wire	Comments
123-21	1KA2	83.1%	86.8	939'	OK
123-22	1KA2	83.1%		1437'	OK
123-28	1KA2	83.1%		912'	OK
123-29	1KA2	83.1%		912'	OK
122-11	1AB2	81.7%	86.0	1713'	*
122-12	1AB2	81.7%		1713'	*
All others	1AB2	81.7%		local	OK
All	1T2	82.2%	86.5	local	OK

* Tests of these starters demonstrated pickup voltage of 340V and 380V which is acceptable for this application. All other Size 1 starters have pickup voltage of 390 V demonstrated during preventive maintenance.

SIZE 2 STARTERS

Motor Number	MCC	MCC Voltage		Control Wire	Comments
126-24	1LA2	83.0%	87.2	973'	OK
All	1AB2	81.7%	86.0	local	OK
All	1T2	82.2%	86.5	local	OK

All Size 2 starters have pickup voltage of 375 V demonstrated during preventive maintenance.

SIZE 3 AND 4 STARTERS

Starters will function with 82.3% at MCC. Interposing relays are used. Only 1AB2 and 1T2 drop below 82.3%. No size 3 or 4 starters are on these MCC's.

Motor 126-37, the Auxiliary Building Special Vent Exhaust Fan (and correspondir fan on Bus 110) do not have interposing relays. Interposing relays may be needed.

TABLE 10 ANALYSIS OF 480 VOLT MOTORS

Bus 1,20 at

Motor Number	Name	Conductor Size	Conductor Length	MCC	83.3 MCC Voltage	83.3 Motor Voltage	83.3% Motor Voltage on Nameplate Base	87.5%
122-27	Diesel CWP Strt Air Comp	#10	89'	1AB2	81.7%	81.1% (note 1)	84.6%	89.1
123-38	Diesel Gen RM Spply Fan	#10	85'	1T2	82.2%	81.5%	85.0%	89.5
123-39	Diesel Gen RM Exh Fan	#10	85'	1T2	82.2%	81.5%	85.0%	89.5
126-38	Control RM Air Handler	#10	211'	1M2	83.1%	81.5%	85.0%	89.5
126-37	Aux Bldg Spcl Vent Exh Fan	# 8	305.5'	1M2	83.1%	81.3% (note 1)	84.8%	89.3

Motor Number	HP	FLA	Starter Size	Overload Relay Heater	80% of Heater Rating Amp	Minimum Motor Protection	Inverse of Min Motor Protection (note 3)	Actual Test Motor Amps
122-27	15	20.0	2	C21.4B	19.4	121%	82.6%	--
123-38	18.4	26.3	2	C25.0B	25.0	119%	84.0%	24
123-39	18.4	26.3	2	C25.0B	25.0	119%	84.0%	20
126-38	15	19.3	2	C19.8B	18.0	117%	85.5% (note 2)	16
126-37	25	34.0	3	F43.0B	32.9	121%	82.6%	26

Notes;

1. The goal is to maintain 85% of nameplate voltage (81.5% of 480 V). This goal is achievied except in case of motors 122-27 and 126-37.

2. There is a remote possibility that motor will trip without adjustment to motor overload relay.

3. Current is inversely proportional to voltage. Voltage below this value

Bus 15 and 25 Loads	11 CCP	0.21	0.10
	Bus 110	0.42	0.09
	22 CCP	0.21	0.10
	Bus 220	0.42	0.09
		----	----
Bus 15 & 25	Total	1.26 MW	0.38 MVAR

Bus 23 Loads	CircWP	1.45	0.08
	ClngWP	0.665	0.346
	HDP	0.306	0.145
Non SG	480V	0.749	0.349
		-----	-----
Bus 23	Total	3.170MW	0.920 MVAR

Bus 24 Loads	CircWP	1.45	0.08
	Cond P	1.39	0.56
2nd	Cond P	1.39	0.56
	HDP	0.306	0.145
Non SG	480V	0.749	0.349
	Chiller	0.509	0.308
		-----	-----
Bus 24	Total	5.794	2.002

1R	Bus 15 & 25		Bus 23		Bus 24		Computed	Voltage drop from Base case	
Case	MW	MVAR	MW	MVAR	MW	MVAR	Bus V	Computed	Measured
Base	1.26	0.38	0.00	0.00	0.00	0.00	103.7%		
1	1.26	0.38	3.170	0.920	0.00	0.00	102.9%	0.8%	0.85%
2	1.26	0.38	3.170	0.92	5.794	2.002	101.2%	2.5%	2.68%

CT11	# of CT		CT Fans		CT Pmps		Bus 16		Bus 26		Bus V	Voltage drop from Base case	
Case	Fan	Pmp	MW	MVAR	MW	MVAR	MW	MVAR	MW	MVAR	Comp	Comp	Measure
Base	21	0	1.75	1.05	0.00	0.00	0.00	0.00	0.00	0.00	104.3%		
1	15	2	1.25	0.75	3.80	2.25	0.42	0.09	0.00	0.00	101.4%	2.9%	2.90%
2	15	4	1.25	0.75	7.60	4.50	0.42	0.09	0.42	0.09	97.8%	6.5%	6.67%
CT12													
Base	8	0	0.67	0.40	0.00	0.00	0.00	0.00	0.00	0.00	104.3%		
1	8	2	0.67	0.40	3.80	2.25	0.42	0.09	0.00	0.00	102.3%	2.0%	1.94%
2	13	4	1.08	0.65	7.60	4.50	0.42	0.09	0.42	0.09	100.0%	4.3%	4.42%

Table 3