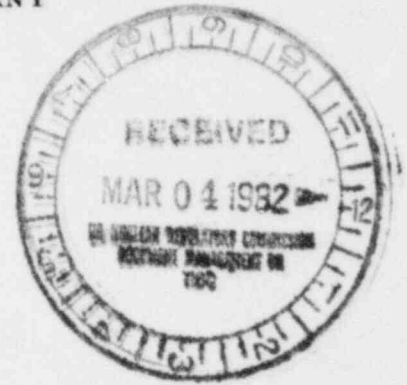


VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

R. H. LEASBURG
VICE PRESIDENT
NUCLEAR OPERATIONS



February 26, 1982

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
Attn: Mr. Robert A. Clark, Chief
Operating Reactors Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 076
PSE&C/cdk/BSD/KSB
Docket Nos. 50-338
50-339
License Nos. NPF-4
NPF-7

Gentlemen:

GENERAL DESIGN CRITERIA 17 ANALYSIS
NORTH ANNA UNIT NOS. 1 AND 2

In accordance with our December 1, 1981 letter, Serial No. 908B, this letter transmits to you the final results of our GDC-17 Analysis. The scope of our analysis is based on all the guidelines and requirements set forth in the NRC's August 8, 1979 letter, entitled "Adequacy of Station Electrical Distribution System Voltages," the NRC's June 25, 1980 letter, which included a "Request for Additional Information Regarding the Adequacy of Station Electric Distribution System Voltages," and our April 2, 1981, telephone conference with Mr. L. B. Engle and with Mr. A. Udy of EG&G.

Our basic assumptions were outlined in a May 20, 1981 telephone conference and were restated in our July 24, 1981 letter, Serial Number 908A, in our December 1, 1981 letter, Serial Number 908B and in our January 20, 1982 letter, Serial Number 017. The interpretation is as follows:

In the analysis of voltage conditions available from the Reserve Station Service System (RSSS), we are assuming that the worst case would be for Unit 2 to have all of its loads on the reserve, while Unit 1 has only its SI activated safety loads and intake structure loads on the reserve. We are able to make this assumption on the basis that Unit 1 has a generator breaker which provides the capability of tripping the unit without transferring loads to the reserve system. We feel that the "accident" or the "anticipated transient in the unit being analyzed" discussed in item 2 of "Guide for Voltage Drop Calculation", which was the second enclosure with your August 8, 1979 letter, does not include the occurrences that would cause Unit 1 to transfer loads to reserve at the same time that Unit 2 is fully loaded from the reserves.

*AOIS
5/15*

We have performed our analysis on this assumption that Unit 1 non-safety loads do not transfer to the reserve station service system. In addition, analysis has been conducted assuming that certain operating restrictions will be followed and modifications will be installed.

The results of the analysis meet the GDC-17 criteria and are summarized below.

The results of our voltage profile analyses are acceptable. There are no cases in which an emergency bus is predicted to separate from its off-site source. There are also no cases where unacceptable steady state voltages occur. The analysis of the ampacity and the current loading on all equipment predicts some equipment to be overloaded under certain conditions. These predicted overloads do not result in unacceptable loss of life for equipment nor do they result in possible simultaneous or consequential loss of off-site power sources. Therefore, there is no impact on safety and results of the analysis satisfy the GDC-17 criteria.

Our compliance with the GDC-17 criteria is based on implementing certain modifications and operating restrictions which were assumed in our detailed analysis.

The operating restrictions include:

- (1) Generator bus voltage must be maintained at an adequate level to ensure acceptable voltages are maintained on a "J" emergency bus fed from a station service bus.
- (2) Load on a station service bus must be limited when a "J" emergency bus is fed from it.
- (3) If Vepco installs the Unit 2 emergency to station service bus ties, then, when emergency bus 2H is transferred to and fed from station service bus 2C, emergency bus 2J must be transferred to a power source other than station service 2C within 1 hour.
- (4) The existing load shed, which is initiated when both units load to the Reserve Station Service transformers (RSSTs), will be enabled at all times when 1) one unit is on line and the other unit is in startup, 2) both units are on line, and 3) both units are in start up.
- (5) A program will be established to ensure station operation is consistent with the assumptions made in the GDC-17 analysis. The program will specify the appropriate corrective actions to be taken if transmission system voltage goes outside the range of 505 KV to 535 KV.

The modifications include:

- (1) Rerate all motor operated valves (MOV's) to assure starting at predicted voltages. Motors on certain MOV's may have to be replaced. (The full scope for MOV rerating/motor replacement is still being developed).
- (2) Install a load shed scheme to remove certain motors when Unit 2 transfers to the RSSTs simultaneously with a Safety Injection (SI) or Containment Depressurization Actuation (CDA) occurrence on Unit 1.
- (3) Trip the 34.5 KV reactors in the switchyard when an SI or CDA occurs on either unit.
- (4) Install overvoltage alarms on 4160 and 480 volt emergency buses to alert station personnel to the need to protect equipment against high voltage.
- (5) Modify RSST load tap changer (LTC) control to eliminate all delays in LTC response during the first three minutes of a SI or CDA event on either unit and on transfer of unit loads to the RSS system.
- (6) Block the auto starting of large non-IE motors, when the station service bus feeding the motor is fed from the same source as an emergency bus of a unit experiencing an SI or CDA.
- (7) Eliminate the automatic transfer of emergency buses from the Reserve Station Service to the Normal Station Service.
- (8) When a unit experiences an SI or CDA and the "G" bus tie breaker is closed, then all circulating water pumps on the unit experiencing the accident will be tripped.

We plan to implement these modifications during currently scheduled maintenance and refueling outages in 1982 and 1983. Completion of all required modifications is anticipated for Unit 1 by the end of the fourth refueling and for Unit 2 by the end of the maintenance outage following its second refueling. We will keep you advised of our modification implementation schedule. The operating restrictions will be implemented by July 1, 1982.

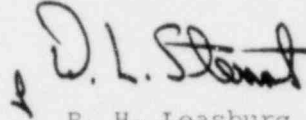
A detailed review of our analysis is provided in Attachment I entitled, "Summary of GDC-17 Analysis Report."

In telephone conferences on January 29 and February 1, 1982 with Messrs. L. B. Engle and R. Trevatte and Mr. A. Udy of EG&G, you have requested that we expand our analysis by analyzing the effects of Unit 1 non-safety loads transferring to the reserve station service system during worst case conditions rather than remaining in a backfeed condition on the normal station service system (a capability made possible by the generator breaker). The additional analysis is provided in Attachment II.

VIRGINIA ELECTRIC AND POWER COMPANY TO

Mr. Harold R. Denton

Should you need more information, please contact us.


R. H. Leasburg

Attachments

cc: Mr. R. C. DeYoung, Director
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ATTACHMENT I

SUMMARY OF GDC-17 ANALYSIS REPORT

I. ELECTRICAL SYSTEM

We are analyzing the electrical system shown on Appendix A. The Unit 1 generator breaker and normal to emergency bus ties, bus 1B to bus 1H and bus 2B to bus 1J, are installed. The installation of the Unit 2 normal to emergency bus ties, bus 2C to bus 2H and bus 1A to bus 2J, is under consideration. We previously indicated their installation would be completed during the upcoming Unit 2 refueling outage (Spring, 1982). However, we have delayed their installation since higher priority modifications require implementation during this outage. The administrative ties between buses 1H and 1J are removed. The administrative ties between buses 2H and 2J will be removed if the normal to emergency bus ties are installed.

With the generator breaker in service, Unit 1 start-ups are accomplished with the Normal Station Service buses being fed from the Normal (Unit) Station Service transformers (normal SST's), back-fed from the 500 kv switchyard, rather than from the Reserve Station Service transformers (RSST's). For the majority of Unit 1 trips, Unit 1 will continue to have its Normal Station Service buses fed from its normal SST's. Unit 2 Normal Station Service buses are fed from the RSST's only during start-ups and when Unit 2 trips off-line. This arrangement reduces the probability of combined loading from both Units' 1 and 2 normal and emergency buses on the RSST's.

The installation of the generator breaker on Unit 1 creates an additional independent source of offsite power from the transmission network to the onsite power distribution system, analogous to the Reserve Station Service system, which is not dependent on the mode of operation of the Unit 1 generator. In addition, the Unit 2 Normal Station Service system can be considered an additional independent source of offsite power from the transmission network to the onsite distribution system. This source, however, is dependent on the mode of operation of the Unit 2 generator.

The installation of the normal to emergency bus ties established an additional, physically independent source of offsite power to each emergency bus under normal conditions. Under normal conditions each emergency bus will now have two physically independent sources of offsite power in addition to its respective onsite source. All of the normal to emergency bus ties have a normally open breaker at each bus. The bus ties will operate as follows:

Regardless of which offsite source is feeding an emergency bus, on either degraded or loss of voltage, that emergency bus will load to the diesel generator as designed.

The manual transfer of an emergency bus from any source to any other source may be accomplished at any time through the use of synchronizing controls.

We previously indicated to you that an automatic operating feature was incorporated into the control of the bus ties. Under certain conditions, our analysis indicated that the automatic transfer from the reserve station service feeder to the normal station service feeder has a low probability for success. On this basis we are removing the automatic portion of this transfer. The only automatic transfer from either offsite source will be to the diesel generator.

The transmission system voltage range at the 500 KV switchyard is 505 KV to 535 KV. This range is based on analysis of system voltages for extreme conditions of unit outages and loading. We will establish a system plan, to become Appendix B, which outlines action to be taken to ensure the voltage stays within these values. This plan will be submitted by July 1, 1982.

II. ELECTRICAL EQUIPMENT RATINGS

A. Transformers

The 500/36.5 KV transformers which feed the RSST's are tapped at 500.0 KV and are rated for 112 MVA at a 65°C winding temperature rise. The 22/500 KV main step-up transformers are tapped at 512.5 KV and are rated for 1108.8 MVA at a 65°C winding temperature rise. The 34.4/4.16 KV RSST's are tapped at 35.3 KV and are rated for 33.6 MVA at a 65°C winding temperature rise. The RSST's have load tap changers (LTC's) on their secondary terminals which are set to maintain a 4317 volt output and which will provide a $\pm 10\%$ voltage adjustment over full range operation. This adjustment capability is provided by 32 taps, each of which provides a 5/8% voltage adjustment.

The 22/4.16 KV normal SST's are tapped at 20.9 KV and are rated for 22.4 MVA at a 65°C winding temperature rise. The 4.16/.48 KV emergency bus load center transformers are tapped at 4056 V and are rated 1333 KVA at a 55°C winding temperature rise.

B. Cables

The Unit 1 and Unit 2 4KV feeders from the RSST's to the normal buses are commonly fed from the RSST's to the turbine building wall on 5" aluminum tube bus, which is rated at 6160 amps. From the turbine building wall, the Unit 1 and Unit 2 feeders separate and they each consist either of 2-2000 MCM copper cables per phase, rated at 3043 amps, or the 2000 MCM copper in series with 3000 amp bus duct. The 4KV feeders from the RSST's to the transfer buses consist of 4-2000 MCM aluminum per phase, with a continuous rating of 1660 amps. The large difference in rating between these two sets of feeders occurs since the transfer bus feeders are routed in underground ducts. The 4KV feeders from the transfer buses to the emergency buses consist of 2-1000 MCM aluminum per phase and are rated at 994 amps. The 4KV feeders from the normal buses to the emergency buses consist of 2-1000 MCM aluminum per phase and are rated at 1084 amps. The 4KV feeders from the normal SST's to the normal buses consist of 4-1500 MCM aluminum per phase and are rated at 3560 amps.

C. 4 KV Switchgear

The 4KV normal bus feeder breakers, fed from both the normal SST's and the RSST's, are rated for 3000 amps. The 4KV emergency bus feeder breakers are rated for 1200 amps. The 4KV breakers, on the transfer or normal buses, which feed the emergency buses are rated for 1200 amps. The transfer bus feeder breakers are rated for 3000 amps.

D. Generator Breaker

Information concerning the Unit 1 22KV generator breaker was requested in a May 20, 1981 telephone conference and in your December 28, 1981 letter. Our September 23, 1981 letter, serial no. 908B, supplied the information requested on May 20. To answer your December 28 letter, we have summarized portions of our September 23 submittal and included the additional information requested. The requested information is as follows:

1. Sources of Operating Power:

The breaker is supplied with two separate 125V D.C. control circuits. One circuit feeds the primary tripping circuit and the closing circuit. The other circuit supplies the back-up tripping circuit.

A single 480 v source, using several circuit breakers for isolation of the supplies to the individual components, supplies the redundant air compressors and water pumps. The compressed air is used for breaker contact movement and additional interrupting capacity. The circulating water is used for breaker cooling.

2. Basis used for Generator Breaker Sizing:

a. Number of phases	<u>3</u>
b. Frequency, Hz	<u>60</u>
c. Operating voltage, KV	<u>22 + 5%</u>
d. Maximum voltage, KV	<u>36</u>
e. Voltage range factor	<u>1.0</u>
f. Basic impulse insulation level (BIL), KV crest	<u>170</u>
g. Power frequency withstand voltage, KV	<u>75</u>
h. Continuous current, A	<u>30,500</u>

"Breaker shall be capable of closing and latching or interrupting the maximum fault current (worst case asymmetry) available from a system with the following characteristics:

Percent impedance on 100 MVA base	<u>1.75</u>
X/R Ratio	<u>102</u>
Maximum Voltage (normal operating-RMS)	<u>23.1KV</u>
Minimum Voltage (normal operating-RMS)	<u>20.9KV</u>

i. Operating duty cycle	<u>CO-15s-CO-5min-CO</u>
j. Permissible tripping delay, sec	
(as defined in ANSI Std C37.04)	<u>1</u>
k. Interrupting time, on 60 Hz basis, cycles	<u>4</u>
l. Hottest spot temperature rise	

(conductor), °C	<u>65</u>
m. Hottest spot temperature rise	
(enclosure), °C	<u>15</u>

The impedance value specified is a result of computer analysis of potential worst case electrical faults.

3. Generator Breaker Design Specifications:

a. Manufacturer's designation	<u>DR36V1750D</u>
b. Operating mechanism	
i. Type	<u>Electro Pneumatic</u>
ii. Normal operating pressure	<u>423/2130 psig</u>
	(Breaker internal /
	storage tank)
iii. Minimum operating pressure	<u>315/2060 psig</u>
	required for rated circuit breaker (Breaker internal /
	interrupting capability
	storage tank)
iiii. Number of stored operations without	
air supply from the compressor station	<u>3</u>
c. Rated maximum voltage	<u>* 23.1KV</u>
d. Voltage range factor	<u>1</u>
e. Frequency	<u>60</u>
f. Continuous current rating	<u>30500 A</u>
g. Symmetrical current interrupting	
capability at rated operating voltage	<u>155000 A</u>
h. Asymmetrical current interrupting	

capability at rated operating voltage	<u>** 232000 A</u>
i. Basic impulse insulation level (BIL)	<u>170 KV-crest</u>
j. Power frequency withstand	<u>75 KV</u>
k. Short time, 3-sec, current rating	<u>155 KA</u>
l. Closing and latching current	<u>600 KA</u>
m. Capacitive current switching capability	<u>30500 A</u>
n. Circuit breaker interrupting time (based upon 60-Hz)	<u>4 cycles</u>
o. Circuit breaker closing time (based upon 60-Hz)	<u>14 cycles</u>
p. Maximum transient recovery voltage	<u>6 KV</u>
q. Maximum noise level at any point five feet above base due to circuit breaker operation	<u>132.4 db</u>
r. Weight of one assembled circuit breaker pole	<u>6830 lbs</u>
s. Shipping weight of one circuit breaker pole	<u>8850 lbs</u>
t. Shipping dimensions of one circuit breaker pole	<u>66" x 134" x 120"</u>
u. Total shipping weight	<u>3 x 8850 lbs</u>

* Insulation level (max. rated voltage): 36KV

** Considering 60% asymmetry which is more than adequate

4. Protection Against Out-of-Phase Operation:

The generator breaker may be closed in one of two ways. The first is by using the auto-synchronizing circuitry. The auto-synchronizing relay adjusts the generator voltage and speed

to match the system's characteristics prior to closing the breaker. In the second method, the operator matches generator voltage and frequency with those of the system by using two voltmeters and a synchronizing scope, then closes the breaker.

5. Testing Requirements:

The testing required by Vepco was as follows:

- a. Each item of equipment and all similar equipment supplied as spare parts shall be given the Seller's routine factory tests and other tests, as specified, to insure successful operation of all parts of the assemblies.
- b. Design tests shall be performed on one item of equipment of each type and rating furnished. Tests made on equipment of the same type and rating as the equipment being furnished will be acceptable as design tests.
- c. Factory test equipment and test methods shall conform to the applicable requirements of ANSI, IEEE, and NEMA Standards and shall be subject to approval by the Purchaser.

d. Circuit Breakers

- i. Routine Tests. Routine tests shall be made as specified in the Section titled, "Production Tests" in ANSI Standard C37.09, "Test Procedure for AC High-Voltage Circuit Breakers".
- ii. Design Tests. Design tests shall be made as specified in the Section titled, "Design Tests" in ANSI Standard C37.09, "Test Procedure for AC High-Voltage Circuit Breakers".
- iii. Air Compressor Plant Tests. Each air compressor shall be given the manufacturer's standard production test and the controls shall be given dielectric tests and a complete operation test after assembly.

6. Attached Appendices C, D, E, and F provide the testing performed and test results for the generator breaker, the cooling plant, the air compressors, and the pneumatic control cabinet, respectively. The Brown Boveri Co. Standard Inspection Plan regarding the breakers was included in our September 23 letter and is omitted here for the sake of brevity.

7. The preoperational tests and periodic tests performed on the breaker are presented in Appendix G and H, respectively. Periodic tests and maintenance are completed during refueling outages, which occur approximately once every 18 months.

E. Motors

The 1E motors are all fed from the emergency buses. The 4KV 1E motors are rated for continuous operation at $4000V \pm 10\%$ (3600 to 4400V) and will start with voltages as low as 2800V (70% of 4000V). The 480V 1E motors are rated for continuous operation at $460V \pm 10\%$ (414V - 506V) and will start with voltages as low as 322V (70% of 460V).

F. MOV's

The 1E MOV's are presently rated for continuous operation at $460V \pm 10\%$ and require 90% of 460V to start. The MOV vendor has indicated that, based on their records of valve torque requirements, the majority of MOV's which start on either containment depressurization actuation (CDA) or safety injection (SI) may be rerated for starting at 80% of 460V. We are pursuing the MOV rerate, which will be discussed in the Motor Operated Valve Analysis (section VI).

G. Contactors

The 1E contactors which are used to start and stop motors fed from motor control centers (MCC's) are rated for $115V \pm 10\%$ (103.5V - 126.5V). They will pick-up at 86.3V (75 % of 115V) and will drop out below 69V (60% of 115V).

III.

ANALYSIS ASSUMPTIONS

- A. The 500 KV switchyard voltage is assumed to remain within the 505 KV - 535 KV previously specified. Worst-case transmission system analysis indicates that the maximum switchyard voltage drop caused by either one or both North Anna units tripping off-line will not exceed 15 KV. In our analysis, we assumed a 15 KV voltage drop would occur instantaneously with the CDA or other anticipated transient being analyzed. Initially, we analyzed the same accident condition twice, once with a voltage drop from 535 KV to 520 KV and once with a voltage drop from 520 KV to 505 KV. Results for the latter case proved to be the worst. For the results we are submitting to you, we have assumed a switchyard voltage drop from 520 KV to 505 KV upon the occurrence of the condition being analyzed.
- B. The LTC tap position just prior to a condition being analyzed is determined by the loading on the RSST's (generally just emergency bus and intake structure loads) and by assuming 520 KV in the switchyard. At the instant a particular condition occurs, the switchyard voltage is assumed to drop to 505 KV and loading caused by the condition is assumed to occur (e.g., emergency loads starting and normal buses transferring to the RSST's).

Voltages at this instant are calculated based on the LTC tap position prior to the condition occurrence. Final voltages are based on the LTC correcting as required with the switchyard voltage still at 505 KV.

- C. For all turbine and reactor trips, with the exception of electrical abnormalities and turbine thrust bearing failure, the generator breaker (the generator breaker refers to the 22 KV breaker on unit 1 and the two 500 KV breakers on unit 2) will be tripped 30 seconds afterwards. The normal station service buses transfer from the normal SST's to the RSST's when the 500 KV breakers of their respective unit are opened. Our studies assume that the Unit 2 normal bus loads are transferred to the PSST's immediately upon the occurrence of the condition being analyzed. This is a conservative approach to the voltage analysis.

- D. The current and voltage analyses are being conducted in accordance with our interpretation of item 2 of the "Guidelines for Voltage Drop Calculations" which was attached to the NRC letter dated August 8, 1979. The interpretation is as follows:

In the analyses of voltage conditions available from the Reserve Station Service System, we are assuming that the worst case would be for Unit 2 to have all of its loads on the reserve, while Unit 1 has only its SI and CDA activated safety loads and intake structure loads on the reserve. We are able to make this assumption on the basis that Unit 1 now has a generator breaker which provides the capability of tripping the unit without transferring loads to the reserve system.

We feel that the "accident" or the "anticipated transient in the unit being analyzed" discussed in item 2 of the above reference, does not include the occurrences that would cause Unit 1 to transfer loads to the reserve at the same time that Unit 2 is fully loaded from the reserves.

Our basis for the above assumption is that the Unit 1 generator breaker greatly reduces the probability of loading the RSST's with the Unit 1 normal station service buses. Therefore, the probability that Unit 1 normal station service buses transfer to the RSST's during worst case voltage conditions is extremely small.

- E. To ensure worst case motor starting results, all motors receiving an SI or a CDA signal were assumed to be not running just prior to the accident, even if some would be running under normal operation (e.g., a charging pump). At the time of the accident all of these motors were assumed to start. Additionally, worst case normal bus loadings were used in the analysis based on the specific condition in question (e.g., analysis of the 2B to 1J normal to emergency bus tie requires that the feedwater pump fed from bus 2B be modeled as one of the two required to be running for Unit 2).
- F. The ampere values used in our analysis are values taken during station measurements. Values not measured (e.g., 480 V emergency bus loading during CDA conditions) were estimated.
- G. No manual load shedding or reduction in motor current due to decreased pump load is assumed to occur prior to 1 hour after the occurrence of a condition being analyzed.
- H. The only sequential loading assumed is that which is presently designed into the system. The sequenced loads are the auxiliary feedwater pumps (20 seconds after an SI signal), inside recirculation spray pump (195 seconds after a CDA signal), and outside recirculation spray pump (210 seconds after a CDA signal).

I. Additional assumptions that were made concerned anticipated modifications which we incorporated into our analysis. We will be tripping the 34.5 KV reactors for the conditions studied. In our studies the reactors were considered to be out of service at all times, which provides the worst case LTC tap prior to the condition being analyzed. The LTC's were assumed to begin correction immediately after the occurrence of the analysis condition rather than delaying for the 30 seconds presently designed into its response.

Our analysis has been directed at identifying and addressing worst case conditions. We have not directly analyzed every possible combination of bus ties. By observation and through the use of engineering judgement, we have ensured that all combinations have been analyzed and the proposed modifications will correct all deficiencies identified as a result of this study.

IV. EQUIPMENT LOADING ANALYSIS

The purpose for this portion of the analysis is to ensure the reserve station service system can adequately handle the safety and nonsafety loads which it is required to supply and to address any overload which might occur due to load transferring to the reserve system. This analysis assumes all sequenced loads are energized and a steady state loading has been achieved. Loads analyzed include the maximum load necessitated by the event and the mode of operation of the plant at the time of the event as well as all loads caused by expected automatic actions and manual actions permitted by administrative procedures. The analysis, rather than

taking credit for load diversity of major loads, maximized loading on individual pieces of equipment. Summation of the loads used to analyze a single event would exceed the actual total load of the event because, in actuality, not all loads run all the time.

The loading conditions analyzed included all combinations of the units at 100% power, start-up, tripping, and tripping with a CDA, with the exception of two units simultaneously in start-up and two units simultaneously tripping with CDA's. These conditions were analyzed for all combinations of supplying the emergency buses. The Equipment Loading Analysis Tabulation, Appendix I, provides results for worst case loading as defined above. While the majority of the equipment will not experience an overload, some of the equipment may possibly become overloaded. These cases are discussed below.

A. 4 KV Normal Service Bus Feeder Breakers

The 4KV normal station service bus feeder breakers to buses 1A, 1B, 2B and 2C may become overloaded due to the use of the normal to emergency bus ties. Worst case loadings for these buses are 3450A, 3234A, 3402A and 3163, respectively, with a maximum overload of 15%. These overloads may cause some small loss of life in the breakers. To ensure no loss of life occurs, we have developed operating restrictions, Number I of Appendix J, which will eliminate all possibility of overloading these breakers.

B. Normal Station Service Transformers

The loading of buses 1A, 1B, 2B and 2C also imposes an overload on normal SST's 1A, 1B, 2B and 2C, of 11%, 4%, 9% and 2%, respectively. Based on a 100% preload and a 30°C average ambient temperature, the 11% overload will cause less than .5% loss of life for a 24 hour period. The operating restrictions referenced above will ensure no normal SST overload will occur.

C. Reserve Station Service Transformer

During a Unit 2 trip concurrent with a Unit 1 CDA, RSST's B and C are overloaded by 13% and 22%, respectively. The largest nonaccident loading, which results from 2 units tripping, results in overloads of 8% and 15% for RSST's B and C, respectively. The maximum loss of life over a 24 hour period, based on a 100% preload, a 30°C average ambient temperature, and a 22% overload will not exceed 2.0%.

Based on the operating restrictions previously referenced, the maximum overload does not exceed 4% and 16% for RSST's B and C, respectively. At 16% overload, a 1.0% loss of life will not be exceeded in 24 hours of operation.

In the event of transfer of 4 KV intake structure bus from its normal RSST source to being fed from the other 4 KV intake structure bus, the maximum nonaccident coincident loading would be 155% and 147% on RSST's B and C, respectively. Only one of these cases can occur at a given time.

At a 55% overload, based on a 100% preload and 30°C average ambient, the maximum loss of life will not exceed 0.5% in 1 hour.

Neither RSST B or C experience overloads during normal power operations.

RSST A does not experience an overload under any condition.

While the RSST's may sustain some loss of life due to overload, the amount incurred is negligible and we do not consider it to be a problem.

D. Normal Station Service Feeder Cable

The 101% overload of the cable to the normal station service buses is negligible and its possibility for occurrence will be removed by the referenced operating restrictions.

E. 3000 AMP Bus Duct

The 103% overload of the 3000 A bus duct is negligible and its possibility for occurrence will be removed by the above-referenced operating restrictions.

V. VOLTAGE ANALYSIS

A. Guidelines and Assumptions

We have conducted our voltage analysis on the assumption that no onsite sources of AC power are available. Our intent is to ensure the offsite power system and the onsite distribution system are of sufficient capacity and capability to automatically start as well as operate all required safety loads within their required voltage ratings in the event of (1) an anticipated transient (such as unit trip) or (2) an accident (such as a LOCA) regardless of other actions the electric power system is designed to automatically initiate and without the need for manual shedding of any electric loads.

Specific goals of our analysis are to ensure:

1. All IE loads receive rated starting and running voltages within the time frame required for proper operation. This includes analysis of voltage drop in cable feeding switchgear, MCC's and motors.
2. No spurious separations from the offsite sources occur. This goal addresses recovery voltages after motor starting and final voltage adequacy to ensure the emergency buses will not separate from the offsite while the offsite has the capability to adequately supply the emergency buses.
3. Final steady-state voltages are within all IE equipment ratings.

4. Starting voltage and minimum running voltage requirements for all equipment are to be achieved based on the lowest system voltage. Maximum running voltage requirements are to be met based on the highest system voltage.
5. 4KV emergency bus loss of voltage and degraded voltage relaying setpoints adequately protect all IE loads, including the 480V and 120V loads.

The above goals are to be achieved while analyzing all offsite sources to each emergency bus and specific worst case loading for each possible condition.

After initial analysis indicated certain modifications would be required to prevent possible spurious separation of the emergency buses, these modifications were incorporated into our analysis and are included in our results. The modifications are as follows:

1. The RSST LTC's presently operate 30 seconds after a voltage correction requirement is indicated. This prevents unnecessary operation during system transients (e.g., system voltage swings and large motor starting). The LTC control will be modified such that for SI and CDA conditions on either unit, the LTC will provide instantaneous voltage correction for approximately 3 minutes after the accident occurs, and for approximately 1 minute after a unit transfers to the RSST's while an SI or CDA condition is occurring on either unit. The voltage profile studies are based on LTC movement for 1.5 seconds per tap after waiting 2 seconds for sensing and for the driving motor to

accelerate. Recent field measurements indicate sensing takes 0.5 cycles, motor acceleration takes 4 cycles and each tap change takes 1.75 seconds. The timing sequences used in our analysis is more conservative than the actual timing sequence for the first 11 seconds after an accident. This is the most critical time period for spurious separation analysis and, as such, justifies our analysis.

2. The 34.5 KV reactor banks will be tripped when a unit transfers to the RSST's if an SI or CDA condition is occurring on either unit.
3. The following loads will be shed if Unit 2 transfers to the RSST's during an SI or CDA on Unit 1:
 - a) Bus 2A: High and low pressure heater drain pumps.
 - b) Bus 2B: Steam generator feedwater, condensate, and high pressure heater drain pumps.

Our voltage analysis assumed occurrence of a CDA, which includes all motors started on an SI plus the additional motors required by a CDA, and loading of the RSST's as defined in the Assumptions section. Unit 1 normal station service loads are assumed not to transfer to the RSST's. Unit 2 loads are assumed to transfer upon the occurrence of a Unit 2 CDA. Three possibilities of Unit 2 load transfer to the RSST's were considered for Unit 1 CDA analysis. Unit 2 loads were assumed to transfer 60 seconds prior to, simultaneous with, and 60

seconds after, a Unit 1 CDA. The simultaneous cases are the worst cases; however, we believe the probability of their occurrence is sufficiently small that modifications are not required specifically for these cases. The 60 second offset cases were run to analyze events we view as credible. Analysis for Unit 2 load transfer with a 60 second offset on either side of the Unit 1 CDA is equivalent to analysis of a Unit 2 load transfer at any time greater than 60 seconds.

B. Voltage Profile Summary Sheet

We have included copies of our voltage profile results for those studies which were run after we decided to implement several modifications. Along with initial starting voltages and final steady state voltages, a series of times are shown to indicate the effects of motor starting, motors reaching full speed, LTC corrective action, and load transferring to the RSST's. This transient analysis is used to ensure no spurious separation of the emergency buses will occur.

The MOV's are modeled as starting loads, drawing locked rotor amps, through the 6.5 second time to reflect their higher starting voltage rating. The 480 volt buses are listed on the voltage profile summary sheets in a format with the 1H bus always above the 1H1 bus, the 2J bus above the 2J1 bus, etc.

Our voltage profile computer model provides voltages on a per unit basis for all 500KV, 36.5KV, 22KV, 4.16KV and 480V buses, using those voltages as base voltages. The voltages are listed in per unit on the voltage profile summary sheets.

C. Motor Terminal Voltage Requirements

To ensure all 4KV and 480V loads receive adequate voltage during all conditions, minimum 4KV and 480V bus voltages were calculated based on each motor receiving its minimum required starting and running voltages. This calculation includes voltage drop in all cables feeding the motors. These results are tabulated in Appendix K. This table provides the guidelines for acceptability of the voltage profile results. Note that the starting voltages required at the 480V buses for loads starting from motor control centers (MCC's) are based on MOV's requiring 90% of their rated voltage (460V) to start. Conservative estimates for the 480V bus voltage requirements for MOV's rerated to start at 80% and 85% voltage can be obtained by subtracting 10% and 5%, respectively, from the values listed in the Table. Reduced voltage starting draws less starting current, consequently the voltage drops to the MOV'S will be less severe at lower voltages.

D. 120V Contactor Requirements

Analysis of voltages available to the 120V contactors, which control the load fed from MCC's, was completed in a similar manner. Based on a review of 1E control circuits' lead lengths and burdens, selected worst case circuits were analyzed. The analysis method assumed MCC bus voltages of 382V (80% of 480V) and calculated the maximum lead lengths which would allow the contactors' coils to receive 86.25V (75% of 115V). MOV's are the only MCC loads which start from SI or CDA signals. Rerating the MOV's to 80% starting requires this analysis be performed with the 382V. The minimum ratio of allowable cable length to actual cable length is approximately 6 to 1, indicating fully acceptable results.

E. Emergency Bus Loss of Voltage/Degraded Voltage Protection

The emergency buses each have a two out of three loss of voltage and a two out of three degraded voltage protective scheme. Each scheme consists of three undervoltage relays set to initiate transfer of an emergency bus from its source at that time, based on an undervoltage of a certain duration. The Unit 1 loss of voltage setpoints are 71% voltage and 2 seconds. The Unit 1 degraded voltage setpoints are 90% voltage and 5 seconds for an SI or CDA condition or 90% voltage and 56 seconds for non-accident conditions. The Unit 2 setpoints are identical with the exceptions that the degraded voltage times are 7 seconds and 60 seconds, respectively. The setpoints are based on a nominal 4160V bus voltage.

As presently designed, in the event of undervoltage on a Unit 1 emergency bus and assuming the emergency bus is connected to its reserve station service feeder, at the end of the specified time, the feeder breakers will be tripped. Two seconds later the feeder breakers from the normal bus tie will close. The voltage now has 2 seconds in which to recover sufficiently to reset all the undervoltage relaying. If the undervoltage relays have not been reset by the end of this two second period, the normal bus feeder breakers will be tripped and sequential loading to the diesel generator will be initiated. During an accident condition, the maximum length of time used in loading to the diesel generator would be with a degraded voltage condition. Including the 5 second sensing time and the 2 second delay in the automatic close circuit of the diesel generator, the first load block of emergency load will be energized by the diesel generator at approximately 11 seconds. The

first load block, which includes high and low head safety injection pumps, will accelerate within 3 seconds. Westinghouse has documented, see Appendix T, that a safety injection flow interruption of approximately 15 seconds, including sequencing of safeguards loads, may be tolerated at any point during an accident. Therefore, the existing timing sequence is acceptable.

In the event of an undervoltage on a Unit 2 emergency bus, the emergency bus will separate from its reserve station service source, at the end of one of the previously indicated design times, and will begin sequential loading to the diesel generator 2 seconds later. Again, the longest time frame in loading to the diesel generator during an accident is for a degraded voltage condition. Including 7 seconds of sensing time and the 2 second diesel generator breaker closing delay, the first load block will load to the diesel generator at approximately 9-10 seconds and will be accelerated at approximately 12-13 seconds.

We are planning to modify both of the above operations. For Unit 1, the automatic transfer from a reserve station service feeder to a normal bus feeder will be removed. Regardless of which offsite feeder is supplying the emergency bus, the undervoltage protection will initiate automatic transfer to the diesel generator only, in a time frame similar to the present operation of Unit 2. Manual transfer between all three sources (including the diesel generator) will be possible. Unit 2 may be modified to include normal to emergency bus ties which will operate in the same manner as the modified Unit 1 operation presented in this paragraph.

The 71% and 90% undervoltage setpoints and associated times are based on protection of the motors. Referral to Appendix K indicates the 90% setpoint adequately protects the 90% continuous rating of the motors. The motors can run at 71% voltage for 90 seconds. This provides the upper limit for the 56 second and 60 second timer setpoints and the basis for setting the loss of voltage protection at 71% voltage. The 56 second setpoint is sufficient to allow the emergency bus to ride through reactor coolant pump motor starting transients. The degraded voltage 5 and 7 second timers ensure the emergency loads are sequenced onto the diesel generator in the same time required for loss of voltage. The 2 second loss of voltage timer allows the emergency bus to ride through transients.

F. Emergency Buses Fed From The RSST's

In this portion of the analysis, the emergency buses are fed via the transfer buses from their normal RSST feeders (1H on F, 1J on D, 2H on E, and 2J on F). This arrangement is the normal mode of operation for the station. It will be in effect during the majority of station operation. It is anticipated the bus ties will be used only during equipment failures and to facilitate maintenance.

Appendix L consists of Cases 1A, 1B, 1C, 1BC, 1A\$ and 1A\$', which summarize our analysis results for this bus arrangement.

Case 1A, Unit 2 CDA with Unit 1 trip, shows adequate starting voltages for all motors, no spurious separation, and adequate steady state voltages.

Cases 1B and 1C, Unit 1 CDA with Unit 2 transfer to the RSST's 60 seconds after and 60 seconds prior to the CDA, respectively, present no problems. Case 3B, to be discussed later, does yield lower voltage on bus 1J than Case 1B on the transfer of Unit 2 loads due to a difference in feedwater pump loading.

Case 1BC, Unit 1 CDA with Unit 2 transferring to the RSST's at the same instant the CDA occurs, indicates all starting voltages are acceptable except the 1H1 voltage, which is 1.1% volts below the minimum requirement of the 480 V quench spray pump motor. Acceleration of the 4 KV motors within 4 seconds will supply sufficient voltages to the quench spray pump motor that it will accelerate within 2 seconds. The protective relaying for the quench spray pump will not trip for at least 10 seconds based on the starting current drawn at 70% voltage. As such, the results of this case are adequate.

Cases 1A\$ and 1A\$', Unit 2 CDA with Unit 1 on-line, provide results for automatic starting of condensate pumps after all emergency loads have sequenced into operation and the LTC's have corrected. These cases present no problems.

G. Emergency Buses Fed as Follows:

1H-F, 1J-2B, 2H-2C, 2J-1A

This emergency bus arrangement assumes buses 1J and 2H have transferred to their bus ties. The basis for this line-up is that the offsite feeds to these buses originate from the same supply and it is credible to assume failure of that supply.

Appendix M consists of cases 2A, 2A', 2B, 2B', 2DP, 2C, 2D, 2E, 2BC which analyze this bus alignment.

Case 2A, Unit 2 CDA with Unit 1 on line operating at 20.9KV, indicates two problems. Bus 2J will separate and load to the diesel generator. Also, the 480V bus voltages are less than required for continuous operation. Case 2A' is a rerun of 2A with the Unit 1 generator voltage at 21.5KV. The results have improved but the steady state 480V bus voltages are still too low. This problem is corrected by maintaining the Unit 1 generator voltage at a minimum of 21.7KV and following the bus loading operating restriction. Case 2DP gives results to substantiate this conclusion.

Case 2B, Unit 1 CDA with Unit 2 generator at 20.9KV until it trips 60 seconds after the CDA, indicates initial motor starting and steady state voltages are acceptable; however, 480V bus 1J may not have adequate voltage during the transient condition, and when Unit 2 transfers to the RSST's, bus 1J may separate. Case 2B' raises Unit 2 to 21.5KV but the same problems still exist although they are not as severe. These problems are solved by raising Unit 2 generator voltage to 21.7KV and following the bus loading operating restrictions as indicated by case 2DP.

Case 2DP, Unit 1 CDA with Unit 2 generator voltage at 21.8 KV, with 2B condensate pump not running as per the operating restrictions, indicates fully acceptable results for an emergency bus fed from a normal bus of the opposite unit. The steady state voltage requirement for 480 V bus 1J is 92.4%, the highest of any 480 V bus. This requirement is exceeded by 1.7%, which justifies establishing a limitation of 21.7 KV on the generator voltage (based on present transformer tap settings) for cases of this type.

Case 2C, Unit 1 CDA with Unit 2 tripping 60 seconds prior to the CDA, indicates no problems exist.

Case 2D, Unit 1 CDA with Unit 2 generator at 20.9KV, indicates the 1J and 1J1 480V bus voltages are too low and the voltage on 4 KV bus 1J may cause separation from the offsite source. Again, this will be solved with a generator voltage of at least 21.7KV and by using the bus loading restrictions.

Case 2E, Unit 2 CDA with a Unit 1 trip, indicates a possible problem with the final 480V bus 2J voltage. It is indicated to be 0.5% lower than required. However, using the bus loading restrictions, the minimum load shed from bus 1A would be a 3500 HP condensate pump. Shedding this pump is sufficient to raise the voltages indicated by greater than 1%. Therefore, the voltages experienced under this condition will be fully acceptable.

Case 2BC, Unit 1 CDA with Unit 2 loads transferring to the RSST's at the same instant the CDA occurs, indicates acceptable results with the exception of the initial 480 V bus 1H1 voltage. The initial voltage is indicated as 70.1% while the quench spray pump requires 71.0%. Acceleration of the 4 KV motors within 4 seconds will supply sufficient voltage to the quench spray pump motor that it will accelerate within 2 seconds. The protective relaying for the quench spray pump will not trip for at least 10 seconds based on the starting current drawn at 70% voltage. As such, the results of this case are adequate.

H. Emergency Buses Fed as Follows:

1H-1B, 1J-D, 2H-E, 2J-1A

Appendix N gives results of Cases 3A, 3B, 3C, 3D, 3AG, 3A\$ and 3D\$. These cases provide analysis for loss of the reserve supply to bus 1H and 2J.

Case 3A, Unit 2 CDA with Unit 1 on line at 20.9 KV, indicates low 480V 2J and 2J1 bus voltages and separation of emergency bus 2J. Again, generator voltage of 21.7KV or greater plus bus loading restrictions will eliminate these problems.

Case 3B, Unit 1 CDA with Unit 2 tripping 60 seconds later, indicates bus 1J may separate with the transfer of Unit 2 to the RSST's. This problem is solved by the load shedding demonstrated in Case 4B, which will be discussed later.

Case 3C, Unit 1 CDA with a Unit 2 trip 60 seconds prior to the CDA, indicates acceptable results.

Case 3D, Unit 1 CDA with Unit 2 generator voltage at 20.9KV, indicates acceptable results.

Case 3AG, Unit 2 CDA with Unit 1 on-line operating at 21.5 KV, analyzes the effect of the automatic transfer of the G buses due to loss of power supply. In this case, bus 2G is assumed to have transformed to bus 1G some time prior to the Unit 2 CDA. The initial 480 V starting voltages are low but would improve quickly enough to accelerate the quench spray pump in an acceptable fashion. However, the recovery of 4 KV bus 2H voltage appears to be too slow and spurious separation is likely to occur. Additionally, the final 480 V bus 2H and bus 2H1 voltages are lower than required. To alleviate these conditions, a load shedding scheme will be installed which will shed all four bus 2G circulating water pumps for this condition. Generically, the load shedding will operate whenever both G buses are being fed from the same source and an SI or CDA occurs. For those conditions all four circulating water pumps of the unit experiencing the accident will be tripped. With this load shedding installed, the worst case condition for this type of event is bounded by other studies. Therefore, these results are fully acceptable.

Case 3A\$, Unit 2 CDA with Unit 1 generator at 21.5KV, indicates some possible problems due to the automatic start of a condensate pump. However, the operator restrictions to maintain 21.7KV and bus loading restrictions will raise the 48°V bus 2J bus voltage at least 2%. The acceleration times of the condensate pump are approximately 6 seconds at 70% voltage and 2 seconds at 100% voltage. The 2J bus voltage will recover prior to spurious separation.

Case 3D\$, Unit 1 CDA with Unit 2 generator at 21.5KV, indicates acceptable results for a condensate pump start.

I. Emergency Buses Fed as Follows:

1H-F, 1J-2B, 2H-E, 2J-1A

Appendix O consists of Cases 4B and 4BC. These are cases which are required to bound worst case conditions.

Case 4B, Unit 1 CDA with Unit 2 generator at 21.5KV until it trips 60 seconds after the CDA, provides the results of shedding bus 2A high and low pressure heater drain pumps and bus 2B feedwater and high pressure heater drain pumps. Bus 2H has been transferred to bus E to decrease the voltage on Bus 1J when it transfers to RSST B. Review of the results indicates the load shedding adequately solves the degraded voltage which was caused by the transfer and no other problems exist.

Case 4BC, Unit 1 CDA with an instantaneous transfer of Unit 2 loads to the RSST's upon the occurrence of the CDA, has used the load shedding from case 4B and added bus 2B condensate pump to the shed loads. Analysis of the initial starting voltages indicates the voltage on bus 1J1 is 0.9% lower than required to start the 480V quench spray pump motor. Acceleration of the 4KV motors within 4 seconds will supply sufficient voltages to the quench spray pump motor that it will accelerate within 2 seconds. The protective relaying for the quench spray pump will not trip for at least 10 seconds based on the starting current drawn at 70% voltage. As such, the results of this case are adequate.

J. Automatic Emergency Bus Transfer

Appendix P summarizes the results of cases 5D, 5F, 5G, 5G', 6H and 7A which provide analysis of the automatic transfer of an emergency bus from its reserve source to its normal bus tie source. Because of the 2 second dead time between separation from the reserve and closure of the bus tie, all connected motors were assumed to draw full starting current when connected to the normal bus source. Criteria for acceptable transfer were sufficient voltage to start all motors and recovery of 4KV bus voltage to reset the undervoltage relaying within 2 seconds to prevent separation from the normal bus and loading to the diesel generator.

Case 5D, transfer of 1H to 1B while Unit 1 is experiencing a CDA, provides unacceptable results. Bus 1H will transfer to the diesel generator.

Case 5F, transfer of 1H to 1B under non CDA trip condition, may provide acceptable results if Bus 1H voltage rises fast enough due to motor acceleration.

Cases 5G and 5G', 1H transfer to 1B with Unit 1 generator at 20.9KV and 21.5KV, respectively, indicate a much better chance of successful transfer with the higher generator voltage.

Case 6H, transfer of 1J to 2B with 2B fed from RSST B, indicates the transfer will probably not be successful.

Case 7A, transfer of 2H to 2C with Unit 2 experiencing a CDA, indicates the transfer will not be successful.

Based on these transfer cases, we have decided that an automatic transfer is not an optimal design. While these results represent the worst case, and we believe that the transfer will be successful in some cases (as it has been in the past), in viewing the results we believe they indicate a much lower probability for success than we require. While the only result of an unsuccessful transfer is to separate and load to the diesel generator, we do not believe we should continue with a design that requires challenging the protective relaying to properly operate. We believe a better design is to make transfers of the emergency buses between their offsite

sources a manual operation only. The only automatic transfers from either source will be to the diesel generator. We will modify the existing Unit 1 design and the the Unit 2 design will be modified prior to installation.

K. Overvoltage Analysis

Based on 535KV in the switchyard, no load on the RSST's, no transformer losses, and the 34.5 KV reactor banks in a de-energized state, the LTC's correct to 4343v or 109% of the nominal rating of the 4kv motors and 103% of the nominal PT rating. At the 480V buses, the maximum voltage will be 514v or 112% of the nominal ratings of the 480V motors and 107% of the nominal PT ratings. The maximum voltage on the 120V motor starting circuits will be 138v, or 120% of the starter coil nominal rating. The overvoltages indicated are strictly for unloaded, lossless analysis. Energizing the 34.5 KV reactor banks, which is done at high system voltage, would reduce the 34.5 KV bus voltage sufficiently to allow the LTC to maintain 4317 V. As loading is added to the RSST system, the overvoltages will cease to exist due to voltage drops across transformers and cables.

For the cases with an emergency bus fed from a normal bus of a unit which is off-line, being backfed from the switchyard and assuming 535KV in the switchyard, no loads on either the normal or emergency buses, and no transformer losses, the maximum 4KV emergency bus voltage is 4571v, or 114% of the nominal motor rating and 108% of the nominal PT rating. At the 480v buses, the maximum voltage will be 541v or 118% of the nominal motor rating and 113% of the nominal PT

rating. The maximum voltage on the 120v motor starting circuits will be 146v, or 127% of the starter coil rating. These results are worse than those experienced while being fed from the RSST's but should also be alleviated with load addition or transfer of the bus to the RSST's.

We plan to install overvoltage monitors on the 4kv and 480v emergency buses to protect all IE equipment from overvoltage. Please reference Appendix J operating restriction number IV for our intended course of action in the event of an overvoltage occurrence.

L. Large Nonsafety Motor Starts

Four nonsafety motors, feedwater, condensate, bearing cooling and component cooling, receive automatic start signals, which conceivably could occur during an accident. Cases 1A\$, 1A\$', 3A\$, and 3D\$ provided results for condensate pump starts after all CDA loads were operating and steady state voltages achieved. Acceptable results will also be achieved with the bearing cooling and component cooling pumps since these have smaller motors than that of the condensate pump. If one of these motors started prior to steady state, it could possibly cause the spurious separation of an emergency bus. Feedwater pump starts could cause spurious separation for all of these conditions.

We will modify the automatic starting circuits of the condensate, bearing cooling, and component cooling pumps to disable the automatic starts for approximately 60 seconds after an SI or CDA to ensure sufficient voltage is available to start the motors without causing emergency bus separation. The automatic feedwater pump starts will be blocked for the duration of the SI or CDA. These blocking features will be initiated based on bus alignment to ensure blocking will not occur in cases which will not affect an emergency bus.

Manual starts of these pumps and of the reactor coolant pumps will not be restricted during accident conditions, however the operators will be informed that starting these pumps may cause emergency bus separation and they will only start the motors if necessary.

Please keep in mind that this spurious separation problem only exists on an emergency bus under SI or CDA conditions. Spurious separation does not occur for NON-SI and NON-CDA conditions.

M. Instrumentation Circuits

The plant vital bus loads, including instrumentation, are fed from uninterruptible power supplies and are not affected by system voltage fluctuation.

N. Control Circuits

The breaker control circuits for the 4,160 V bus and 480 V load center bus loads are supplied by the station batteries and are independent of system voltage.

Each MCC control circuit has two 15 amp dual element time delay fuses, one in each control transformer secondary lead. Since the maximum pick-up current of any of the contactors at 75 percent rated voltage is 8.2 amp, well below the 15 amp fuse rating, there is no possibility that a reduced voltage would cause an overcurrent high enough to blow the 15 amp fuses.

VI. MOTOR OPERATED VALVE ANALYSIS

Our initial investigations indicated all MOV's required to start on either SI or CDA signals were rated to start and run at a minimum of 90% of rated voltage (460 V). Further investigations with the MOV vendor have indicated the majority of MOV's may be rerated for 80% voltage starting, several may be rerated for 84% - 86% voltage starting, and some may not be rerated at all. In addition, some MOV's are still being investigated for rerating. Out of a total of 128 MOV's, 68 may be rerated for 80% starting, 2 may be rerated in the 84% - 86% starting range, 1 is rated for 90% starting only, and 57 are still being investigated.

Along with providing rerating values, the MOV vendor also recommended we contact the valve manufacturer to ensure the valve torque requirements on which the MOV vendor based his reratings are indeed the valve torque requirements as defined by the valve manufacturer. We are in the process of making this confirmation. Our present schedule estimates 3 months until the valve manufacturer's review is completed.

The acceptability of our voltage profile results is based on rerating the MOV's to 80% voltage starting, and 84% - 86% voltage starting. Review of the voltage profile results indicates that 80% MOV's will probably start before and definitely no later than 4 seconds after the initial accident. Starting within this time frame ensures proper MOV operation. For the MOV's rated in the 84% - 86%, an individual analysis was completed for each MOV. These MOV's all receive adequate voltage and will properly operate. The MOV's which cannot be rerated below 90% voltage starting will be replaced with MOV's rated at 80% voltage starting.

The scope of this modification is presently undetermined. If the valve manufacturer is in concurrence with the MOV manufacturer concerning required torque values, the scope will be relatively small. The rerating may require installation of new torque switch limiter plates to ensure the units will "torque out" at the maximum operating output of the unit. We are pursuing this investigation with the MOV manufacturer. The MOV's on which the MOV vendor has not yet provided a rerating capability present an unknown scope. Additionally, the reply from the valve manufacturer will affect the scope of this modification.

It should be noted that the ability to rerate an MOV to 80% voltage starting is based on the torque developed at that voltage versus the torque requirements of the valve. The MOV manufacturer has certified, based on his record of valve torque requirements, that the majority of the existing MOV's are capable of starting at 80% voltage. This certification provides documentation that the MOV's are presently starting at 80% voltage. The torque limiter plate modification is simply to provide better protection of the MOV.

VII. COMPUTER MODEL VERIFICATION

To verify our computer model and to ensure that our voltage analysis results are valid, we performed a voltage profile test, 1-ST-9, in which Unit 2 station service loads were transferred from the normal SST's to the RSST's, after which a charging pump was started on Bus 2J. System voltages, RSST load tap changer (LTC) positions, and 4.16 KV (emergency and normal) and 480 volt (emergency) bus voltages and currents were recorded. The system voltages, RSST's LTC positions, and the bus current values were input into the computer model to calculate bus voltages. Appendix Q contains tabulations of the recorded and calculated values after the transfer from normal SST to RSST and during the charging pump start. The largest error is 4.0%. These results justify the use of our computer model in predicting voltages during worst case analysis.

VIII. REVIEW FOR SIMULTANEOUS OR CONSEQUENTIAL LOSS OF OFFSITE POWER SOURCES

We have reviewed our electrical distribution system to determine its compliance with GDC-17 and whether or not any events or conditions exist which could result in the simultaneous or consequential loss of both required circuits to the offsite network. The design of our offsite power supply is in full compliance with GDC-17. We have completed some minor modifications to comply with the requirement concerning the simultaneous or consequential loss of both offsite sources. These modifications are depicted in Appendix R.

The first modification concerned the 34.5KV tie breaker between the two 34.5KV buses which supply the redundant offsite power supplies. This tie breaker would normally be open and would be automatically closed upon the loss of supply power to either 34.5KV bus. However, to eliminate any possibility of simultaneous loss of both offsite sources due to tie breaker failure, we have incorporated operating procedures to leave both 34.5KV disconnects open (one disconnect is installed on each side of the breaker). The automatic close feature is removed and manual closing is required.

The second modification involved the switchyard service transformers. Each of these 1500KVA transformers can supply the entire switchyard load. The primaries of these transformers are connected to each 34.5KV bus and the secondaries are routed in a common cable trough to manual throwover switches.

The purpose of the throwover switches is to allow the loads to be transferred to either transformer. In order to eliminate the possibility of simultaneous loss of both offsite sources, switches have been installed in the secondary leads of both transformers and all the secondary leads of one of the transformers have been removed from the common trough and installed in conduit. The new switches are operated such that only one transformer source will be available at the throwover switch at any time.

IX. TECHNICAL SPECIFICATIONS

Our July 24, 1981 letter contained a preliminary copy of our proposed changes to the Unit 1 Technical Specifications which more accurately reflect operational requirements with the normal to emergency bus ties installed. With the removal of the automatic transfer feature of these bus ties, the previously submitted preliminary technical specification revision is no longer valid. A revised draft of our proposed Unit 1 Technical Specification changes is included in Appendix S.

Also included in Appendix S, is a preliminary draft of Unit 2 Technical Specification changes required to more accurately reflect electrical system requirements after the installation of the normal to emergency bus ties.

Based on the results of our GDC-17 analysis, these are the only Technical Specification revisions required.

X. SUMMARY OF MODIFICATIONS

A. Operating Restrictions (See Attachment I, Appendix J and Attachment II, Appendix B for details)

1. To limit normal bus loading to 3000 amps maximum.
2. To prevent buses 2H and 2J from being fed from RSST C at the occurrence of an accident.

3. To limit generator bus voltage to 21.7 KV (based on existing transformer taps) if an associated normal bus is feeding an emergency bus from the opposite unit.
4. The existing load shedding scheme, which automatically occurs on two unit loading to the RSST's, will be enabled at all times.
5. Adherence to the transmission system voltage regulation action plan.

B. MOV Re-Rate and Replacement

1. Rerate all MOV's with the capability to be rerated to either 80%, 84%, or 86% voltage starting. This may require installation of new torque limiter plates on these MOV's.
2. Replace all 90% voltage starting MOV's with MOV's rated for 80% voltage starting.

C. Load Shedding

1. For conditions of Unit 2 loading on the RSST's during the occurrence of a Unit 1 SI or CDA. The loads to be shed are bus 2A high and low pressure heater drain pumps and bus 2B feedwater, condensate and high pressure heater drain pump.

2. For conditions whenever both G buses are being fed from the same source, and an SI or CDA occurs, all circulating water pumps of the unit experiencing the accident will be tripped.

D. Automatic Tripping of the 34.5 KV Reactor Banks

1. Both 34.5 KV reactor banks will be tripped, following an SI or CDA on either unit, when a unit's normal buses load to the RSST's.

E. Overvoltage Alarm Installation

1. Install overvoltage relaying on the 4 KV and 480 v emergency buses.
2. Overvoltage will be limited by operator action to a duration not to exceed 15 minutes.

F. Instantaneous LTC Voltage Correction

1. The LTC voltage correction mechanism will be given a signal to provide instantaneous voltage correction upon the occurrence of an SI or CDA on either unit. This signal will last for approximately 3 minutes.

2. The LTC voltage correction mechanism will be given a signal to provide instantaneous voltage correction when a unit transfers to the RSST's during an SI or CDA. This signal will last for approximately 1 minute.

G. Blocking Automatic Starting of Large Non LE Motors

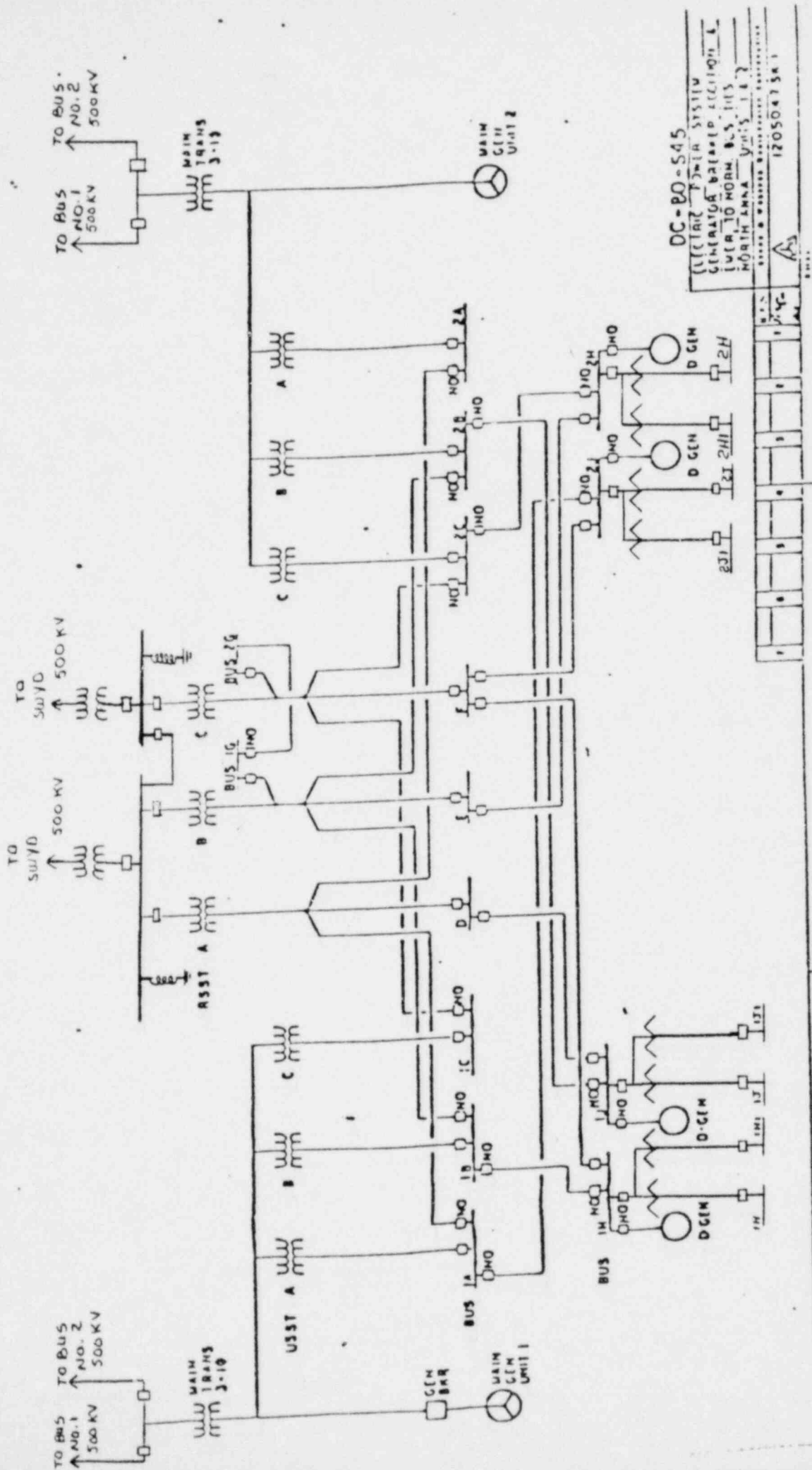
1. Block condensate, bearing cooling, and component cooling pumps from starting for approximately 60 seconds after an SI or CDA occurs.
2. Block feedwater pumps from automatic starting during an SI or CDA.

H. Manual Transfer of Emergency Buses from the Reserve Source to the Normal Bus Source

1. Modify the existing control logic for the Unit 1 normal to emergency bus ties to remove the automatic transfer of the emergency buses from their reserve station service feeders to their normal bus feeders.
2. Modify the Unit 2 normal to emergency bus tie Design Change Package to remove the automatic transfer of the emergency buses from their reserve station service feeders to their normal bus feeders.

3. Modify the timing and control sequences of the loss of voltage/degraded voltage protection schemes on the emergency buses to reflect a direct transfer to their respective diesel generators.

APPENDIX A



APPENDIX B

This appendix is for our transmission system voltage regulation action plan which will be submitted by July 1. 1982.

APPENDIX C



BESTELLUNG/ORDER/COMMANDE 1-322 130

FABR.-NR./NO. DE FABR. HA 1885645

			Einheit Unit Unité	Gewert Nom.val. Valeur nom.	Messwert Mes.val. Mesure
6. Schaltungen/Operations/Manceuvres					
1 C	1,2 P _n	5046/3175 g/min	Schaltg.	10	10
2 C	1,2 P _n	3221/3175 g/min	Operat.	10	10
3 C	1,0 P _n	4205/3175 g/min	Operat.	20	20
4 C	1,0 P _n	319/3175 g/min	Manceuv.	20	20
5 CO	1,0 P _n	4205/3175 g/min		5	5
7. NT-Behälter/HP-Receiver/Réservoir à BP					
NT-Behälter/HP-Receiver/Réservoir à HP		360	Hr.	—	39262
Wl.-Ka.-Behälter/Hes.chamber receiver/Réservoir chambre de rés.		10	No.	—	39236
		30	No.	—	39316
8. Luftverbrauch/Air consumption/Consommation d'air					
Inhalt Schalterpol	Schaltedruck	Verbrauch/Consumption/Consom.			
Contenu de pole	Operat.pressure	Niederdruck			
Contenu du pole	Pres.de manouv.	Low pressure			
		High pressure			
		Haute pression			
1 C	4205/3175 g/min	22.5 g/min	1	280110	2752
2 C	4205/3175 g/min	22.5 g/min	1	—	2710
3 C	4205/3175 g/min	22.5 g/min	1	—	2081
4 C	4205/3175 g/min	22.5 g/min	1	280110	2032
5 1st.-Aus/Prot.trip/Décl.à prot.	4205/3175 g/min	1609 g/min	1	—	2752
5 1st.-Aus/Prot.trip/Décl.à prot.	4205/3175 g/min	1609 g/min	1	280110	2680
1 CO	4205/3175 g/min	1609 g/min	1	—	5175
1 CO	4205/3175 g/min	1609 g/min	1	—	5092
9. Min. Betätigungsdruck/Min. operating pressure/Pression min. de manouv.					
1 C Trennerrohr läuft vollständig in Endstellung			Pa/g	261	232
2 C Isolator moves correct to end position			Pa/g	261	132
3 CU Sectionneur atteint position finale			Pa/g	260	246
10. C Min. Betätigungsdruck der pneumat. Steuerung bei					
Min. operating pressure of pneumatic control at			bar	—	—
O Pression min. de la commande pneumatique à			bar	—	—
11. Mechanische Kontrolle/Mechanical check/Vérif. au point mécanique					
1 Trenneinstellung	Zentrierung			geprüft	18544
Setting of isolator	Centering			tested	
Justage du sectionneur	Centrage			essaye	
2	Differenz/Difference/Différence		mm	≤ 2,0	1,0
3 Kommutierungspalt/Change-over distance/Distance de commutation			mm	5,6 ± 0,6	5,3
4 Distanz A-B/Distance A-B; Zeichnung/Drawing/Dessin			mm	23,0 ± 0,3	22,0
5 Regulierschraube der Dämpfung "Ein"	Vorstehend		mm	—	274
Setting of screw for damping "On"	Protruding			—	
Via de réglage d'amortissement "Encl."	en saillie			—	
6 Anzahl Reg.-Schrauben im Dampf.-Zyl./quantity of screws/Nombre de vis			Ans./No.	—	4
7 Regulierschraube der Dämpfung "Aus"	Vorstehend		mm	—	201
Setting of screw for damping "Off"	Protruding			—	
Via de réglage d'amortissement "Decl."	en saillie			—	
8 Anzahl Reg.-Schrauben im Dampf.-Zyl./quantity of screws/Nombre de vis			Ans./No.	—	0
9 Einschal.blende/Orifice "Close"/Diaphragme d'encl.			mm	70-90	71
10 Anschlag/End stop/arrêt			mm	20-30	20
11 Ausschaltblende/Orifice "Trip"/Diaphragme de décl.			mm	70-90	71
12 Rückschlagklappe/Non-return orifice/Diaphragme de retour			mm	214-25	210/21
13 Dämpfung des Kontaktkörpers			mm	≥ 1,0	—
Damping of load contact					
Amortissement du contact de commutation					
14 Rückprallung des Kontaktkörpers	bei		mm	≤ 2,0	1,5
Rebound of load contact	at				
Rebondissement du contact de commutation à					
15 Hub des Loschkontaktes/Travel of arcing contact/Course du contact d'interrupt.			mm	24,5 ± 1,5	25,0
16 Hub des Kontaktkörpers/Travel of load contact/Course du contact de commutation			mm	60,0 ± 3,5	62,0
17 Bohrung der Kontaktbohrung/Bore of contact nozzle/Diamètre de la tuyère			mm	60,0 ± 0,3	60,0
18 Distanz Auffangelektrode/Distance transfer electrode/Distance de l'électrode			mm	110,0 ± 3,0	110,0
19 Trennerrohr läuft aus der "Aus"-Raststellung			Pa/g	290-540	536
Min. pressure to move isolator against latching device "Open"-position					
Sectionneur quitte l'arrêt de la position "Decl."					
20 Trennerrohr läuft aus der "Ein"-Raststellung			Pa/g	435-725	667
Min. pressure to move isolator against latching device "Close"-position					
Sectionneur quitte l'arrêt de la position "Encl."					
21 Kontaktsystem/Contact pieces/Système du contact				checked	checked
22 Resorbt-widerstand	Anzahl Rollen		Typ/Type	P13	P13
Resorbt resistor	Quantity of rolls				
Résistance du type résorbt	Nombre de rouleaux				
23 Kondensatoren/Capacitors/Condensateurs					

Baden 82-02-18

Gepüft : 21.12.74
Tested by :
Vérifié par :

Akzeptiert:
Passed:
Accepté :

W. Weber

PRUEFPROTOKOLL / TEST REPORT / PROCES VERBAL

Seite 3



BESTELLUNG/ORDER/COMMANDE 1-322 130

FABR.-NR./SERIAL NO./NO. DE FABR. HA 1225 645

			Einheit Unit Unité	Sollwert Nom. value Valeur nom.	Neuewert Mean. val. Mesure
12. Kontrollmasse der Löschkammer Check measurement of interrupting chamber Mesure de la chambre d'extinction	A B C D E		mm	5,6 ± 0,6 24,5 ± 0,7 34,5 ± 0,3 15,0 ± 0,5 18,0 ± 0,2	5,35 25,0 34,5 15,0 18,0
13. Löschkammer- u. Trennerstützer Supporting insulators Isolateur supports	(Material) (Material) (Matériau)	Polyamid, Silikon			
14. Auslösekraft der Halteklappe am Steuerblock Releasing force of holding latch on control block Force de déclenchement du cliquet du bloc de commande	C D		P	600 - 800 600 - 800	
15. Sicherheitsventile/Safety valves/Soufflets de sûreté	No. No. No.			462 ± 7,25 462 ± 7,25 462 ± 7,25	462 462 462
1. Niederdruck/Low pressure/basse pression Öffnungsdruck/Opening pressure/S'ouvre Schließendruck/Resealing pressure/Se ferme	Prüfung Prüfung Prüfung			462 ± 7,25 462 ± 7,25 462 ± 7,25	462 462 462
2. Hochdruck/High pressure/Haute pression Öffnungsdruck/Opening pressure/S'ouvre Schließendruck/Resealing pressure/Se ferme	Prüfung Prüfung Prüfung			462 ± 7,25 462 ± 7,25 462 ± 7,25	462 462 462
16. Hilfschalter und elektrische Verbindungen nach Schema Auxiliary switch and connections per diagram contacts auxiliaires et circuits électriques d'après schéma		HAUT 200 514		geprüft tested essayé	tested
1. Durchfederung der Hilfskontakte Contact travel of auxiliary contacts Plaque des contacts auxiliaires		HAUT 100 609		geprüft tested essayé	tested
17. Massbild/Dimension drawing/Dessin coté					
1. Leuchtzeichenschild/Warning plate/Plaque signal étiquette					
2. Drehmoment der Schrauben/Torque setting of bolts/Couple des vis					
18. Dichtigkeit des Schalters/Leakage of breaker/Etanchéité du disjoncteur					
1. Luftverlust Pressure drop Perte de pression	bei at à	4205 bar psig	während during pendant	10 h	3,2
2. Hochdrucksystem High-pressure side Partie haute pression	bei at à	2125 bar psig	während during pendant	1 h	3,2
3. Dichtigkeit der Stützer/Leakage of supporting insulat./Etanchéité des supports					tested
4. Dichtigkeit der Kapselung/Leakage of breaker seal./Etanchéité du blindage					
1. Luftverlust Pressure drop Perte de pression	bei at à	200 mm	Wassersäule während water column during colonne d'eau pendant	5 Min.	50
2. Luftverlust Pressure drop Perte de pression	bei at à	100 mm	Wassersäule während water column during colonne d'eau pendant	5 Min.	50
3. Druckprobe Testing pressure Pression d'épreuve	bei at à	1000 mm	Wassersäule während water column during colonne d'eau pendant	1 Min.	50
5. Kühlwassersystem/Water cooling system/Circuit de refroidis.					
1. Wasserdurchfluss/Water flow/Écoulement d'eau					
2. Dichtigkeit Leakage Etanchéité	bei at à	725 bar psig	während during pendant	1 h	5,5
3. Druckprobe Testing pressure Pression d'épreuve	bei at à	725 bar psig	während during pendant	1 h	1,16
Water flow 'right' + 'left' //		20 l/min		psig	2,8-2,2
Leakage both sides //		during 1h		psig	≤ 1,45

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BESTELLUNG/ORDER/COMMANDE 1-322130

FABR.-NR./SERIAL NO./NO. DE FABR. HA 185645

19. Schaltzeiten/Operating times/Temps de manoeuvre

Schaltvorgang Operation Manoeuvre	1 Einschaltzeit				2 Löschkontakt Aus				3 Blasseit				4 Schaltvorgang				5 Max. Dr. Trenner-Akt			
	N	ss	M	ss	N	ss	M	ss	N	ss	M	ss	N	ss	M	ss	N	ss	M	ss
C 420/2175 emp/ig	22-25		24.6		52.5		48.2		192.5		194.1		2.5		62.5		112.5		120.3	
C 420/2175 emp/ig			24.5				47.5				194.0				62.5				124.0	
C 406/2175 emp/ig			24.0				47.5				192.5				62.5				124.0	
C 406/2175 emp/ig			24.0				48.2				192.5				62.5				124.0	
C 377/2175 emp/ig			24.5				48.2				192.5				62.5				124.0	
C bar																				

Schaltvorgang Operation Manoeuvre	6 Bew. Zeit. Löschkont.				7 Auftr. - Geschw. Korb a. Kl.				8 V max. C. Kont. Korb				9 V max. Trennerrohr				10 Max. Druck Löschk.			
	N	ss	M	ss	N	ss	M	ss	N	ss	M	ss	N	ss	M	ss	N	ss	M	ss
C 420/2175 emp/ig	10-15		14.0		2.2-2.4		3.1		2.2-2.4		3.2		2.2-2.4		3.2		5.2-5.5		5.3	
C 420/2175 emp/ig			13.2				3.1				3.2				3.2		5.3		5.3	
C 406/2175 emp/ig			13.2				3.05				3.2				3.2		5.3		5.3	
C 406/2175 emp/ig			13.2				3.05				3.2				3.2		5.3		5.3	
C 377/2175 emp/ig			13.2				3.0				3.2				3.2		5.3		5.3	
C bar																				

Masswert-Legende zu Kolonne 1...10 siehe Seite 6
 Explication of measurements according to points 1...10 see page 6
 Explication des mesures des points 1...10 voir page 6

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BESTELLUNG/ORDER/COMMANDE 1-322 130

FABR.-NR./SERIAL NO./NO. DE FABR. HA 1885 645

21. Pneumatische Versögerungszeit der Widerstandskammer
Pneumatic switching delay of resistance chamber to arcing chamber
Temps de retardement pneumatique de la chambre de résistance comparé au contact d'extinction

Schaltvorgang Operation Manoeuvre	Variante Nr. 2 Nr. 62/80				Variante Nr. 2 Nr. 62/80			
	Widerstandskammer 1		Widerstandskammer 2		Widerstandskammer 1		Widerstandskammer 2	
	Versögerungszeit	V max. bei Kont.berüh.	Versögerungszeit	V max. bei Kont.berüh.	Versögerungszeit	V max. bei Kont.berüh.	Versögerungszeit	V max. bei Kont.berüh.
	U	ms	M	ms	U	ms	M	ms
C	425/2475 P119	20-33	30.0	—	20-33	30.5	—	—
C	425/2475 P119	—	30.0	—	—	30.5	—	—
C	406/2475 P119	—	30.0	—	—	31.0	—	—
C	406/2475 P119	—	30.0	—	—	31.0	—	—
C	323/2475 P119	—	30.0	—	—	31.0	—	—
C	— bar	—	—	—	—	—	—	—
C	323/2475 P119	—	30.5	—	—	31.0	—	—
O	323/2475 P119	—	30.5	—	—	31.0	—	—
O	319/2475 P119	30-33	30.5	—	30-33	31.0	—	—
O	319/2475 P119	—	30.5	—	—	31.0	—	—
O	290/2475 P119	—	31.0	—	—	31.0	—	—
O	290/2475 P119	—	—	—	—	—	—	—
O	— bar	—	—	—	—	—	—	—
O	323/2475 P119	—	32.5	—	—	32.5	—	—
O 1 Leistung	323/2475 P119	35-43	31.0	—	35-43	32.0	—	—
O 1 Protection	323/2475 P119	—	31.0	—	—	32.0	—	—
O 1 à protection	323/2475 P119	—	31.0	—	—	32.0	—	—
O 1 Leistung	—	—	32.5	—	—	32.5	—	—
O 1 Protection	250/2042 P119	—	32.5	—	—	32.5	—	—
O 1 à protection	—	—	—	—	—	—	—	—
O 2 Leistung	319/2475 P119	35-43	31.0	—	35-43	32.0	—	—
O 2 Protection	319/2475 P119	—	31.0	—	—	32.0	—	—
O 2 à protection	—	—	—	—	—	—	—	—

22. Ohm'scher Widerstand
Ohmic resistance
Résistance ohmique

	U	U	U
Sollwert F	10.0 ± 5%	10.3/10.0 ± 5%	10.0 ± 5%
Messwert M	10.0	2.6	7.94

Messwert-Legende zu Kolonne 13...14 siehe Seite 6

Explanation of measurements according to points 11...14 see page 6

Explication des mesures des points 11...14 voir page 6

Schaltzeiten gemessen bei 20°C

Operating times measured at 20°C

Temps de fonctionnement mesuré à 20°C

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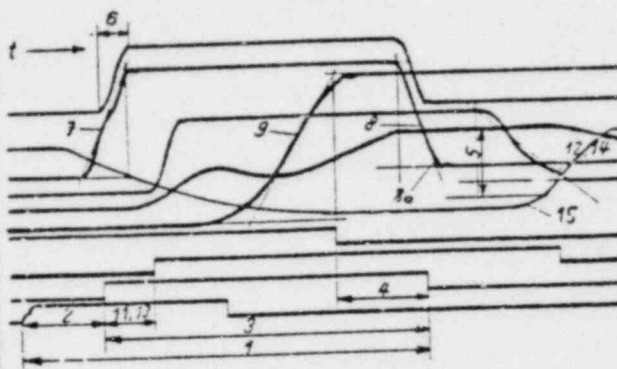
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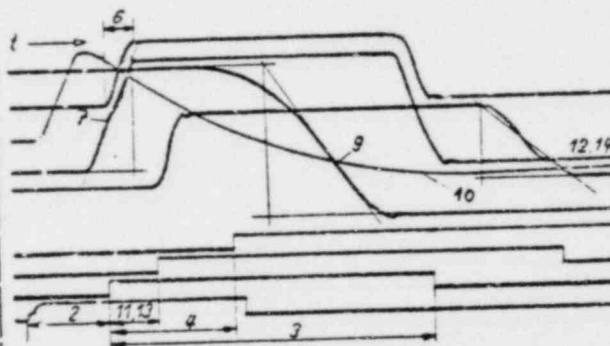


Einschalten/Closing/Enclenchement



Trenner/Isolator tube/Sectionneur
 Löschkont./Arcing cont./Contact d'extinct.
 Druck Trenner-Antr./Pressure isol.drive/
 Prässion du sectionneur
 Kont.Korb/Load cont./Cont. de commut.
 Widerstandsk./Resist.chamber/Chambre de résist.
 Trenner/Isolator/Sectionneur
 Widerstandsk./Resist.chamber/Chambre de résist.
 Löschk./Arching chamber/Chambre d'ext.
 Spulenstrom/Coil current/Courant de la bobine

Ausschalten/Opening/Déclenchement



Löschkont./Arching cont./Cont. d'extinct.
 Kontaktkorb/Load cont./Cont. de commut.
 Widerstandsk./Resist.chamber/Chambre de résist.
 Trenner/Isolator tube/Sectionneur
 Trenner/Isolator tube/Sectionneur
 Widerstandsk./Resist.chamber/Chambre de résist.
 Löschk./Arching chamber/Chambre d'extinct.
 Spulenstrom/Coil current/Courant de la bobine

Einschalten/Closing/Enclenchement

- 1 Einschaltzeit/Making time/Tempo d'enclenchement
- 2 L.-K.Aus/Arching cont.open/Cont.d'extinction s'ouvre
- 3 Blasezeit/Blast time/Tempo de soufflage
- 4 Schaltverzögerung/switching delay/delay à la fermeture
- 5 Trenner, Druck max./Max.press.isol.drive/Pr.max. du sect.
- 6 Bewegungszeit Löschkont./Arching contact, travel time
- 7 Max. Auftreffgeschwindigkeit Korb auf Kontakt
- 8 Max. speed of load contact on impact with arcing contact
- 9 Vitesse max. au choc du cont. de comm. comp. au cont. d'ext.
- 10 Max. Einschaltgeschwindigkeit des Kontaktkorbes
- 11 Vitesse max. d'enclenchement du contact de commutation
- 12 Max. Auftreffgeschw. Korb auf Dichtung
- 13 Max. speed of load contact on impact with gasket
- 14 Vitesse max. au choc du cont. de comm. comp. au point
- 15 Max. Einschaltgeschwindigkeit des Trennerrohrs
- 16 Max. close speed of isolator tube
- 17 Vitesse max. d'enclenchement du sectionneur
- 18 Widerstandskammer, Versögerungszeit
- 19 Resistance chamber, delay time
- 20 Chambre de résistance, temps de retardement
- 21 Widerstandskammer V max. bei Kontaktberührung
- 22 Resistance chamber, V max. at contact touch
- 23 Chambre de résistance, V max. au point de contact
- 24 Druck in der Löschkammer
- 25 Pressure in the arcing chamber
- 26 Pression dans la chambre d'extinction

Ausschalten/Opening/Déclenchement

- 2 Ausschaltzeit/Opening time/Tempo de déclenchement
- 3 Blasezeit/Blast time/Tempo de soufflage
- 4 Schaltverzögerung/switching delay/delay à l'ouverture
- 6 Bewegungszeit Löschkont./Arching contact, travel time
- 7 Max. Auftreffgeschwindigkeit Korb auf Kontakt
- 8 Max. speed of load contact on impact with arcing contact
- 9 Vitesse max. au choc du cont. de comm. comp. au cont. d'ext.
- 9 Max. Ausschaltgeschwindigkeit des Trennerrohrs
- 10 Max. open speed of isolator tube
- 11 Vitesse max. d'ouverture du sectionneur
- 12 Max. Druck der Löschkammer
- 13 Max. pressure of arcing chamber
- 14 Pression max. de la chambre d'extinction
- 15 Widerstandskammer, Versögerungszeit
- 16 Resistance chamber, delay time
- 17 Chambre de résistance, temps de retardement
- 18 Widerstandskammer V max. bei Kontaktberührung
- 19 Resistance chamber, V max. at contact touch
- 20 Chambre de résistance, V max. au point de contact
- 21 N = Sollwert/Nominal value/ Valeur nominale
- 22 M = Messwert/Measured value/ Mesure

W. L. ...



PRUEFPROTOKOLL / TEST REPORT / PROCES VERBAL

Seite 1
Page 1
Total 6 Seiten
Total 6 Pages

BESTELLUNG/ORDER/COMMANDE 1-772430-202-4 FABR.-NR./SERIAL NO./NO. DE FABR.HA 1825643

Generatorschalter-Pol 1 Single-pole generator breaker Interrupteur unipolaire pour générateur Type	Typ <u>DR36V1750 DS</u>	Pos. der Reet. Item. 181 of order 1-772430 Pos. de la commande	Verk.Abt. Sales dept. AMV-S Dép. vente
Nennspannung/Rated voltage/Tension nom.	U_n 22 kV	Anlage Installation	North Anna 1
Nennstrom/Rated current/Courant nom.	I_n 3600 A	Installation	
Nennfrequenz/Rated frequ./Fréquence nom.	f_n 60 Hz	Besteller Gould BB	
Aus-schaltstr./Breaking current/Courant de coup.	I_b 155 kA	Käufer Springhouse, U.S.A.	
Ausschaltvermögen/Breaking cap./Pouvoir de coup.	P_n 24/1750 MVA	Client	
Betriebesdruck/Rated pressure/Pression nom.	P_n 125 V	Bemerkungen Remarks	Pol A 1
Steuerspg./Control voltage/Tension de commande	U_n		

Die Prüfung berücksichtigt die massgebenden Normen und Länderpublikationen. The test takes into consideration relevant specifications and standards. Les essais prennent en considération les normes nationales.

Prüfvorschrift/Testing instruction/Instruction AGT 20056 Schaltbild/Wiring diagram/Schema AMT 20056-14

Aufstellungsort: Horizontal/Vertikal Erection : Horizontally/Vertically Montage : Horizontal/Vertical			APA-Nr.	Einheit Unit Unité	Nennwert Nom. value Valeur nom.	Messwert Meas. val. Mesure
			APA-Nr. TK			
1. Sicherungspule/Control coil/Bobine de commande			1: Zeichnung: <u>AGT-UN274-P26</u>	U	10 A	13,2
1.1 Einschaltpule/Closing coil/Bobine d'enc.			1: Drawing: <u>AGT-UN274-P26</u>	U	10 A	13,2
Ausgleichsvent./Compens.valve/Souape de compens.			1: Dessin: <u>AGT-UN274-P26</u>	U	10 A	13,2
Vorwiderstand/Series resistor/Résistance en série			2: Zeichnung: <u>AGT-UN274-P26</u>	U	10 A	13,2
2. Einschaltpule/Closing coil/Bobine d'enc.			2: Drawing: <u>AGT-UN274-P26</u>	U	10 A	13,2
Ausgleichsvent./Compens.valve/Souape de compens.			2: Dessin: <u>AGT-UN274-P26</u>	U	10 A	13,2
Vorwiderstand/Series resistor/Résistance en série			1: Zeichnung: <u>AGT-UN274-P26</u>	U	10 A	13,2
3. Ausschaltpule/Tripping coil/Bobine de décl.			1: Drawing: <u>AGT-UN274-P26</u>	U	10 A	13,2
Ausgleichsvent./Compens.valve/Souape de compens.			1: Dessin: <u>AGT-UN274-P26</u>	U	10 A	13,2
Vorwiderstand/Series resistor/Résistance en série			2: Zeichnung: <u>AGT-UN274-P26</u>	U	10 A	13,2
4. Ausschaltpule/Tripping coil/Bobine de décl.			2: Drawing: <u>AGT-UN274-P26</u>	U	10 A	13,2
Ausgleichsvent./Compens.valve/Souape de compens.			2: Dessin: <u>AGT-UN274-P26</u>	U	10 A	13,2
Vorwiderstand/Series resistor/Résistance en série			1: Zeichnung: <u>AGT-UN274-P26</u>	U	10 A	13,2
5. Leistungs-Aus Protection trip Décl. à protection			1: Drawing: <u>AGT-UN274-P26</u>	U	10 A	13,2
Schnellnachschleusventil Rapid replenishing valve Souape rapide			1: Dessin: <u>AGT-UN274-P26</u>	U	10 A	13,2
6. Leistungs-Aus Protection trip Décl. à protection			2: Zeichnung: <u>AGT-UN274-P26</u>	U	10 A	13,2
Schnellnachschleusventil Rapid replenishing valve Souape rapide			2: Drawing: <u>AGT-UN274-P26</u>	U	10 A	13,2
2. Sicherung/Control/Commande (St.Block/Control block/Bloc de comm. no. <u>420S/274-P26</u>)				V	≤ 0,5 U _N	45
1 C (1)			U _N <u>13,5</u> V	ds	≤ 0,5 U _N	45
2 C (2)			U _N <u>13,5</u> V	ds	≤ 0,5 U _N	45
3 C (1)			U _N <u>13,5</u> V	ds	≤ 0,5 U _N	45
4 C (2)			U _N <u>13,5</u> V	ds	≤ 0,5 U _N	45
5 Leistungs-Aus/Protection trip/Décl. à protection			1	ds	≤ 0,5 U _N	45
6 Leistungs-Aus/Protection trip/Décl. à protection			2	ds	≤ 0,5 U _N	45
3. Kontrollschaltungen/General operating test/Contrôle de fonctionnement					5	5
1 C/O			1,0 U _N <u>13,5</u> V	1,0 P _N <u>420S/274-P26</u>	Schaltf.	5
2 C			0,5 U _N <u>6,75</u> V	0,85 P _N <u>374/274-P26</u>	Operat.	5
3 C			0,5 U _N <u>6,75</u> V	0,85 P _N <u>374/274-P26</u>	Manöuv.	5
4 C/O			1,1 U _N <u>14,85</u> V	1,0 P _N <u>420S/274-P26</u>		5
5 CO/			1,0 U _N <u>13,5</u> V	1,0 P _N <u>420S/274-P26</u>		5
6 Tot.Schaltzahl/Tot.of oper./Tot.de des manoeuvres				1000 amp.		5
4. Spannungsausfall bei Verlust der Spannung 1 Total: Anschluss-Anschluss/Terminal to terminal/entrée-sortie					mV mV	56-90
2 Loschramm 1/Arching-chamber 1/Chambre d'extinction 1					mV mV	13-21
3 Loschramm 2/Arching-chamber 2/Chambre d'extinction 2					mV mV	13-21
4 Zwischengeh.-Loschramm 1/Interm.housing-Interr.chamb.1/pièce interm.-chambre d'ext.1					mV mV	13-21
5 Zwischengeh.-Loschramm 2/Interm.housing-Interr.chamb.2/pièce interm.-chambre d'ext.2					mV mV	13-21
6 Ausp.-Geh.-Zwischengeh./Outlet housing-Interr.housing/Carier d'échapp.-pièce interm.					mV mV	13-21
7 Zwischengeh.-Trennerrohr/Interm.housing-isolator tube/Pièce interm.-actionneur					mV mV	13-21
8 Trennerrohr-Trennerantr./Isolator tube-isolator drive/Sect.-boîte de comm. de sect.					mV mV	13-21
5. Spannungsprüfung/Voltage test/Verdicté électrostatique 50 Hz, 60/70					kV kV	75
1 Schalter geschlossen gegen Erde/Breaker closed to earth/Déjonc.encl.contre terre					kV kV	100
2 Schalter offen/Breaker open/Déjonc. décl.					kV kV	2
3 Hilfstromkreise gegen Erde/Aux.circuits to earth/Circuits auxil. contre terre					kV kV	2
4 Schalter gegen Träger/Breaker frame to support/Blindage du disjonct.-support					kV kV	2
5 Klemmenkasten/Breaker/Term.box to breaker frame/Boîte de bornes - blindage du disj.					kV kV	2

PRUEFPROTOKOLL / TEST REPORT / PROCES VERBAL

Seite 2
Page



BESTELLUNG/ORDER/COMMANDE 1-222 130

FABR.-NR./NO. DE FABR. HA 185 643

			Mindest Unit Unité	Sollwert Nom. value Valeur nom.	Fasswert Pass. val. Capacité
6. Schaltungen/Operations/Manoeuvres					
.1 C	1,2 Pa	500/1000	Schaltg.	10	10
.2 C	1,2 Pa	1000/1000	Operat.	10	10
.3 C	1,0 Pa	1000/1000	Manoeuv.	20	20
.4 C	1,0 Pa	1000/1000		5	5
.5 CO	1,0 Pa	1000/1000			
7. HD-Schalter/LP-Receiver/Réserveur à BP					
HD-Schalter/LP-Receiver/Réserveur à BP		1000	Nr.	1	1
VL-Ka.-Schalter/Res.chambre receiver/Réserveur chambre de rés.		1000	No.	1	1
		1000	No.	1	1
8. Luftverbrauch/Air consumption/Consommation d'air					
Inhalt Behälterpol	U8U				
Contenu du pôle					
.1 C					
.2 C					
.3 C					
.4 C					
.5 leis...Aus/Prot.trip/Decl. à prot.					
.6 leis...Aus/Prot.trip/Decl. à prot.					
.7 CO					
.8 CO					
9. Min. Betätigungsdruck/Min. operating pressure/Pression min. de manoeuvre					
.1 C Trennerrohr läuft vollständig in Endstellung					
.2 C Isolator moves correct to end position					
.3 CO Sectionneur atteint position finale					
10. C Min. Betätigungsdruck der pneumat. Steuerung bei					
Min. operating pressure of pneumatic control at					
Pression min. de la commande pneumatique à					
11. Mechanische Kontrollen/Mechanical check/Mise au point mécanique					
.1 Trommereinrichtung					
Setting of isolator					
Ajustage du sectionneur					
.2					
.3 Kommutierungszeit/Change-over distance/Distance de commutation					
.4 Distanz A-B/Distance A-B; Zeichnung/Drawing/Dessin					
.5 Regulierschraube der Dämpfung "Ein"					
Setting of screw for damping "On"					
Vis de réglage d'amortissement "Encl."					
.6 Anzahl Reg.-Schrauben im Dämpf.-Zyl./Quantity of screws/Hombre de vis					
.7 Regulierschraube der Dämpfung "Aus"					
Setting of screw for damping "Off"					
Vis de réglage d'amortissement "Decl."					
.8 Anzahl Reg.-Schrauben im Dämpf.-Zyl./Quantity of screws/Hombre de vis					
.9 Einschaltblende/Orifice "Close"/Diaphragme d'encl.					
.10 Anschlag/End stop/Arrêt					
.11 Ausschaltblende/Orifice "Trip"/Diaphragme de décl.					
.12 Rückschlagblende/Non-return orifice/Diaphragme de retenue					
.13 Dämpfung des Kontaktkorbes					
Amortissement du contact de commutation					
.14 Rückprallung des Kontaktkorbes					
Rebound of load contact					
Rebondissement du contact de commutation à					
.15 Hub des Löschkontaktes/Travel of arcing contact/Course du contact d'interrupt.					
.16 Hub des Kontaktkorbes/Travel of load contact/Course du contact de commutation					
.17 Bohrung der Kontaktbohrung/Bore of contact nozzle/Diamètre de la tuyère					
.18 Distanz Auffangelektrode/Distance transfer electrode/Distance de l'électrode					
.19 Trennerrohr läuft aus der "Aus"-Raststellung					
Min. pressure to move isolator against latching device "Open"-position					
Sectionneur quitte l'arrêt de la position "Decl."					
.20 Trennerrohr läuft aus der "Ein"-Raststellung					
Min. pressure to move isolator against latching device "Close"-position					
Sectionneur quitte l'arrêt de la position "Encl."					
.21 Kontaktsystem/Contact pieces/Système du contact					
.22 Resorbt-Widerstand					
Resorbt resistor					
Résistance du type résorbt					
.23 Kondensatoren/Capacitors/Condensateurs					

Raden 80-02-24

Geprüft 1. Inzko/74
Tented by
Vérifié par

Akzeptiert:
Passend
accepté

W. L. L. L.



BESTELLUNG/ORDER/COMMANDE 1-322-130

FABR.-NR./SERIAL NO./NO. DE FABR. HA 1825643

TESTSTELLUNG / ORDER / COMMAND			TESTANLEITUNG / INSTRUCTIONS			TESTERGÄNZUNG / ADDITIONAL INFORMATION		
			Einheit Unit	Gewert Value	Resultat Result	Messwert Measure		
			Unité	Valeur nom.		Valeur		
12.	Kontrollmaße der Löschkammer Check measurement of interrupting chamber Mesure de la chambre d'extinction	A B C D E	mm	5,6 ± 0,6 24,5 ± 0,7 34,5 ± 0,9 15,0 ± 0,5 18,0 ± 0,2	5,0 24,45 34,05 14,5 18,0			
13.	Löschkammer- u. Trennerstützer Supporting insulators Isolateur supports	(Material) (Material) (Matériel)				Polyamid, Silikon		
14.	Auslösekraft der Halteklappe am Steuerblock Releasing force of holding latch on control block Force de déclenchement du cliquet du bloc de commande	C O	p	600 - 800 600 - 800				
15.	Sicherheitsventile / Safety valves / Soupapes de sûreté	No. ps/gauge psi/gauge br. ps/gauge psi/gauge				20/100 2.35 4.8 4.52 22/153 6.25 6.62 6.3		
16.	Hilfsschalter und elektrische Verbindungen nach Schema Auxiliary switch and connections per diagram Contacts auxiliaires et circuits électriques d'après schéma	geprüft tested essayé				tested		
17.	Kennabild / Dimension drawing / Dessin cote	geprüft tested essayé				tested		
18.	Dichtigkeit des Schalters / Leakage of breaker / Étanchéité du disjoncteur	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
19.	Kühlwassersystem / Water cooling system / Circuit de refroidissement	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
20.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
21.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
22.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
23.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
24.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
25.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
26.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
27.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
28.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
29.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
30.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
31.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
32.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
33.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
34.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
35.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
36.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
37.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
38.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
39.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
40.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
41.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
42.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
43.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
44.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
45.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
46.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
47.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
48.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
49.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
50.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
51.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
52.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
53.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
54.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
55.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
56.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
57.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
58.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
59.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
60.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
61.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
62.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
63.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
64.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
65.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
66.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
67.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
68.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
69.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
70.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
71.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
72.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
73.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
74.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
75.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
76.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
77.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
78.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
79.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
80.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
81.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
82.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
83.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
84.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
85.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
86.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
87.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
88.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
89.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
90.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
91.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
92.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
93.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
94.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
95.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
96.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
97.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
98.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
99.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
100.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
101.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
102.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
103.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
104.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
105.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
106.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
107.	Leakage / Étanchéité	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm	5 Min. 5 Min. 1 Min.	WS WC WC	≤ 50 ≤ 50 ≤ 50	
108.	Druckprobe / Testing pressure / Pression d'épreuve	bei at à	Wasserprobe water column colonne d'eau	200 mm 100 mm 1000 mm</				

Baden PO-02-24

Gepuift : 10240/176
 Tested by :
 Verifie per:

akseptiert:
 Passed :
 Anceptid :



FABR.-NR./SERIAL NO./NO. DE FABR. HA 1825643

[illegible][illegible]

20. Bewegungs-Momente/ Moments des Manöuvre														
Schaltvorgang Operation Manoeuvre		K			7			8			9			
		Bew. Zeit.	Losch./Kont.	Aufz./Gensch./Korb a/b	V max. C	Kont. Korb	Aufz./Gensch./Korb a/b	V max. C	Kont. Korb	Aufz./Gensch./Korb a/b	V max. C	Kont. Korb		
		N	a/b	M	N	a/b	M	N	a/b	M	N	a/b	M	
C	420-425	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	425-430	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	430-435	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	435-440	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	440-445	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	445-450	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	450-455	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	455-460	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	460-465	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	465-470	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	470-475	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	475-480	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	480-485	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	485-490	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	490-495	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	495-500	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	500-505	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	505-510	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	510-515	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	515-520	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	520-525	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	525-530	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	530-535	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	535-540	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	540-545	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	545-550	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	550-555	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	555-560	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	560-565	12.0		3.0	3.0-4.0	3.0		3.0		3.0	3.0-4.0	3.0		
C	565-570	12.0		3.0	3.0-4.0	3.0								

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Explication des mesures des points 1...10 voir page 6

Akzeptiert: ☐
 Passed: ☐
 Accepté: ☐

W. J. ...

PRUEFPROTOKOLL / TEST REPORT / PROCES VERBAL

Seite 5
Page



DESTELLUNG/ORDER/COMMANDE 4-322 430 FABR.-NR./SERIAL NO./NO. DE FABR. HA 4885643

21. Pneumatische Versögerungszeit der Widerstandskammer
Pneumatic switching delay of resistance chamber to arcing chamber
Temps de retardement pneumatique de la chambre de résistance comparé au contact d'extinction

Schaltvorgang Operation Manoeuvre		Variante Nr. 11 Widerstandskammer 1				Variante Nr. 12 Loschkammerweite				Variante Nr. 13 Widerstandskammer 2				Variante Nr. 14 Trennvorrichtung			
		Versögerungszeit				V max. bei Kont.berüh.				Versögerungszeit				V max. bei Kont.berüh.			
		N	25	M	25	N	25	M	25	N	25	M	25	N	25	M	25
C	420,5/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
C	420,5/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
C	420,5/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
C	420,5/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
C	333,5/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O	333,5/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O	319/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O	319/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O	240,5/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O	333,5/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O 1 Leistung	333,5/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O 1 Protection	319/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O 1 à protection	319/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O 1 Leistung	240,5/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O 1 à protection	319/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O 2 Protection	319/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55
O 2 à protection	319/31750119 bar	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55	30-33	30,5	0,55	0,55

22. Ohm'scher Widerstand
Ohmic resistance
Résistance ohmique

	U	U	U
Sollwert N	10,0 ± 5 %	123/10,0 ± 5 %	10,0 ± 5 %
Kennwert N	10,05	2,2	7,93

Kennwert-Logende zu Kolonne 11...14 siehe Seite 6
Explanation of measurements according to points 11...14 see page 6
Explication des mesures des points 11...14 voir page 6

Schaltzeiten gemessen bei 10°C
Operating times measured at 10°C
Temps de fonctionnement mesuré à 10°C

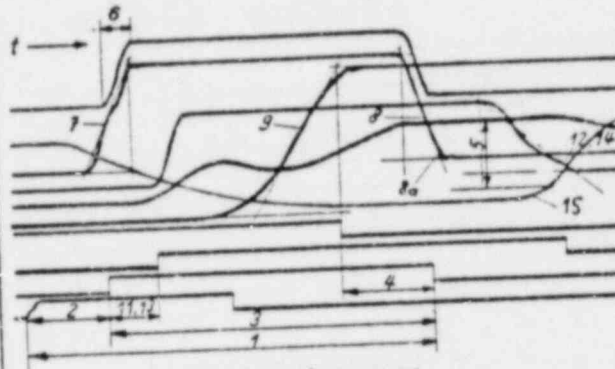
Baden 80-02-24

Gepüft : Inzko / TK
Tested by :
Vérifié par :

Akzeptiert:
Passed :
Accepté :

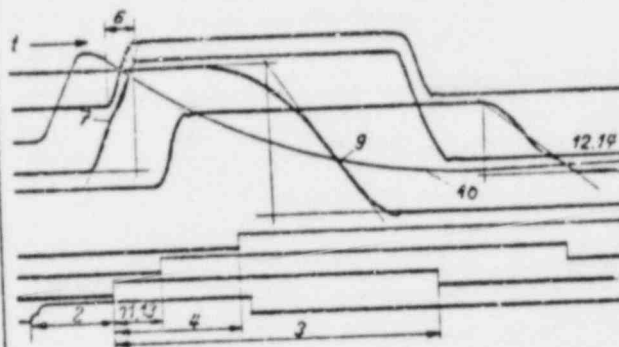
[Signature]

Einschalten/Closing/Enclenchement



Trenner/Isolator tube/Sectionneur
Loschkont./Arcing cont./Contact d'extinct.
Druck Trenner-Antr./Pressure isolator drive/
Pression du sectionneur
Kont.korb/load cont./Cont. de commut.
Widerstandsk./Resist.chamber/Chambre de résist.
Trenner/Isolator tube/Sectionneur
Widerstandsk./Resist.chamber/Chambre de résist.
Loschkont./Arcing chamber/Chambre d'ext.
Spulenstrom/Coil current/Courant de la bobine

Ausschalten/Opening/Déclenchement



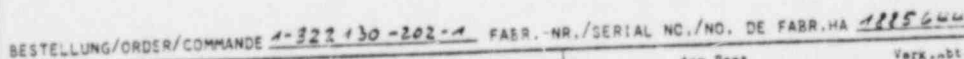
Loschkont./Arcing cont./Cont. d'extinct.
Kontaktkorb/Load cont./Cont. de commut.
Widerstandsk./Resist.chamber/Chambre de résist.
Trenner/Isolator tube/Sectionneur
Trenner/Isolator tube/Sectionneur
Widerstandsk./Resist.chamber/Chambre de résist.
Loschkont./Arcing chamber/Chambre d'extinct.
Spulenstrom/Coil current/Courant de la bobine

Einschalten/Closing/Enclenchement

- 1 Einschaltzeit/Making time/Temps d'enclenchement
- 2 L.-K.Aus/Arising cont.oper./Cont.d'extinction s'ouvre
- 3 Blasezeit/Blast time/Temp de soufflage
- 4 Schaltverzögerung/Switching delay/Retard à la fermeture
- 5 Trenner, Druck max./Max.press.isolator drive/Pr.max. du sect.
- 6 Bewegungszeit Loschkont./Arising contact, travel time
Durée du mouvement du contact d'extinction
- 7 Max. Auftreffgeschwindigkeit Korb auf Kontakt
Max.speed of load contact on impact with arcing contact
Vitesse max.au choc du cont.de comm.comp.au cont.d'ext.
- 8 Max.Einschaltgeschwindigkeit des Kontaktkorbes
Max.close speed of load contact
Vitesse max.d'enclenchement du contact de commutation
- 9a Max. Auftreffgeschw. Korb auf Dichtung
Max. speed of load contact on impact with gasket
Vitesse max. au choc du cont. de comm. comp. au point
- 9 Max. Einschaltgeschwindigkeit des Trennerrohrs
Max. close speed of isolator tube
Vitesse max. d'enclenchement du sectionneur
- 11/ Widerstandskammer, Versögerungszeit
- 13 Resistence chamber, delay time
Chambre de résistance, temps de retardement
- 12/ Widerstandskammer V max. bei Kontaktberührung
- 14 Resistence chamber, V max. at contact touch
Chambre de résistance, V max. au point de contact
- 15 Druck in der Loschkammer
Pressure in the arcing chamber
Pression dans le chambre d'extinction

Ausschalten/Opening/Déclenchement

- 2 Ausschaltzeit/Opening time/Temp de déclenchement
 - 3 Elspritz/Blast time/Temp de soufflage
 - 4 Schaltverzögerung/Switching delay/Retard à l'ouverture
 - 6 Bewegungszeit Loschkont./Arising contact, travel time
Durée du mouvement du contact d'extinction
 - 7 Max. Aufreißgeschwindigkeit Korb auf Kontakt
Max.speed of load contact on impact with arcing contact
Vitesse max.au choc du cont.de comm.comp.au cont.d'ext.
 - 9 Max.Ausschaltgeschwindigkeit des Trennerrohrs
Max.open speed of isolator tube
Vitesse max.d'ouverture du sectionneur
 - 10 Max.Druck der Loschkammer
Max.pressure of arcing chamber
Pression max.de la chambre d'extinction
 - 11/ Widerstandskammer, Versögerungszeit
 - 13 Resistence chamber, delay time
Chambre de résistance, temps de retardement
 - 12/ Widerstandskammer V max. bei Kontaktberührung
 - 14 Resistence chamber, V max. at contact touch
Chambre de résistance, V max. au point de contact
- S = Sollwert/Nominal value/Valeur nominale
M = Messwert/Measured value/Mesure



BESTELLUNG/ORDER/COMMANDE		- 322 130 - 202 - A		FAB. - NR./SERIAL NO./NO. DE FABRIQUE		VERK. ABT.	
Generatorschalter-Pol 1 Single-pole generator breaker Interrupteur unipolaire pour générateur Type		Typ <u>DR 36 VT 250 D 3</u>		Pos. <u>104</u>		der Best. <u>4-322 130</u>	
				Pos. <u>104</u>		des la commande <u>104</u>	
Nennspannung/Rated voltage/Tension nom.		U _n <u>22</u> kV		Anlage <u>North Anna 1</u>			
Nennstrom/Rated current/Courant nom.		I _n <u>26000</u> A		Installation <u>Installation</u>			
Nennfrequenz/Rated frequ./Fréquence nom.		f _n <u>60</u> Hz		Besteller <u>Gould 3B</u>			
Ausschaltstr./Breaking current/Courant de coup.		I _b <u>155</u> kA		Purchaser <u>Springhouse, U.S.A.</u>			
Ausschaltvermögen/Breaking cap./Pouvoir de coup.		— kVA		Client			
Betriebsdruck/Rated pressure/Pression nom.		p _n <u>24/71320</u> psi		Bemerkungen <u>Pol A 2</u>			
Steuerspann./Control voltage/Tension de commande		U _c <u>125</u> V		Bemerkungen <u>Pol A 2</u>			

Die Prüfung berücksichtigt die massgebenden Normen und Länderpublikationen. The test takes into consideration relevant specifications and standards. Les essais prennent en considération les normes nationales.

[illegible]

Index 80-07-22

Dessiné : *J. L. W. Knecht*
 Testé par : *J. L. W. Knecht*
 Vérifié par:

Akzeptiert:
Passed :
Accepted :

Dist. AG Quality Assurance
and High Voltage Tests.
Revised -



BLSTELLUNG/ORDER/COMMANDE 1-322430

FABR.-NR./NO. DE FABR. HA 185.644

			Einheit Unit Unité	Sollwert Nom. value Valeur nom.	Festwert Mess. val. Mesure
6. Schaltungen/Connections/Manoeuvres					
1 C	1,2 Pn	504,6/1175 Pa	Schaltg.	10	10
2 C	1,2 Pn	322,4/1175 Pa	Operat.	10	10
3 C	1,0 Pn	420,6/1175 Pa	Operat.	20	20
4 C	1,0 Pn	348,1/1175 Pa	Manoeuv.	20	20
5 CO	1,0 Pn	620,6/1175 Pa		5	5
7. KD-Behälter/LP-Receiver/Réservoir à BP					
KD-Behälter/KP-Receiver/Réservoir à KP		360	Nr.	—	39269
WL-Ka.-Behälter/Res.chamber receiver/Réservoir chambre de rés.		70	No.	—	39318
8. Luftverbrauch/Air consumption/Consommation d'air					
Iv alt Schalterpol		Schaltendruck	Niederdruck	Hochdruck	
L. contents of pole		Operat. pressure	Low pressure	High pressure	
Contenu du pôle		Pres. de manoeuv.	Basse pression	Haute pression	
1 C	420,6/1175 Pa	24,1 Pa	1	2800 ± 10	2802
2 C	420,6/1175 Pa	22,6 Pa	1	—	2258
3 C	348,1/1175 Pa	60,4 Pa	1	—	2032
4 C	348,1/1175 Pa	54,6 Pa	1	2800 ± 10	2824
5 CO	620,6/1175 Pa	16,0 Pa	1	—	2802
6 Leist.-Aus/Prot. trip/Décl. à prot.	420,6/1175 Pa	15,9 Pa	1	2800 ± 10	2822
7 CO	420,6/1175 Pa	15,9 Pa	1	—	2810
8 CO	420,6/1175 Pa	15,9 Pa	1	—	2810
9. Min. Betätigungsdruk/Min. operating pressure/Pression min. de manoeuvre					
1 C Trennerrohr läuft vollständig in Endstellung			Pa/gmm	426,1	732
2 C Isolator moves correct to end position			Pa/gmm	426,1	732
3 CO Sectionneur atteint position finale			Pa/gmm	426,1	732
10. C Min. Betätigungsdruk der pneumat. Steuerung bei					
Min. operating pressure of pneumatic control at			bar	—	—
Pression min. de la commande pneumatique			bar	—	—
11. Mechanische Kontrolle/Mechanical check/Min. au point mécanique					
1 Trennerreinstellung	Centering		geprüft	tested	tested
Setting of isolator	Centering		essaye.	essaye.	essaye.
Ajustage du sectionneur	Centering		—	2,0	1,0
2 Differenz/Difference/Différence			—	5,6 ± 0,8	5,2
3 Kommutierungspalt/Change-over distance/Distance de commutation			—	27,0 ± 0,3	23,2
4 Distanz A-B/Distance A-B; Zeichnung/Drawing/Dessin			—	—	23,2
5 Regulierverschraubung der Dämpfung "Ein"	Vorstehtend		—	—	23,2
Setting of screw for damping "On"	Protruding		—	—	0
Vis de réglage d'amortissement "Encl."	en saillie		Ans./No.	—	0
6 Anzahl Reg.-Schrauben in Dämpf.-Zyl./Quantity of screws/Nombre de vis			—	—	29,4
7 Regulierverschraubung der Dämpfung "Aus"	Vorstehtend		—	—	29,4
Setting of screw for damping "Off"	Protruding		—	—	0
Vis de réglage d'amortissement "Décl."	en saillie		Ans./No.	—	0
8 Anzahl Reg.-Schrauben in Dämpf.-Zyl./Quantity of screws/Nombre de vis			—	20-20	25
9 Einachtlende/Orifice "Close"/Diaphragme d'encl.			—	20-20	25
10 Anschlende/Orifice "Trip"/Diaphragme de décl.			—	20-20	25
11 Anschlende/Orifice "Trip"/Diaphragme de décl.			—	20-20	25
12 Rückschlagsventil/Non-return orifice/Diaphragme de retenue			—	—	—
13 Dämpfung des Kontaktkorbes			—	≥ 1,0	—
Damping of load contact			—	—	—
Amortissement du contact de commutation			—	—	—
14 Rückstellung des Kontaktkorbes	bei	420,6/1175 Pa	—	≤ 2,0	1,5
Rebound of load contact	at		—	—	—
Rebondissement du contact de commutation	à		—	—	—
15 Hub des Lötchkontaktes/Travel of arcing contact/Course du contact d'interrupt.			—	24,5 ± 1,5	25,0
16 Hub des Kontaktkorbes/Travel of load contact/Course du contact de commutation			—	62,0 ± 3,4	63,0
17 Bohrung der Kontaktdüse/Bore of contact nozzle/Diamètre de la tuyère			—	60,0 ± 0,3	60,0
18 Distanz Auffangelektrode/Distance transfer electrode/Distance de l'électrode			—	210,0 ± 3,0	210,0
19 Trennerrohr läuft aus der "Aus"-Raststellung			Pa/gmm	29,2-520	42,0
Min. pressure to move isolator against latching device "Open"-position			—	—	—
Sectionneur quitte l'arrêt de la position "Décl."			—	—	—
20 Trennerrohr läuft aus der "Ein"-Raststellung			Pa/gmm	435-725	65,2
Min. pressure to move isolator against latching device "Close"-position			—	—	—
Sectionneur quitte l'arrêt de la position "Encl."			—	—	—
21 Kontaktsystem/Contact pieces/Système du contact			—	checked	checked
22 Resorbt-Widerstand	Anzahl Rollen	4	Typ/Type	P13	P13
Resorbt resistor	Quantity of rolls		—	—	—
Résistance du type resorbt	Nombre de rouleaux		—	—	—
23 Kondensatoren/Capacitors/Condensateurs			—	—	—

Baden 10-02-22

Geprüft: 1. 7.2.60 RF
Tested by: 1. 7.2.60 RF
Vérifié par: 1. 7.2.60 RF

Akzeptiert:
Passed:
Accepté:

[Handwritten signature]

[illegible]

Gepriift : Inzio/KS
Tested by :
Vérifié par :

Akzeptiert:
Passed
Accepted

PRUEFPROTOKOLL / TEST REPORT / PROCES VERBAL

Seite 4
Page 4



BESTELLUNG/ORDER/COMMANDE 1-322 130

FABR.-NR./SERIAL NO./NO.DE FABR.HA 1885 644

19. Schaltzeiten/Operating times/Temps de manœuvre

Schaltvorgang Operation Manoeuvre	1 Einschaltzeit			2 Löschkontakt Aus			3 Blasseit			4 Schaltvorgang			5 Max. Dr. Trenner-Art	
	N	sa	M	N	sa	M	N	sa	M	N	sa	M	sa	M
420/5/125 Amp/10	242.0			52.5	41.0		195.5	194.0		55	69.0		100-145	124.5
420/5/125 Amp/10	243.5			52.5	41.0		195.5	194.0		55	69.0			124.5
406/12125 Amp/10	245.5			52.5	41.0		195.5	194.0		55	69.0			124.5
406/12125 Amp/10	245.5			52.5	41.0		195.5	194.0		55	69.0			124.5
377/12125 Amp/10	246.0			52.5	41.0		195.5	194.0		55	69.0			124.5
bar														

Schaltvorgang Operation Manoeuvre	2 Auswahlzeit			3 Blasseit			4 Schaltvorgang		
	N	sa	M	N	sa	M	N	sa	M
311.5/12125 Amp/10				52.5		195.5			64.0
311.5/12125 Amp/10				52.5		195.5			64.0
319/12125 Amp/10				52.5		195.5			64.0
319/12125 Amp/10				52.5		195.5			64.0
290/12125 Amp/10				52.5		195.5			64.0
bar									
0 1 Leistung 311.5/12125 Amp/10				52.5		195.5			64.0
0 1 Protection 311.5/12125 Amp/10				52.5		195.5			64.0
0 1 a protect 311.5/12125 Amp/10				52.5		195.5			64.0
0 1 Leistung 290/12125 Amp/10				52.5		195.5			64.0
0 1 a protect. Leistung				52.5		195.5			64.0
0 2 Protection 311.5/12125 Amp/10				52.5		195.5			64.0
0 2 a protect.				52.5		195.5			64.0

20. Bewegungen/Movements/Mouvements des contacts

Schaltvorgang Operation Manoeuvre	6 Bew. Zeit			7 Löschkontakt			8 V max. C Kont. Korb			9 V max. Trennerrohr			10 V max. Trennerrohr	
	N	sa	M	N	sa	M	N	sa	M	N	sa	M	N	M
420/5/125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
420/5/125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
406/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
406/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
377/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
bar														

Schaltvorgang Operation Manoeuvre	6 Bew. Zeit			7 Löschkontakt			8 V max. C Kont. Korb			9 V max. Trennerrohr			10 V max. Trennerrohr	
	N	sa	M	N	sa	M	N	sa	M	N	sa	M	N	M
311.5/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
311.5/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
319/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
319/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
290/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
bar														
0 1 Leistung 311.5/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
0 1 Protection 311.5/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
0 1 a protect 311.5/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
0 1 Leistung 290/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
0 1 a protect. Leistung	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
0 2 Protection 311.5/12125 Amp/10	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0
0 2 a protect.	10-15			12.0	12.0	12.0	2.0-4.0	3.0	3.0	5.0-5.5	5.0	5.0	5.0	5.0

Messwert-Legende zu Kolonne 1...10 siehe Seite 6

Explication of measurements according to points 1...10 see page 6

Explication des mesures des points 1...10 voir page 6

Baden 12-22-22

Geprüft : 12-22-22
Tested by : 12-22-22
Vérifié par :

Akzeptiert :
Passed :
Accepté :



BESTELLUNG/ORDER/COMMANDE A-322 430 FABR.-NR./SERIAL NO./NO. DE FABR. HA 1885 644

21. Pneumatische Versögerungszeit der Widerstandskammer
Pneumatic switching delay of resistance chamber to arcing chamber
Temps de retardement pneumatique de la chambre de résistance comparé au contact d'extinction

Schaltvorgang Operation Manoeuvre	11 Variante Nr. 2 Widerstandskammer 1 Lochkammerweite				12 Variante Nr. 2 Widerstandskammer 1 Lochkammerweite				13 Variante Nr. 2 Widerstandskammer 1 Lochkammerweite				14 Variante Nr. 2 Widerstandskammer 1 Lochkammerweite			
	Versögerungszeit				V max. bei Kont.berüh.				Versögerungszeit				V max. bei Kont.berüh.			
	N	ms	M	ms	U	m/s	M	m/s	N	ms	M	ms	U	m/s	M	m/s
C 420.5/21250.019	30-33	30.2	—	—	—	—	—	—	30-33	30.2	—	—	—	—	—	—
C 420.5/21250.019	—	30.5	—	—	—	—	—	—	—	30.5	—	—	—	—	—	—
C 406.1/21250.019	—	30.5	—	—	—	—	—	—	—	30.5	—	—	—	—	—	—
C 406.1/21250.019	—	30.0	—	—	—	—	—	—	—	30.0	—	—	—	—	—	—
C 373.2/21250.019	—	28.0	—	—	—	—	—	—	—	28.0	—	—	—	—	—	—
C 373.2/21250.019	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
O 373.2/21250.019	—	30.5	—	—	—	—	—	—	—	33.0	—	—	—	—	—	—
O 373.2/21250.019	—	30.0	—	—	—	—	—	—	—	32.0	—	—	—	—	—	—
O 349.1/21250.019	30-33	24.0	—	—	—	—	—	—	30-33	24.0	—	—	—	—	—	—
O 349.1/21250.019	—	30.5	—	—	—	—	—	—	—	34.0	—	—	—	—	—	—
O 349.1/21250.019	—	24.0	—	—	—	—	—	—	—	34.0	—	—	—	—	—	—
O 290.1/21250.019	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
O 290.1/21250.019	—	35.0	—	—	—	—	—	—	—	35.0	—	—	—	—	—	—
O 1 Leistung 373.2/21250.019	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
O 1 Protection 373.2/21250.019	35-43	34.0	—	—	—	—	—	—	35-43	42.0	—	—	—	—	—	—
O 1 a protection 373.2/21250.019	—	32.0	—	—	—	—	—	—	—	40.0	—	—	—	—	—	—
O 1 Leistung 290.1/21250.019	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
O 1 Protection 290.1/21250.019	—	35.0	—	—	—	—	—	—	—	43.0	—	—	—	—	—	—
O 1 a protection 290.1/21250.019	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
O 2 Protection 349.1/21250.019	35-43	38.0	—	—	—	—	—	—	35-43	41.0	—	—	—	—	—	—
O 2 a protection 349.1/21250.019	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

22. Ohm'scher Widerstand
Ohmic resistance
Résistance ohmique

Sollwert N

10.0 ± 5 %

10.0 ± 5 %

10.0 ± 5 %

Messwert M

10.1

22

8.04

Messwert-Legende zu Folie 11...14 siehe Seite 6

Explication of measurements according to points 11...14 see page 6

Explication des mesures des points 11...14 voir page 6

Schaltzeiten gemessen bei 20°C

Operating times measured at 20°C

Temps de fonctionnement mesuré à 20°C

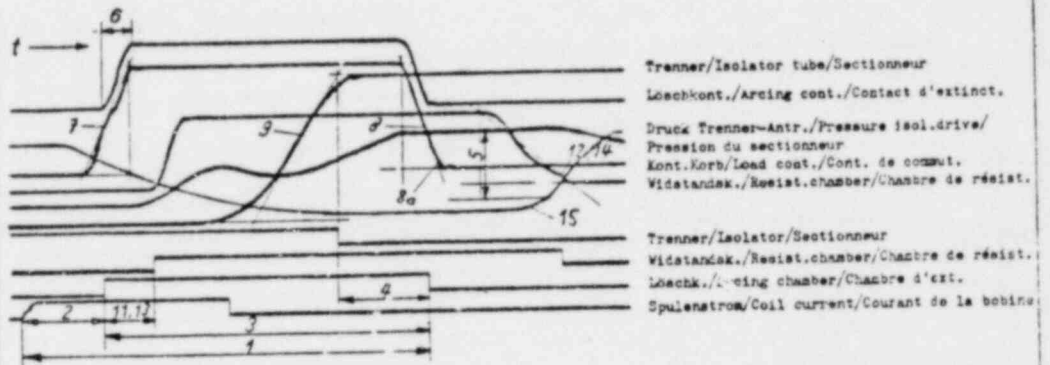
Noten 80-02-22

Geprüft : J. K. K.
Tested by :
Vérifié par :

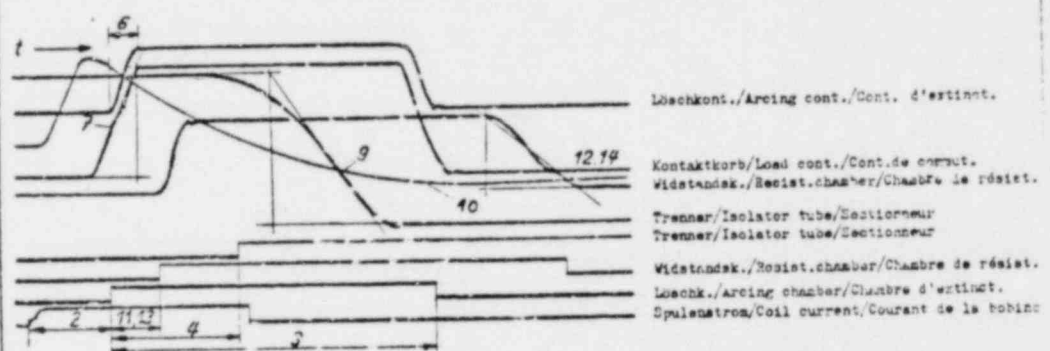
AKzeptiert:
Passed :
Accepté :

[Signature]

Einschalten/Closing/Enclenchement



Ausschalten/Opening/Déclenchement



Einschalten/Closing/Enclenchement

- 1 Einschaltzeit/Making time/Temp. d'enclenchement
- 2 L.-K.Aus/Arcing cont.open/Cont.d'extinction s'ouvre
- 3 Blasezeit/Blast time/Temp. de soufflage
- 4 Schaltverzögerung/Switching delay/Retard à la fermeture
- 5 Trenner, Druck max./Max.press.isol.drive/Pr.max.au sect.
- 6 Bewegungszeit Löschkont./Arcing contact, travel time
Durée du mouvement du contact d'extinction
- 7 Max. Auftreffgeschwindigkeit Korb auf Kontakt
Max.speed of load contact on impact with arcing contact
- 8 Vitesse max.au choc du cont.de comm.comp.au cont.d'ext.
Max.Einschaltgeschwindigkeit des Kontaktkorbes
Max.close speed of load contact
- 8a Max. Auftreffgeschw. Korb auf Dichtung
Max. speed of load contact on impact with gasket
- 9 Vitesse max. au choc du cont. de comm. comp. au joint
Max. Einschaltgeschwindigkeit des Trennerrohrs
Max. close speed of isolator tube
- 9 Vitesse max. d'enclenchement du sectionneur
- 11/ Widerstandskammer, Verzögerungszeit
- 13 Resistance chamber, delay time
Chambre de résistance, temps de retardement
- 12/ Widerstandskammer V max. bei Kontaktberührung
- 14 Resistance chamber, V max. at contact touch
Chambre de résistance, V max. au point de contact
- 15 Druck in der Löschkammer
Pressure in the arcing chamber
Pression dans la chambre d'extinction

Ausschalten/Opening/Déclenchement

- 2 Ausschaltzeit/Opening time/Temp. de déclenchement
- 3 Blasezeit/Blast time/Temp. de soufflage
- 4 Schaltverzögerung/Switching delay/Retard à l'ouverture
- 6 Bewegungszeit Löschkont./Arcing contact, travel time
Durée du mouvement du contact d'extinction
- 7 Max. Auftreffgeschwindigkeit Korb auf Kontakt
Max.speed of load contact on impact with arcing contact
- 7 Vitesse max.au choc du cont.de comm.comp.au cont.d'ext.
- 9 Max.Ausschaltgeschwindigkeit des Trennerrohrs
Max.open speed of isolator tube
- 9 Vitesse max.d'ouverture du sectionneur
- 10 Max.Druck der Löschkammer
Max.pressure of arcing chamber
Pression max.de la chambre d'extinction
- 11/ Widerstandskammer, Verzögerungszeit
- 13 Resistance chamber, delay time
Chambre de résistance, temps de retardement
- 12/ Widerstandskammer V max. bei Kontaktberührung
- 14 Resistance chamber, V max. at contact touch
Chambre de résistance, V max. au point de contact
- 8 = Sollwert/Nominal value/Valeur nominale
- 8 = Messwert/Measured value/Mesure

W. Linke

INSPECTION RELEASE NOTE

Purchase Order (or Sub-order) No. *H.A. 1.611*Vendor (or Sub-vendor) *BROWN COVERI - BAYEN*Work's Reference *1-322-130*The following material/equipment was subjected to final inspection on the
25-7-80 and found satisfactory.*UNIT No. 1**1044 COMPLETE 3 POLE**GENERATOR BREAKER**TYPE DR 36V 1750 DS**SERIAL NO. H.A. 1885643/4/5*Part / Complete Order: *W. L. Thompson*

Inspecting Engineer

Date *25-7-80*

The issuing of this Release Note for the above material/equipment does not release your Company from the responsibilities or liabilities as per the instructions and conditions of our Purchase Order.

STONE & WEBSTER ENGINEERING LIMITED

STONE & WEBSTER ENGINEERING LIMITED
INSPECTION REPORT - MISCELLANEOUS

1 Client Virginia Electric & Power Company Page No. 1 of 1
2 Project Or Plant North Anna Location U.S.A. J.O. No. 12050.47
3 Vendor Gould-Brown Boveri P.O. No. NA 1611
4 Sub-Vendor Sub/Order No.
5 Description of Material Generator Breakers Report No. WA/67/RO

6 Remarks -

7 (Give here details of inspection & Tests carried out and any information likely to assist site Engineers during construction).

8 Unit No.1

9
10
11 1 off complete 3 Pole Generator Breaker type DR 36V1750 DS, serial no.12
13 H.A. 1885643/4/514
15 Above items electrically, functionally and mechanically tested as
16 detailed in attached test report.17
18 Dimensionally checked to drawing no. H.A.M.T. 100609, all tests
19 satisfactory.20
21 Item will now be prepared for shipping, estimated shipping date -
22 mid August 1980. Release Note WA/70/80 attached.

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Manufacturers	Welding - Yes / No	Operators - Yes / No	N.D. Test - Yes / No
Procedures Approved			

I certify that I have inspected the above equipment, in accordance with the Stone & Webster Inspection Procedure. Materials, Workmanship and all dimensions meet this Company's requirements, as specified in the Purchase Order and / or in:

S & W Drawing No. Issue

S & W Spec. No. Issue

Manufacturer's Drawing No. Which was approved on

Date 25th July 1980 Signed W. Anderson

Expects to INSPECTING ENGINEER.



PRUEFPROTOKOLL / TEST REPORT / PROCES VERBAL

Seite 1
Total 6 Seiten
Total 6 Pages

BESTELLUNG/ORDER/COMMANDE 1-322 130-202-4 ABR.-NR./SERIAL NO./NO. DE FABR. HA 1885 645

Generatorschalter-Pol 1 Single-pole generator breaker Interrupteur unipolaire pour générateur Type	Typ DR 26 V 130-202-4	Pos. der Best. Item. 101 of order 1-322 130	Vert. abt. Sales dept. AMY-S
Nennspannung/Rated voltage/Tension nom.	U _n 22 kV	Anlage North Anna 1	Uales dept. Dép. vente
Nennstrom/Rated current/Courant nom.	I _n 26000 A	Installation	
Nennfrequenz/Rated frequency/Fréquence nom.	f _n 60 Hz	Installation	
Ausschaltstr./Breaking current/Courant de coup.	I _g 155 kA	Besteller GULD. 33	
Ausschaltvermögen/Breaking cap./Pouvoir de coup.	NVA	Purchaser Springhouse, U. S. A.	
Betriebsdruck/Rated pressure/Pression nom.	P _n 440/1122 kPa	Client	
Steuerspg./Control voltage/Tension de commande	U _n 125	Bemerkungen	
		Remarks	Pol A 3

Die Prüfung berücksichtigt die massgebenden Normen und Länderpublikationen. The test takes into consideration relevant specifications and standards. Les essais prennent en considération les normes nationales.

Prüfvorschrift/Testing instruction/Instruction AGT 20056 Schaltbild/Wiring diagram/Schéma HMT 200514

Aufstellungsart: Horizontal/Vertikal Erection : Horizontally/Vertically Montage : Horizontal/Vertical	APA-Nr. 520/80 APA-Nr. TK	Einheit Unit Unité	Dollvert Doll. value Valeur nom.	Massvert Mass. val. Mesure
1. Steuerungspulen/Control coils/Bobines de commande			10 %	
1.1 Einschaltpule/Closing coil/Bobine d'engl.	1: Zeichnung HMT 200514 P. 26 1: Drawing 1: Dessin HMT 200514 P. 26	U	13.5	13.4
2.1 Ausgleichsvent./Compens. valve/Coupe de compens.	2: Zeichnung 2: Drawing 2: Dessin	U	22.0	22.0
3.1 Auschaltpule/Tripping coil/Bobine de décl.	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin HMT 200514 P. 26	U	13.5	13.2
4.1 Ausgleichsvent./Compens. valve/Coupe de compens.	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	U	13.5	13.3
5.1 Leistungs-Aus Schnellschachleusventil Protection trip Rapid replenishing valve Décl. à protection Coupe rapide	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	U	13.5	13.4
6.1 Leistungs-Aus Schnellschachleusventil Protection trip Rapid replenishing valve Décl. à protection Coupe rapide	2: Zeichnung HMT 200514 P. 26 2: Drawing HMT 200514 P. 26 2: Dessin	U	13.5	13.2
2. Steuerung/Control/Commande (St. Block/Control block/Bloc de comm. no. 1)				
2.1 C (1) U _n 125 V	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	V	≤ 0.5 U _n	16.0
2.2 C (2) U _n 125 V	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	V	≤ 0.7 U _n	14.0
2.3 C (1) U _n 125 V	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	V	≤ 0.5 U _n	14.0
2.4 C (2) U _n 125 V	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	V	≤ 0.5 U _n	14.0
2.5 Leistungs-Aus/Protection trip/Décl. à protection	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	V	≤ 0.5 U _n	14.0
2.6 Leistungs-Aus/Protection trip/Décl. à protection	2: Zeichnung HMT 200514 P. 26 2: Drawing HMT 200514 P. 26 2: Dessin	V	≤ 0.5 U _n	14.0
3. Kontrollschaltungen/General operating test/Contrôle de fonctionnement				
3.1 C/O 1.0 U _n 125 V	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	U	13.5	13.4
3.2 C 0.5 U _n 62.5 V	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	U	13.5	13.2
3.3 C 0.5 U _n 62.5 V	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	U	13.5	13.3
3.4 C/O 1.1 U _n 122.5 V	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	U	13.5	13.2
3.5 C/O 1.0 U _n 125 V	1: Zeichnung HMT 200514 P. 26 1: Drawing HMT 200514 P. 26 1: Dessin	U	13.5	13.4
3.6 Tot. Schaltzahl/Tot. of ener./Tot. de des manœuvres			5	5
4. Spannungsfestigkeit bei/Voltage drop at/Chute de tension à 1000 Hz				
4.1 Total: Anschlüsse-Anschlüsse Terminal to terminal/Entrée-sortie			56-9.0	2.2
4.2 Loschkammer 1/Arching-chamber 1/Chambre d'extinction 1			13-3.6	2.2
4.3 Loschkammer 2/Arching-chamber 2/Chambre d'extinction 2			105-0.2	1.16
4.4 Zwischenkammer 1/Interr. chamber 1/Interr. chambre d'ext. 1				
4.5 Zwischenkammer 2/Interr. chamber 2/Interr. chambre d'ext. 2				
4.6 Ausp.-Geh.-Zwischengänge/Outlet housing-interr. housing/Carter d'échapp.-pièce interr.			1.2-1.2	0.8
4.7 Zwischenkammer-Trennerrohr/Interr. housing-isolator tube/Pièce interr. sectionneur			0.2-1.2	1.4
4.8 Trennerrohr-Trennerantrieb/Isolator tube-isolator drive/Sect.-boîte de comm. de sect.				
5. Spannungsprüfung/Voltage test/Rigidité diélectrique 50 Hz, 72 s				
5.1 Schalter geschlossen gegen Erde/Breaker closed to earth/Diajonc. encl. contre terre			75	7.5
5.2 Schalter offen/Breaker open/Diajonc. décl.			140	100
5.3 Hilfstromkreise gegen Erde/aux. circuits to earth/Circuits auxil. contre terre			2	2
5.4 Schalter gegen Träger/Breaker frame to support/Blindage du diajonc. - support			2	2
5.5 Klemmen gegen Schalterg./Term. box to breaker frame/Boîte de bornes - blind. du diaj.			2	2

Radon: 12-07-12

Geprüft: 12/20/12
Tested by: 12/20/12
Vérifié par: 12/20/12Akzeptiert:
Passed:
Accepted:Deep AD Quality Assurance
High Voltage Test
Rising

APPENDIX D

INSPECTION RELEASE NOTE

Purchase Order (or Sub-order) No. N.A. 1611Vendor (or Sub-vendor) Brown Boveri - B.A. Ltd.Work's Reference 1-322-130The following ~~material~~ equipment was subjected to final inspection on the
7-7-80 and found satisfactory.UNIT No. I1. C.H. COOLING PLANT TYPE DAK 80SERIAL No. H.A. 1886.131

Part / Sample Order

Inspecting Engineer

Date 7-7-80

The issuing of the Release Note for the above material/equipment does not release your Company from the responsibilities or liabilities as per the instructions and conditions of our Purchase Order.

STONE & WEBSTER ENGINEERING LIMITED

B.691 77

STONE & WEBSTER ENGINEERING LIMITED
INSPECTION REPORT - MISCELLANEOUS

1	Client	Virginia Electric & Power Company	Page No.	1 of 1
2	Project Or Plant	North Anna	Location	U.S.A.
3	Vendor	Gould-Brown Boveri	J.O. No.	12050.47
4	Sub-Vendor		P.O. No.	NA 1611
5	Description of Material	Generator Breakers	Sub/Order No.	
6			Report No.	WA/98/80

Remarks:-

(Give here details of inspection & Tests carried out and any information likely to assist site Engineers during construction).

Unit No.1

1 off Cooling Plant type DRK 80 - Serial No. H.A. 1666131

Above item hydraulically tested, functions simulated and checked.

Insulation tests carried out, wiring checked. All testing carried out as detailed in attached test report. Item dimensionally checked to drawing

HAMT 200853 Rev. 'A' and found acceptable.

Item will now be prepared for shipping, estimated shipping date - mid

August 1980. Release Note WA/68/80 issued.

47	Manufacturers	Welding - Yes / No	Operators - Yes / No.	N.D. Test:- Yes / No.
48	Procedures Approved			

I certify that I have inspected the above equipment, in accordance with the Stone & Webster Inspection Procedure. Materials, Workman-ship and all dimensions meet this Company's requirements, as specified in the Purchase Order and / or in:-

S & W Drawing No.

Issue

S & W Spec. No.

Issue

Manufacturer's Drawing No.

Which was approved on

Date

7th July 1980

Signed: W. Anderson

Copies to

INSPECTING ENGINEER

Mr. Sukheswala

056 75 6014

Gould Brown Poveri
Harristown Road, Rt. 300
Spring House, Pa. 19477
USA

Attn. Mr. Samarakkody

03-0001

1977-7/1-333/130

20-07-10

Subject: VAPCO - Werth Anna 1 + 2
Certificate of Conformance (Cofc)
for Cooling water unit No. 1

Dear Sam,

Please find enclosed the Certificate of Conformance in triplicate for the Cooling water unit No. 1 inspected in Baden on the 7th July 1980 by Mr. Anderson of Stone & Webster, London. Please arrange to forward two copies to VAPCO as per their instructions enclosed.

Thanks & regards.

Yours truly,
Sales Department AMV-3

Enclosure:
as above

cc: Stone & Webster Eng. Ltd.
Stone & Webster House
236 Gray's Inn Road
London, WC 1 X 9BA/England
Attn. Mr. P.C.J. Dunston/Mr. W. Anderson

VIRGINIA ELECTRIC AND POWER COMPANY

CERTIFICATE OF CONFORMANCE

PROJECT NAME North Anna Units 1 and 2
SELLER Brown, Boveri & Cie, AG ADDRESS CH-5401, Baden, Switzerland
ITEM OR SERVICE Cooling water unit No. 1 MARK NO. HA 1'886'131
SPECIFICATION NO. AND TITLE 4198-North Anna Units 1 and 2 Generator
Circuit Breakers
PURCHASE ORDER NO. NA - 1611 J.O. NO. 12050.47
SELLER IDENTIFYING NO. 1-322'130 DRAWING NO. HAMT 200'853 rev. A
HAMT 301'936 rev. A
DEVIATIONS FROM SPECIFICATION REQUIREMENTS: (IF NONE, SO STATE) ATTACH
COPIES OF DEVIATION APPROVAL DOCUMENTS. None

1. _____ 4. _____
2. _____ 5. _____
3. _____ 6. _____

The seller, including his sub-suppliers, hereby certifies that the
item or service, supplied on this order complies with the above listed
specifications, drawings, applicable codes, standards and procedures. The
seller certifies that all deviations from specification requirements are
listed above and that deviation approval documents are attached.

BBC BROWN, BOVERI & COMPANY
United
Bopt. AO Quality Assurance
and High Voltage Tests

SIGNATURE _____

QUALITY ASSURANCE MANAGER

OR EQUIVALENT

N.B.: The above cooling water unit was subjected to acceptance test in
Baden on the 7th July 1980 in the presence of Mr. W. Anderson -
Senior Inspecting Engineer of Stone & Webster, London office.



BESTELLUNG/ORDER/COMMANDE 1-322'130 FABR.-NR./SERIAL NO./NO. DE FABR. HA 1886'131

1 Stück	Kühlaggregat	Vorrichtung zur Temperierung	For.	der Best.	Verk. Abt.
Quantity	water cooling plant	Water circulation apparatus	Item <u>602</u>	of order <u>1-322730</u>	Sales dept.
Pièce	refrigeration	Appareil de refroidissement	Pos.	de la commande	Dep.
Typ/Type	<u>DRK80</u>		Anlage		
Nennspannung/Rated voltage/Tension nom.	U_n	<u>460</u> V	Installation	<u>North Anna I</u>	
Nennfrequenz/Rated frequ./Fréquence nom.	f_n	<u>60</u> Hz	Besteller		
Steuerspg./Control voltage/Tension de com.	U_s	<u>220</u> V <u>60</u> Hz	Purchaser	<u>Gould Brown Borer</u>	
Steuerspg./Control voltage/Tension de com.	U_s	<u>—</u> V <u>—</u> Hz	Client	<u>USA</u>	
Betriebsdruck/Rated pressure/Pression nom.	P_n	<u>—</u>	Bemerkungen		
			Remarks		
			Remarques		

Die Prüfung berücksichtigt die massgebenden Normen und Länderpublikationen. The test takes into consideration relevant specifications and standards. Les essais prennent en considération les normes nationales.

Prüfvorschrift: Testing instruction/ Instruction A2-E3 Schaltbild/ Wiring diagram: Schema MAGT 175 112 A

Die Anlage besteht aus : <u>Water cooling plant</u>		Einheit	Geprüft	Resultat
Arrangement	: <u>Control panel</u>	Unit	Non value	Meas. value
Installation component	: <u>Compensating tank</u>	Unit	Value	Result
Stromlaufplan	: <u>HAGT 195'1124</u>	-	geprüft	<u>tested</u>
Single line diagram	: <u>HAGT 195'1124</u>	-	tested	<u>tested</u>
Schéma principal	: <u>HAGT 195'1124</u>	-	essaye	<u>tested</u>
Tordrängungschema	: <u>HAGT 195'1124</u>	-	geprüft	<u>tested</u>
Wiring diagram	: <u>HAGT 195'1124</u>	-	tested	<u>tested</u>
Schéma des connexions	: <u>HAGT 195'1124</u>	-	essaye	<u>tested</u>
Kohrschema	: <u>HAGT 301'536</u>	-	geprüft	<u>tested</u>
Piping diagram	: <u>HAGT 301'536</u>	-	tested	<u>tested</u>
Schéma de la tuyauterie	: <u>HAGT 301'536</u>	-	essaye	<u>tested</u>
1. Steuerung/Control/Commande				
1. Hauptstromkreis/Main circuit/Circuit principal	<u>460 Volt 60 Hz</u>	V	<u>344</u>	<u>344</u>
2. Steuerspannung/Control voltage/Tension de commande	<u>220 Volt 60 Hz</u>	V	<u>183</u>	<u>183</u>
3. Hilfstransformator/Aux. transformer/Transf. auxiliaire	<u>460/220 Volt 60 Hz</u>	V	<u>344/183</u>	<u>344/183</u>
4. Hilfstransformator/Aux. transformer/Transf. auxiliaire	<u>460/220 Volt 60 Hz</u>	V	<u>344/183</u>	<u>344/183</u>
5. Gleichstromsteuerung/D.C. voltage control/Com. a courant continu	<u>24 Volt</u>	V	<u>24</u>	<u>24</u>
2. Isolationsprüfung/Power frequency voltage test/Rigidité diélectrique 50 Hz, 72 s				
3. Dichtheit/Tightness et, Etanchéité	<u>6.7 bar/psi</u>	-	geprüft	<u>tested</u>
1. Prüfdruck/Test pressure/Pression d'essai	<u>6.7 bar/psi</u>	bar/psi	essaye	<u>tested</u>
3. Einstellung der Mess- und Überwachungsgeräte				
Setting of measuring and controlling devices		-	geprüft	<u>tested</u>
Ajustage des instruments de mesure et de surveillance		-	tested	<u>tested</u>
4. Thermistat Kühlaggregat				
Water cooling plant Temp. max.	Schliesskontakt./Closing cont./Cont. de ferm.	OC	<u>48</u>	<u>48</u>
Réfrigération	Öffnungskontakt./Opening cont./Cont. d'ouvert.	OC	<u>—</u>	<u>46</u>
Ausgang zum Schalter	Schliesskontakt./Closing cont./Cont. de ferm.	OC	<u>6</u>	<u>6</u>
Outlet to circ. breaker	Öffnungskontakt./Opening cont./Cont. d'ouvert.	OC	<u>—</u>	<u>8</u>
Sortie vers l'interr.	Schliesskontakt./Closing cont./Cont. de ferm.	OC	<u>57</u>	<u>57</u>
5. Thermistat Messgruppe				
Metering unit	Schliesskontakt./Closing cont./Cont. de ferm.	OC	<u>—</u>	<u>55</u>
Install. de mesure	Öffnungskontakt./Opening cont./Cont. d'ouvert.	OC	<u>—</u>	<u>55</u>
6. Stromwächter/Ausgang vom Schalterkreis				
Flow-meter, outlet from circuit breaker	Min. Durchfluss	l./min.	<u>20-23</u>	<u>20-23</u>
Contrôle d'écoulement, sortie de l'interr.	Item 2-2-2	l./min.	<u>10-21</u>	<u>10-21</u>
Écoulement min.	Pos. 2-2-2	l./min.	<u>4-6</u>	<u>4-6</u>
7. Leitwertprüfer/Conductivity measuring/Mesure de la conductance				
Steuerschrank	Geräteausfall	NA	<u>5</u>	<u>4.1</u>
Control panel	Device failure	NA	<u>5</u>	<u>4.1</u>
Dispositif de manoeuvre	panne	NA	<u>5</u>	<u>4.1</u>
Pos./Item/Pos.	Ringestellt auf/Set at/Ajusté à	NA	<u>—</u>	<u>34</u>
Sonde Kühlagg.	Probe cooling plant outl./Sonde sortie de l'install. de refroid.	NA	<u>2</u>	<u>2</u>
Pos./Item/Pos.	Ringestellt auf/Set at/Ajusté à	NA	<u>2</u>	<u>2</u>
Sonde Kühlagg.	Probe cooling plant outl./Sonde sortie de l'install. de refroid.	NA	<u>2</u>	<u>2</u>
Pos./Item/Pos.	Ringestellt auf/Set at/Ajusté à	NA	<u>2</u>	<u>2</u>
8. Doppel-Druckschalter				
Double pressure switch	Min. Max.	-	geprüft	<u>—</u>
Contacteur manométrique	Typ/Type	-	tested	<u>—</u>

Bodas PC.FZ.04.

Geprüft : E. Heiler 9/12/80
 Tested by : E. Heiler 9/12/80
 Validated by: E. Heiler 9/12/80

SEPL 80 Quality Assurance
and High Voltage Tests

PRÜFPROTOKOLL / TEST REPORT / PROCES VERBAL

Seite 2
Page 2

BBC
BROWN BOVERI

BESTELLUNG/ORDER/COMMANDE 1-322130 FABR.-NR./SERIAL NO./NO. DE FABR. HA 1886131

	Einheit Unit Unité	Sollwert Nom. value Valeur nom.	Messwert Meas. value Valeur mes.
5. Ausgleichsgefäß/Compensating tank/Vase de compensation			
Wasserstandsmesser/Level metering unit/Indic. du niveau d'eau			
.1 Vom oberen Rand gemessen/Measured from top/Mesure du bord supérieur	cm	—	25
.2	cm	—	40
6. Kühlkreis des Schalters/Cooling syst. of circ. breaker/Circ. de ref. de l'interrompteur			
.1 Durchflussmenge eingest./Quantity of water flow/Débit d'eau réglé	l/min.	98	98
.2 Ausgangstemperatur am Schalter : Bei Vollast Outlet temperature on breaker : Bei Vollast	°C	—	54
Temperatur de l'eau sortante : At full load	°C	64	45
.3 Eingangstemperatur am Schalter : Inlet temperature on breaker : A pleine charge	°C	—	43
Temperatur de l'eau d'entrée : A pleine charge	°C	—	38,6
.4 Ausgangstemperatur am Schalter : Bei 1/2 Last Outlet temperature on breaker : Bei 1/2 Last	°C	—	—
Temperatur de l'eau sortante : At 1/2 load	°C	32	—
.5 Eingangstemperatur am Schalter : Inlet temperature on breaker : A 1/2 charge	°C	—	—
Temperatur de l'eau d'entrée : A 1/2 charge	°C	—	—
7. Frischwasser Kühlaggregat/Fresh water cooling plant/Circ. d'eau de refroidissement			
.1 Durchfluss bei Vollast/Quant. of water flow at full load/Débit d'eau à pleine charge	l/min.	183	183
.2 Ausgangstemperatur : Bei Vollast Outlet temperature : Bei Vollast	°C	—	44,7
Temperatur de l'eau sortante : At full load	°C	64	40
.3 Eingangstemperatur : Inlet temperature : A pleine charge	°C	—	—
Temperatur de l'eau d'entrée : A pleine charge	°C	—	—
.4 Durchfluss bei 1/2 Last/Quant. of water flow at 1/2 load/Débit d'eau à 1/2 charge	l/min.	183	183
.5 Ausgangstemperatur : Bei 1/2 Last Outlet temperature : Bei 1/2 Last	°C	—	31
Temperatur de l'eau sortante : At 1/2 load	°C	32	—
.6 Eingangstemperatur : Inlet temperature : A 1/2 charge	°C	—	28,6
Temperatur de l'eau d'entrée : A 1/2 charge	°C	—	—
.7 Eingestellter Druck vor Regulierventil Setting of pressure ahead of regulating valve Pression d'eau réglée avant la soupape de réglage	kg/cm ² bar/psi	—	—
8. Druckabfall über mech. Filter bei voller Leistung der einzelnen Pumpen			
Pressure drop across mech. filter at full power of each pump Chute de pression à travers filtre mec. tout pleine charge de chaque pompe			
Wasserdurchfluss/Water flow/Écoulement d'eau			
1/min.			
.1 Entionisierungsfilter offen/Deionizing filter open/Filtre déionisant ouvert			
Pumpe A: Druck vor Filter/Pressure ahead filter/Pression avant filtre	KPa bar/psi	—	—
Pumpe A: Druck nach Filter/Pressure after filter/Pression après filtre	KPa bar/psi	—	—
Pumpe A: Differenz/Difference/Différence	KPa bar/psi	—	—
Pumpe B: Druck vor Filter/Pressure ahead filter/Pression avant filtre	KPa bar/psi	—	—
Pumpe B: Druck nach Filter/Pressure after filter/Pression après filtre	KPa bar/psi	—	—
Pumpe B: Differenz/Difference/Différence	KPa bar/psi	—	—
.2 Entionisierungsfilter geschl./Deionizing filter closed/Filtre déionisant fermé			
Pumpe A: Druck vor Filter/Pressure ahead filter/Pression avant filtre	KPa bar/psi	—	—
Pumpe A: Druck nach Filter/Pressure after filter/Pression après filtre	KPa bar/psi	—	—
Pumpe A: Differenz/Difference/Différence	KPa bar/psi	—	—
Pumpe B: Druck vor Filter/Pressure ahead filter/Pression avant filtre	KPa bar/psi	—	—
Pumpe B: Druck nach Filter/Pressure after filter/Pression après filtre	KPa bar/psi	—	—
Pumpe B: Differenz/Difference/Différence	KPa bar/psi	—	—
9. Thermostat Messgruppe closing contact			
T 26.4 Metering unit opening contact	°C	67	67
	°C	—	59

Baden 20.07.84 Geprüft : W. Heiler / Akzeptiert : W. Heiler
Tested by : W. Heiler / Passed : W. Heiler
Vérifié par : W. Heiler / Accepted : W. Heiler



BESTELLUNG/ORDER/COMMANDE 1-322 130 FABR.-NR./SERIAL NO./NO. DE FABR.HA 1886 131

Pumpe A

Fabrikat Pittschi Pump
Nr. 2933091014
Typ NCP3-160
Fördermenge 16 l/sec
bei Förderhöhe 45 m
Leistung 2 kW/2000
Drehzahl 3500 U/min.

Pumpe B

Fabrikat Pittschi Pump
Nr. 2933092016
Typ NCP3-160
Fördermenge 16 l/sec
bei Förderhöhe 45 m
Leistung 2 kW/2000
Drehzahl 3500 U/min.

Motor A

Fabrikat ABC
Nr. TA 3460446
Typ GU 90 L 2 AT
U Y 400 V 60 Hz
I 2,9 A
P 2 kW/2000 HP
Drehzahl 3450 U/min.

Motor B

Fabrikat ABC
Nr. TA 9060447
Typ GU 90 L 2 AT
U Y 400 V 60 Hz
I 2,9 A
P 2 kW/2000 HP
Drehzahl 3450 U/min.

1 Wärmetauscher Nr. 50A541

Druckkessel 145 bar, pur Temp. max 125/112 °C
Bohre 145 bar, pur Temp. max 125/112 °C

1 Druckkessel mit Hochdruckanlage für Wasserstand

1 Rückschlagventil für Pumpe

1 Entionisierungsfilter

1 Mechanischer Filter

1 Durchflussmesser

1 Leitwertgeber

1 Doppelthermostat

1 Manometer Aggregat

1 Manometer Aggregat

1 Thermometer

1 Reg.-Ventil, Nr. 0A79

1 Doppelaruchschalter

1 Vektorstromregler

1 Schauglas f. Durchfluss

1 Sicherheitsventil zu Wärmetauscher, Frischwasserkreis

1 Leuchttafel, Messumformer Typ: MK2 Gruppe B

1 Grenzwertmelder f. Ausfall Typ: 48 F NR2002

1 Leitfähigkeitsanzeige Typ: RF 96-201 CBA

1 Prüfstands- und Umformer Typ: E 10

1 Halbleiter Typ: E 10

1 Halbleiter Typ: E 10

1 Stützautomaten Typ: S 212 IS

1 Stützautomaten Typ: 16 2 V

1 Schnellsicherungen

1 Motorschutze Typ: SLA ABC

1 Stütztaleslöser Typ: MG 11

1 Hilfschutze Typ: HS 22

1 Hilfschutze Typ: HS 44 E

1 Hilfschutze Typ: HS 53 E

1 Umschalter Typ: Spindel

1 Steuerschalter Typ: SEM 4 TPA

1 Zeitrelais Typ: "

1 Zeitrelais Typ: "

1 Zeitrelais Typ: "

1 Betriebsstundenanähler Typ: Stiller HW 40

1 Impulsanähler Typ: ABC NG 7.01

1 Netzanschlussgerät

1 Signallampen

1 Leuchttafel

1 Loschglieder

Nr. 7m Druckkessel für Temp. — °C

Nr. 6X10-40/100-20 l/min

Nr. 149085

Nr. 768301 Einst. min. +6 °C Einst. max. 48 °C

Nr. 768302 3x 57 °C 1x Einstellung 61 °C

Schaltwasser 0-230 pur.

Frischwasser 0-230

Schaltwasser für 60-200 °F/0-100 °C

Frischwasser " 60-200 °F/0-100 °C

Typ: V33 JW K 8 (NW 32) ND 40 mit Thermostat

Typ: — Einst. min. — Einst. max. —

Typ: — Einst. min. — Einst. max. —

Typ: — Einst. min. — Einst. max. —

Typ: — Einst. min. — Einst. max. —

Nr. 5062 190-240 V, 60 Hz 0...100%

Pos. 99 F 7, — Hz Einstellung 34 °C

Pos. 99 HA/108 H2 7, — Hz Einstellung 2/3 °C

Nr. 84710340 0-10, 13 Hz

Nr. — 460/220 V, 6, — Hz 450 7A

Nr. — 460/220 V, 6, — Hz 450 7A

Nr. — 460/220 V, 6, — Hz 220 7A

Nr. — 460/220 V, 6, — Hz 220 7A

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Nr. — 460/220 V, 6, — Hz 220 7A

Baden 10.07.04

Geprüft

Tested by

Werkstoff

Stiller

Geprüft

Tested by

Werkstoff

Stiller

Geprüft

Tested by

Werkstoff

Stiller

Geprüft

Tested by

Werkstoff

Stiller

Geprüft

Tested by

Werkstoff

BBC
BROWN BOVERILISTE DER VERWENDETEN INSTRUMENTE
Beilage zu Endprüf-Protokoll

BESTELLUNG/WRZ 1-322130

FABR.-NR. HA 1'886'131

1 STÜCK TYP DRKPD
GEGENSTAND: Kühlaggregat

ANLAGE: North Anna I

BEMERKUNG:

Nuklearmaterial Klasse 1E
Erdbebensicherheitsklasse I

Lauf Nr.	Instrumenten-Nummer	Instrumenten-Bezeichnung	Bemerkungen
1	AG LA 105	6 kV Trafo	2 kV Test
2	B 61540 Typ MQK 22126	BBC Motor 490 U/min	Steuerung
	B 61207 Typ MQK 22100	BBC Motor 585 U/min	
	B 67557 Typ MK 22114	BBC Generator 50/60 Hz	
3	AF-VL 235 Typ 13	Universal-Messungsinstrument	v. H. 76
4	2'403'405	Frequenz-Meter 75-75 Hz	
5	AF-VL 9614 Typ 13	Universal-Messungsinstrument	
6	B 25111 Typ MIC 20	Induktions-Reaktor	v. H. 76 Nr. 13
7	AR af 39	BBC Digital-Meter 1-070017	
8	AF-VL 952	Ampèremeter Norma	
9	AF-VL 940	" "	
10	AF-VL 942	" "	
11	AF-VL 14	Stromwandler	
12	AF-VL 15	"	
13	AF-VL 16	"	
14	H 0375 Typ DHKW	Boiler	Heizung
15	H 0673 Typ DHKW	Boiler	
16	144'502 Typ 4112	Durchfluss-Messer Krone	Schmelz- wasser
17	144'502 Typ 4112	" " "	
18	134'296 Typ 4112	" " "	
19	136'792 Typ 4112	" " "	
20	635'238'062 E18	BBC-Motor 2920 U/min	zu Pumpe
21	75520'65 Typ CN80	Rütschi Pumpe HM 100	
22	1-378'017-436-121	BBC Wärmetauscher	Frühwasser
23	3-266'050-436	" "	
24	1440 Typ 1315	" "	
25	Typ G 1925	Durchfluss-Messer Krone	
26	Typ G 51.20	" "	

ALLE OBEN AUFGEFÜHRTE INSTRUMENTE
WURDEN BEI DEN VORGESCHRIEBENEN
PRÜFUNGEN VERWENDET.BADEN, OERLIKON, LENZBURG, DATUM:
30.07.04.

AG-P 800110

UNTERSCHRIFT
VIS.

FABR.-NR. HA 1'886'137

ANLAGE: North Anna I

Nuklearmaterial Klasse 1E
Erdbebensicherheitsklasse I

ALLE OBEN AUFGEFUEHRTEN INSTRUMENTE
WURDEN BEI DEN VORGESCHRIEBENEN
PRUEFUNGEN VERPENDET.

BADEN, OERLIKON, LENZBURG, DATUM:

UNTERSCHRIFT
VIS.



BBC
BROWN BOVERI

BESTELLUNG/ORDER/COMMANDE 1-322130

NO. HA 1886131

1	Stück Kühlaggregat Qty. Water cooling plant Pièce Réfrigération	Pos. der Best. Item <u>602</u> of order <u>1-322120</u> Pos. de la commande	Verk.-abt. Sales dept. <u>AME</u> Dep. vente
Typ Type	<u>DRK 80</u>	Anlage Installation Installation	
Konstruktionsüberdruck Design pressure Pression calculée	pe <u>150</u>	Besteller Purchase Client	<u>North Arna I</u> <u>Brown Bork</u> <u>USA</u>
Betriebsüberdruck Working pressure Pression de service	pe <u>150</u>	Bemerkungen Remarks Remarques	

1. Hersteller Manufactururer Fabricant 2. Herge stellt für Manufactured for Fabriqué pour 3. Bestellnummer RBC (Rink.-Nr.) Order number RBC No. de commande RBC 4. Bestelldatum RBC Date of order RBC Date de commande RBC 5. Laufende Fabrikations-Nr. des Herstellers Serial no. of manufacturer No. de fabrication du fabricant 6. Zusammenbau (incl. Nationalisierungsfilter) Assembly (incl. de-ionizing filter) Assemblage (avec filtre de déionisation) 7. Frischwasserkreis : Prüfdruck : Sollwert Fresh water circuit : Test pressure : Nominal value Circ. d'eau de refroid. : Pression d'essai : Valeur nominal 7.1 Prüfdauer/Te : duration/Durée d'essai : t : Sollwert Nominal value 7.2 Undichtigkeit/Leakage/Imétanchéité : ape: Valeur nominal 8. Schalterwasserkreis : Prüfdruck : Sollwert Cooling system of breaker : Test pressure : Nominal value Circ. de ref. de l'inter : Pression d'essai : Valeur nominal 8.1 Prüfdauer/Test duration/Durée d'essai : t : Sollwert Nominal value 8.2 Undichtigkeit/Leakage/Imétanchéité : ape: Valeur nominal 9. Prüfstempel : Stamp : Timbre : 10. Prüfdatum : Test date : Date d'essai : Ort und Datum : Place and date : Lieu et date :		Wülser AG RBC AG Brown Boveri & Cie. 43-16207-1-1-322130-041-0260 2. Febr. 1980 DRK 30/225 Zeichnung. SKAMT 00017 Geprüft Drawing Checked Dessin Passed Neuwert : 230 Measured value : 230 Mesure Neuwert : 4 Measured value : 4 in 4h Mesure Neuwert : 230 Measured value : 230 Mesure Neuwert : 4 Measured value : 4 in 4h Mesure Prüfer : Tester : Contrôleur Stempel : Stamp : Timbre Datum : Date : Date 20.6.80 Stempel und Unterschrift : Stamp and signature : Timbre et signature 20.6.80 Stempel und Unterschrift : Stamp and signature : Timbre et signature 20.6.80 Stempel und Unterschrift : Stamp and signature : Timbre et signature
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Baden 10-07-04

Greenham 1

Akzeptiert:

Carlsson

W

Accepted

APPENDIX E

No. 97730090
Rev. A

VEPCO
LICENSING AND QUALITY ASSURANCE

V.S.I. REPORT FOR WORTHINGTON AIR COMPRESSORS

P. O. NO. NA-1611

SHEET 1 OF 1

PROJECT: North Anna Units 1 & 2 Generator Circuit		J. O. NO. 12050.47	CAT. NO. 2
VENDOR/LOCATION: Gould-Brown Boveri - Springfield, Pa		MARK NO.	
DRAWING NO. (S): L-DGM-1239, R-DGM-1099, R-DGM-807			
CONTACT:	TELEPHONE	CHANGE ORDER NO. 1	
SUBVENDOR/LOCATION: WORTHINGTON CORP - HOLYOKE, MASS		SUBCONTRACT NO. GBB-1005-55-29010	
SPECIFICATION: NO/ACCM 4198 REV. 0 2-26-80		VENDOR SHOP NO. A-50855 & 50856	

	INSPECTION AND DOCUMENT RECORD	RECORD REQUIRED IN VENDOR, FILL	A/E APP. REQ'D	ACTION REQ'D	W - WITNESS V - VERIFY P - PERFORM	DEVIATIONS/TEST PARAMETER/ APPROVAL/ETC.	REF. NO.	P.	DATE
1	Welding Procedures	X		V				N/A	
2	Welding Qualifications	X		V				N/A	
3	Welding			V				N/A	
4	Operating & Maintenance							N/A	
5	Manuals			V					
6	Installation Instructions			V				N/A	
7	Routine Tests	X		V				G.L. Volpe	6/25/80
8	Design Tests (first one of each type)	X		V				N/A	
	Wiring Inspection			P				G.L. Volpe	6/25/80
11	Piping			P				N/A	
12	Spare Parts & Special Tools			V				N/A	
13	Accessory Equipment			V				N/A	
14	Cleaning/Painting			P				G.L. Volpe	6/25/80
15	Visual Inspection			P				G.L. Volpe	6/25/80
16	Dimensional Checks			P				G.L. Volpe	6/25/80
17	Nameplate Inspection			P				G.L. Volpe	6/25/80
18	TEST REPORTS			V				G.L. Volpe	6/26/80
19	VEPCO CERT. OF CONFORMANCE			V				G.L. Volpe	6/26/80
20									

DISCUSSION:
SIX(6) AIR RECEIVERS, NATIONAL BOARD # 33994, 34260, 34261, 34262, 34263 AND 34264 were ordered by Gould-Brown Boveri from U.S. STEEL AND SHIPPED TO WORTHINGTON CORP. CERTIFIED DATA (U-1A form) WAS NOT SENT WITH AIR RECEIVERS. Gould-Brown Boveri to supply forms.
THIS Report covers two(2) Compressors model # 2HBC10-33 AND ONE(1) SPARE Compressor.

DOCUMENTATION CERTIFICATION:

SIGNATURE ON THIS DOCUMENT, WHEN CHECKED HERE (✓), CERTIFIES THAT ALL SURVEILLANCE ACTIONS INITIALED ABOVE HAVE BEEN ACCOMPLISHED WITH SATISFACTORY RESULTS, AND THAT REQUIRED DOCUMENTATION HAS BEEN REVIEWED AND ACCEPTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE PURCHASE SPECIFICATION.

COPIES TO: E. G. Lifrage* G.A. Helm* P.A. Slater* J.W.Kelly W.F.Whitten
R.B. Bradbury* G. L. Volpe - 2

*COPIES OF DOCUMENTATION

DISTRIBUTION:	AE QA COORDINATOR	DATE 7-1-80	SAT NO.
CENTRAL FILE	AE PROJECT ENGR		
VEPCO PROJECT ENGR	SITE QA	CERTIFIED BY (SIGNATURE)	
	SUPERVISOR QA ENGR.	G.L. Volpe	

VIRGINIA ELECTRIC AND POWER COMPANY

CERTIFICATE OF CONFORMANCE

PROJECT NAME North Anna Units 1 and 2
SELLER WORTHINGTON COMPRESSORS ADDRESS HOLYOKE, MASS.
ITEM OR SERVICE _____ MARK NO. _____
SPECIFICATION NO. AND TITLE 4198-North Anna Units 1 and 2 Generator
Circuit Breakers REV.O 2-26-80
PURCHASE ORDER NO. NA-1611 J.O. NO. 12050.50
SELLER IDENTIFYING NO. A-50855 & 50856 DRAWING NO. _____
DEVIATIONS FROM SPECIFICATION REQUIREMENTS: (IF NONE, SO STATE) ATTACH
COPIES OF DEVIATION APPROVAL DOCUMENTS.

- | | |
|----------------|----------|
| 1. <u>NONE</u> | 4. _____ |
| 2. _____ | 5. _____ |
| 3. _____ | 6. _____ |

The seller, including his sub-suppliers, hereby certifies that the item or service, supplied on this order complies with the above listed specifications, drawings, applicable codes, standards and procedures. The seller certifies that all deviations from specification requirements are listed above and that deviation approval documents are attached.

SIGNATURE _____

QUALITY ASSURANCE MANAGER
OR EQUIVALENT

Compressor S/N#767-C-1196,1192,1195,1184
Spare Compressor S/N#767-C-1175
Gould-Brown Bover: P.O.# GBB-1005-55-79010-1



K-MP-334

MANUFACTURING PROCEDURE

COMPRESSOR PACKAGE FOR AIR BLAST CIRCUIT BREAKERS

BREAK-IN AND 18 HOUR TEST RUN DATA

1. THIS LOG OF TEST DATA SHALL BE ENTERED IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
 - (A) K-MP-333, BREAK-IN AND 18 HOUR TEST PROCEDURE.
 - (B) K-MP-215, TORQUE VALUES.
2. THIS LOG OF TESTS IS TO ACCOMPANY THE MACHINE THROUGH ALL THE TESTS PERFORMED AND DATA SHALL BE ENTERED AS FOLLOWS:
 - (A) ALL BLANK SPACES MUST BE FILLED IN WITH A FIGURE OR INITIALED, AS SPECIFIED.
 - (B) THE LAST COLUMN OF THE 18 HOUR TEST SHEET MUST BE WITHIN THE SPECIFIED LIMITS EXCEPT WHEN ENGINEERING AUTHORIZES A DEVIATION.
 - (C) ALL OTHER TEST DATA RECORDS MUST BE WITHIN THE SPECIFIED LIMITS EXCEPT WHEN A DEVIATION IS AUTHORIZED BY THE FOREMEN AND INITIALED.
3. UPON COMPLETION OF THIS LOG:
 - (A) ORIGINAL IS TO BE RETAINED BY QUALITY ASSURANCE.
 - (B) COPY IS TO BE SENT TO ENGINEERING.
4. THIS LOG HAS BEEN EXAMINED FOR COMPLETENESS AND ACCURACY AND FOUND TO BE WITHIN LIMITS SPECIFIED WHERE A DEVIATION HAS BEEN AUTHORIZED.
 - (A) FOREMAN'S SIGNATURE [Signature] DATE 4-25-80
 - (B) Q.A. ANALYST SIGNATURE _____ DATE _____

COMPRESSOR SERIAL NUMBER 767-C-1184

- OVER -



UNIT BREAK-IN TEST DATA WITHOUT ENCLOSURE (SEE K-MP-233)

WORTHINGTON SALES ORDER # 150855 COMPRESSOR SERIAL # 767-C-1184
 MOTOR SERIAL # _____ MOTOR H.P. _____
 MOTOR VOLTAGE _____ UNIT WIRING DIAG. # _____

1. TESTER'S NAME AND CLOCK NO. #157 T. L. Luehl DATE _____
 2. SOLENOID VALVE: 240 VOLT
 NAMEPLATE VOLTAGE _____
 3. POWER SUPPLY UNIT TESTED ON (3 PHASE 60 CYCLES) 230 VOLTS
 4. OIL PRESSURE (A) AT START UP..... 46 PSIG.
 (B) PRESSURE GAUGE NEEDLE FLUCTUATION (5 PSIG MAX.) 0 PSIG.
 5. TORQUE 3RD STAGE HEAD 50 FT/LBS..... 50 FT./LB.
 6. TIME DELAY AT START UP (30-50 SECONDS BEFORE COMPRESSOR LOADS) 40 SECONDS
 7. OIL PRESSURE: (A) AFTER 2½ HRS. RUNNING 40 PSIG. (B) PRESS. DROP 6 P
 (35-50 PSIG) IN 2½ HRS.
 (10 PSIG MAX.)

8. PERFORMANCE DATA	1-1/2 HR.	1/2 HR.	1/2 HR.	1/2 HR.	1 1/2
HOURLY METER	<u>.5</u>	<u>2.</u>	<u>2.5</u>	<u>3.</u>	<u>3.5</u>
1ST STAGE DISCHARGE PRESSURE PSIG	<u>47</u>	<u>49</u>	<u>50</u>	<u>53</u>	<u>54</u> 52-60
2ND STAGE DISCHARGE PRESSURE PSIG	<u>260</u>	<u>280</u>	<u>300</u>	<u>340</u>	<u>350</u> 300-400
3RD STAGE DISCHARGE PRESSURE PSIG	<u>680</u>	<u>790</u>	<u>900</u>	<u>1100</u>	<u>1150</u> 1100-1200
4TH STAGE DISCHARGE PRESSURE PSIG	<u>1000</u> 1000	<u>1500</u> 1500	<u>2000</u> 2000	<u>3000</u> 3000	<u>3700</u> 3700
BLOW BY (CFM) <u>W. E.</u>	<u>1.02</u>	<u>1.05</u>	<u>1.05</u>	<u>1.05</u>	<u>.95</u>
COMPRESSOR (RPM) <u>900-950</u>	<u>920</u>	<u>920</u>	<u>920</u>	<u>920</u>	<u>920</u>
CAPACITY (CFM) <u>8.5</u>	<u>11.7</u>	<u>11.6</u>	<u>11.5</u>	<u>11.4</u>	<u>11.5</u>

FOREMAN'S APPROVAL AND REMARKS [Signature] DATE 1-25-80

9.

(A) HOURMETER					
(B) AMPS (MOTOR)	LINE A	24	24	24	
	LINE B	24	24	24	
	LINE C	25	25	25	
(C) VOLTS	LINE AB	220	220	220	
	LINE AC	220	220	220	
	LINE BC	220	220	220	
(D) 1ST STAGE	RUNNING, MAX. 60	54	54	54	
	DISCH. PRESS. PSIG. DRAINED, 0-30	20	20	20	
(E) 2ND STAGE	RUNNING, MAX. 400	355	355	355	
	DISCH. PRESS. PSIG. DRAINED 35-85	35	35	35	
(F) 3RD STAGE	RUNNING, MAX. 1300	1180	1180	1180	
	DISCH. PRESS. PSIG. DRAINED, 100-250	100	100	100	
(G) 4TH STAGE	RUNNING, MAX. 3750	3700	3700	3700	
	DISCH. PRESS. PSIG. DRAINED, 200-500	300	300	300	
(H) SUCTION TEMPERATURE					
(I) 4TH STAGE	AMBIENT TEMPERATURE				
DISCH. TEMP.	FLUID 320°F. MAX.	382	382	382	
(J) AMBIENT TEMPERATURE		62	62	62	
(K) SHUTTER - OPEN OR CLOSED		Closed			
(L) CAPACITY (CFM) 10 CFM MIN. AT 3700 PSIG		11.5	11.5	11.5	
(M) BLOW BY (CFM) 1.5 CFM AT 3700 PSIG		.98	.98	.98	
(N) COMPRESSOR (RPM) 900-950		920	920	920	



10. HEATER CHECK:

A. SPACE HEATERS 4.6 AMPS 220 VOLTS
 B. COOLER HEATER 3.2 AMPS 220 VOLTS
 C. OIL HEATER .9 AMPS

11. HIGH TEMPERATURE SWITCH CHECK.

INITIALS T.L.

12. RECORD ALL OIL AND AIR LEAKS AND INDICATE WHAT WAS DONE TO CORRECT CONDITION:

No leaks

13. OIL CONSUMPTION (A) OIL ADDED 0 OZ. (B) HOURS RUN 29.4 HRS.(C) CALCULATE OZ/HR. (.70 OZ. PER HR. AVERAGE MAX.) 0 OZ/HR

14. CHECK OF PRESSURE SWITCH SETTING AND CONSISTENCY OF OPERATION.

RECORD OPERATIONAL PRESSURE EACH CYCLE

PRESSURE SWITCH	CYCLE #1		CYCLE #2		CYCLE #3	
	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT
PS (3700 PSIG)	3400	3700	3400	3700	3400	3700

15. PISTON BOLT TORQUE _____
(25 FT./LBS.)25 FT.LBS.THIRD STAGE HEAD TORQUE 50 FT. L.
(50 FT/LBS)16. SEPARATORS DRAINED YES TESTER'S INITIALS T.L.17. COMPRESSOR BOLTS AND NUTS TORQUED YES TESTER'S INITIALS T.L.

18. TUBES & FITTINGS LEAK TIGHT, SECURED, AND INTERFERENCE FREE.

TESTER'S INITIALS T.L.FOREMAN'S APPROVAL AND REMARKS T. L. Costello DATE 4-15-80

REVISED 5/16/79 RFR/NT


 WORTHINGTON COMPRESSORS, INC.
 HOLYOKE, MASSACHUSETTS

MANUFACTURING PROCEDURE
AIR PLANT TEST Y-MP-338

CUSTOMER P.O.# _____ WORTH. SALES ORDER # A-58055
CUSTOMER SPEC.# _____ PACKAGE VOLTAGE _____

UNIT SERIAL # 267c-1184

1. TESTER'S NAME & CLOCK # R Krawczyk 83.5 DATE 4/23/80
2. OIL LEVEL OF EACH COMPRESSOR AT 1/2 FULL MARK Full
3. CHECK MOTOR WIRING FOR PROPER PACKAGE VOLTAGE yes
4. CHECK FOR CORRECT ROTATION FOR EACH MOTOR yes
5. STARTING TIME DELAY 40 sec
6. HOURMETER READING 51.5
7. PERFORMANCE

	62			
START UP	48.2	MID-POINT	49.6	CONCLUSION
1 HR. AFTER START				LEAKAGE RATE TEST
48.2				
56	40	38	40	
MOTOR VOLTAGE-LINES AB	480	488	486	482
LINES AC	484	486	482	482
LINES BC	484	487	484	484
MOTOR AMPERAGE LINE A	16.4	16.6	16.7	16.8
LINE B	16.2	16.2	16.8	16.2
LINE C	16.0	16.4	16.6	16.7
4TH STAGE DISCHARGE PRESS. PSIG	3600	3300	3600	3200
AMBIENT TEMP.	62	64	66	62
BLOWBY	1.1	1.0	1.0	1.0
COMPRESSION R.P.M.	920	920	920	920

8. SYSTEM FREE OF LEAKS yes

continued



9. ✓ SET PRESSURE TIME RECORDER TIME AT ACTUAL TIME . . . 3:45 . . .
10. RECORD DATA ONE HOUR AFTER START UP IN STEP 7 ABOVE, ALSO RECORD THE FOLLOWING DATA. . . 4:45 . . .
- (A) CYCLING TIME BETWEEN DRAINS (20 MIN. PLUS OR MINUS 2 MIN. . . 20 . . . MIN.
- (B) TIME DELAY TO LOAD AFTER COMPRESSOR STARTS. (30-50 SEC.) . . 40 . . . SEC.
- (C) AT START, AFTER BOTH COMPRESSORS HAVE LOADED
1. RECEIVER PRESSURE PSIG . . . 0 . . . PSIG
 2. RECEIVER TEMPERATURE DEG. F. . . 62 . . . DEG.
 3. TIME TAKEN FROM PRESS. TIME RECORDER . . . 3:45 . . .
- (D) AT 1400 PSIG RECEIVER PRESSURE
1. RECEIVER PRESSURE . . . 1400 . . . PSIG
 2. RECEIVER TEMPERATURE . . . 72 . . . DEG.
 3. TIME TAKEN FROM PRESS. TIME RECORDER . . . 4:45 . . .
- (E) AT 3700 PSIG RECEIVER PRESS. (WHEN BOTH COMPRESSORS STOP)
1. RECEIVER PRESSURE . . . 3700 . . . PSIG
 2. RECEIVER TEMPERATURE . . . 91 . . . DEG.
 3. TIME TAKEN FROM PRESS. TIME RECORDER . . . 6:30 . . .
- IF TOTAL CHARGING TIME EXCEEDS 6 HOURS-20 MIN. FOR GRP-1896 OR 4 HOURS - - - - - GRP-1918 NOTIFY FOREMAN BEFORE PROCEEDING.
- (F) 5 HOURS AFTER BOTH COMPRESSORS HAVE STOPPED
1. RECEIVER PRESSURE . . . 3580 . . . PSIG
 2. RECEIVER TEMPERATURE . . . 74 . . . DEG.
 3. TIME TAKEN FROM PRESS. TIME RECORDER . . . 11:30 PM . . .
- (G) ELAPSED TIME BETWEEN START-UP AND SHUT DOWN AT 3700 PSIG 2 hrs 45 min.
- (H) ELAPSED TIME BETWEEN RECEIVER PRESSURE OF 1400 PSIG AND 3700 PSIG. 1 hr 45 min.

continued



(I) DROP IN RECEIVER PRESSURE DURING (5) HOUR PERIOD

120 . . . PS

(J) MAXIMUM ALLOWABLE RECEIVER DROP

ALLOWABLE PRESSURE DROP - - - - - 57 PSIG

ADDITIONAL PRESS. DROP CAUSED BY TEMP. CHANGE

6.8 % (RECEIVER TEMP. DROP) - - - - -

MAXIMUM ALLOWABLE PRESS. DROP, SUM OF ABOVE

118 . . . PS
2 . . . PS

(K) RECEIVER PRESS. DROP PER ITEM (I) IS LESS THAN
MAXIMUM ALLOWABLE PER ITEM (J), IF NOT, NOTIFY
FOREMAN BEFORE PROCEEDING. - - - - -

0.54 % . . .

11. COMPRESSOR FREE OF OIL LEAKS. *yes*

12. CHECK FOR PROPER OPERATION OF MOMENTARY CONTACT "TEST" BUTTON.

13. CUT-IN PRESSURE SWITCH SETTINGS - - - - - 3500 . . . PSI

14. CUT-OUT PRESSURE SWITCH SETTINGS - - - - - 3700 . . . PS

15. CONDENSATE EJECTION HEATER CURRENT
COMPRESSOR RANGE 0.5 TO 0.9

16. ALLOW UNIT TO RUN FOR A TOTAL OF 15 HOURS FROM TIME RECORDED
STEP (5) ABOVE. RECORD FOLLOWING AT CONCLUSION.

HOUREMETER

51

OIL PRESSURE

38

MOTOR AMPERAGE

LINE A

167

LINE B

168

LINE C

166

MOTOR VOLTAGE

LINE AB

486

LINE AC

482

LINE BC

484

4TH STAGE DISCHARGE PRESS. 3600

AMBIENT TEMPERATURE 66

BLOWBY 1.0

COMPRESSOR R.P.M. 920

17. OIL CONSUMPTION (A) OIL ADDED - - - - - 0-30 . . . OZ.
(B) HOURS RUN - - - - - 20 . . . HR
(C) CALCULATE OZ/HR. (.55 OZ/HR) AVG. MAX.) OZ

continued



18. CHECK BELT TENSION BY C.A. *yes*
- CLEAN OIL FILTER AND CHECK FOR LEAKS. *yes*
- CHECK FOR PROPER OPERATION OF LOW OIL PRESS. CUT
OUT SWITCH. RECORD CUT-OUT PRESS. - - - - - *14* PSIG
21. UNIT PRESERVATION WITH P-10 *yes*
22. RETORQUE BOLTS AND NUTS. *yes*
23. RECORD RECEIVER IDENTICAL BOARD NUMBERS

RECEIVER LOCATION

#1

#2

#3

#4

VIEWED FROM
SHUT OFF
VALVE END

#1

34263

#2

34260

#3

#4

FOREMAN'S APPROVAL AND REMARKS

Glatt

4-25-80



A-50855

K-MP-334

MANUFACTURING PROCEDURE

COMPRESSOR PACKAGE FOR AIR BLAST CIRCUIT BREAKERS
BREAK-IN AND 18 HOUR TEST RUN DATA

1. THIS LOG OF TEST DATA SHALL BE ENTERED IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
 - (A) K-MP-333, BREAK-IN AND 18 HOUR TEST PROCEDURE.
 - (B) K-MP-215, TORQUE VALUES.
2. THIS LOG OF TESTS IS TO ACCOMPANY THE MACHINE THROUGH ALL THE TESTS PERFORMED AND DATA SHALL BE ENTERED AS FOLLOWS:
 - (A) ALL BLANK SPACES MUST BE FILLED IN WITH A FIGURE OR INITIALED, AS SPECIFIED.
 - (B) THE LAST COLUMN OF THE 18 HOUR TEST SHEET MUST BE WITHIN THE SPECIFIED LIMITS EXCEPT WHEN ENGINEERING AUTHORIZES A DEVIATION.
 - (C) ALL OTHER TEST DATA RECORDS MUST BE WITHIN THE SPECIFIED LIMITS EXCEPT WHEN A DEVIATION IS AUTHORIZED BY THE FOREMEN AND INITIALED.
3. UPON COMPLETION OF THIS LOG:
 - (A) ORIGINAL IS TO BE RETAINED BY QUALITY ASSURANCE.
 - (B) COPY IS TO BE SENT TO ENGINEERING.
4. THIS LOG HAS BEEN EXAMINED FOR COMPLETENESS AND ACCURACY AND FOUND TO BE WITHIN LIMITS SPECIFIED WHERE A DEVIATION HAS BEEN AUTHORIZED.
 - (A) FOREMAN'S SIGNATURE *Castello* DATE 4-25-80
 - (B) Q.A. ANALYST SIGNATURE _____ DATE _____

COMPRESSOR SERIAL NUMBER 267-0-1195

- OVER -



K-MP-334

UNIT BREAK-IN TEST DATA WITHOUT ENCLOSURE (SEE K-MP-233)

WORTHINGTON SALES ORDER # A 50855 COMPRESSOR SERIAL # 767-C-1195
MOTOR SERIAL # _____ MOTOR H.P. _____
MOTOR VOLTAGE _____ UNIT WIRING DIAG. # _____

1. TESTER'S NAME AND CLOCK NO. # 157 T. Lavelle DATE _____
2. SOLENOID VALVE: 240 VOLT
NAMEPLATE VOLTAGE _____
3. POWER SUPPLY UNIT TESTED ON (3 PHASE 60 CYCLES) _____ 230 VOLTS
4. OIL PRESSURE (A) AT START UP..... 46 PSIG.
(B) PRESSURE GAUGE NEEDLE FLUCTUATION(5 PSIG MAX.) _____ PSIG.
5. TORQUE 3RD STAGE HEAD 50 FT/LBS..... 50 FT./LBS
6. TIME DELAY AT START UP (30-50 SECONDS BEFORE COMPRESSOR LOADS) _____ 40 SECONDS
7. OIL PRESSURE: (A) AFTER 2½ HRS. RUNNING 38 PSIG. (B) PRESS. DROP 8 PSIG.
(35-50 PSIG) IN 2½ HRS.
(10 PSIG MAX.)

PERFORMANCE DATA	1-1/2 HR.	1/2 HR.	1/2 HR.	1/2 HR.	1 HR.
HOURLY METER	<u>.5</u>	<u>2.</u>	<u>2.5</u>	<u>3.</u>	<u>3.5</u>
1ST STAGE DISCHARGE PRESSURE PSIG	<u>47</u>	<u>49</u>	<u>50</u>	<u>53</u>	<u>58</u> 52-60
2ND STAGE DISCHARGE PRESSURE PSIG	<u>250</u>	<u>270</u>	<u>300</u>	<u>330</u>	<u>350</u> 300-400
3RD STAGE DISCHARGE PRESSURE PSIG	<u>690</u>	<u>800</u>	<u>930</u>	<u>1120</u>	<u>1200</u> 1100-1300
4TH STAGE DISCHARGE PRESSURE PSIG	<u>1100</u> 1000	<u>1500</u> 1500	<u>2000</u> 2000	<u>3000</u> 3000	<u>3700</u> 3700
BLOW BY (CFM)	<u>1.25</u>	<u>1.25</u>	<u>1.35</u>	<u>1.15</u>	<u>1.25</u>
COMPRESSOR (RPM)	<u>900-950</u>				
CAPACITY (CFM)	<u>11.3</u>	<u>11.3</u>	<u>11.</u>	<u>11.2</u>	<u>11.10</u>

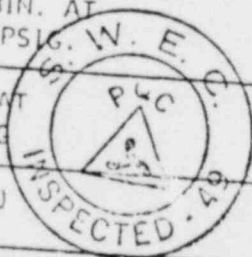
FOREMAN'S APPROVAL T. Lavelle DATE 4-25-80

9.

(A) HOURMETER					
(B) AMPS	(MOTOR)	LINE A	24	24	24
		LINE B	24	24	24
		LINE C	25	26	25
(C) VOLTS		LINE AB	220	220	220
		LINE AC	220	220	220
		LINE BC	220	220	220
(D) 1ST STAGE		RUNNING, MAX. 60	56	54	54
	DISCH. PRESS. PSIG.	DRAINED, 0-30	20	20	20
(E) 2ND STAGE		RUNNING, MAX. 400	355	350	350
	DISCH. PRESS. PSIG.	DRAINED 35-85	40	40	40
(F) 3RD STAGE		RUNNING, MAX. 1300	1180	1160	1160
	DISCH. PRESS. PSIG.	DRAINED, 100-250	160	160	160
(G) 4TH STAGE		RUNNING, MAX. 3750	3700	3700	3700
	DISCH. PRESS. PSIG.	DRAINED, 200-500	350	350	350
(H) SUCTION TEMPERATURE					
(I) 4TH STAGE	AMBIENT TEMPERATURE				
	DISCH. TEMP.	PLUS 320° F. MAX.	382	380	355
(J) AMBIENT TEMPERATURE			62	60	65
(K) SHUTTER - OPEN OR CLOSED			Closed	Closed	Closed
(L) CAPACITY (CFM) 10 CFM MIN. AT 3700 PSIG.			11	11	11
(M) BLOW BY (CFM) 1.5 CFM AT 3700 PSIG.			1.1	1.4	1.4
(N) COMPRESSOR (RPM) 900-950			920	920	920

W. E. C. O.

INSPECTED



10. HEATER CHECK:

A. SPACE HEATERS 4.6 AMPS 220 VOLTS
 B. COOLER HEATER 3.2 AMPS 220 VOLTS
 C. OIL HEATER 1.0 AMPS

11. HIGH TEMPERATURE SWITCH CHECK.

INITIALS A.L.

12. RECORD ALL OIL AND AIR LEAKS AND INDICATE WHAT WAS DONE TO CORRECT CONDITION:

None

13. OIL CONSUMPTION (A) OIL ADDED 0 OZ. (B) HOURS RUN 29.9 HRS.
 (C) CALCULATE OZ/HR. (.70 OZ. PER HR. AVERAGE MAX.) 0 OZ/HR.

14. CHECK OF PRESSURE SWITCH SETTING AND CONSISTENCY OF OPERATION.

RECORD OPERATIONAL PRESSURE EACH CYCLE

PRESSURE SWITCH	CYCLE #1		CYCLE #2		CYCLE #3	
	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT
PS (3700 PSIG)	3400	3700	3400	3700	3400	3700

15. PISTON BOLT TORQUE 25 FT.LBS. THIRD STAGE HEAD TORQUE 50 FT. L
 (25 FT./LBS.) (50 FT/LBS)

16. SEPARATORS DRAINED yes TESTER'S INITIALS A.L.17. COMPRESSOR BOLTS AND NUTS TORQUED yes TESTER'S INITIALS A.L.

18. TUBES & FITTINGS LEAK TIGHT, SECURED, AND INTERFERENCE FREE.

TESTER'S INITIALS yes A.L.FOREMAN'S APPROVAL AND REMARKS J. Little DATE 4-25-80

REVISED 5/16/79 RFR/NT


 WORTHINGTON COMPRESSORS, INC.
 HOLYOKE, MASSACHUSETTS

K-MP-337
MANUFACTURING PROCEDURE
AIR PLANT TEST Y-MP-338

CUSTOMER P.O.# _____ WORTH. SALES ORDER # A-52055
CUSTOMER SPEC.# _____ PACKAGE VOLTAGE _____

UNIT SERIAL # 7626 - 1195

1. TESTER'S NAME & CLOCK # R KRAWCZYK # 835 DATE 4/23/60
2. OIL LEVEL OF EACH COMPRESSOR AT 1/2 FULL MARK Full
3. CHECK MOTOR WIRING FOR PROPER PACKAGE VOLTAGE yes
4. CHECK FOR CORRECT ROTATION FOR EACH MOTOR yes
5. STARTING TIME DELAY 90 sec
6. HOURMETER READING 50.5
7. PERFORMANCE

	cc			
	START UP	MID-POINT	CONCLUSION	1 HR. AFTER START LEAKAGE RATE TEST
HOURLMETER	47.2	48.6	50	48.2
OIL PRESSURE	58	42	40	42
MOTOR VOLTAGE-LINES AB	476	485	488	484
LINES AC	478	480	488	488
LINES BC	477	486	477	482
MOTOR AMPERAGE LINE A	16.4	16.8	16.9	16.8
LINE B	16.2	16.6	16.2	16.7
LINE C	15.8	15.6	15.2	15.7
4TH STAGE DISCHARGE PRESS. PSIG	3000	3200	3500	3200
AMBIENT TEMP.	62	64	66	62
BLOWBY	1.35	1.35	1.3	1.35
COMPRESSION R.P.M.	920	920	920	920

8. SYSTEM FREE OF LEAKS yes

continued



K-111-537

9. SET PRESSURE TIME RECORDER TIME AT ACTUAL TIME . . . 3:45 . . .
10. RECORD DATA ONE HOUR AFTER START UP IN STEP 7 ABOVE,
ALSO RECORD THE FOLLOWING DATA. . . 4:45 . . .
- (A) CYCLING TIME BETWEEN DRAINS (20 MIN. PLUS OR MINUS
2 MIN. . . 20 . . . MIN.
- (B) TIME DELAY TO LOAD AFTER COMPRESSOR STARTS.
(30-50 SEC.) . . . 40 . . . SEC.
- (C) AT START, AFTER BOTH COMPRESSORS HAVE LOADED
1. RECEIVER PRESSURE PSIG . . . 0 . . . PSIG
2. RECEIVER TEMPERATURE DEG. F. . . 62 . . . DEG.
3. TIME TAKEN FROM PRESS. TIME
RECORDER . . . 3:45 . . .
- (D) AT 1400 PSIG RECEIVER PRESSURE
1. RECEIVER PRESSURE . . . 1400 . . . PSIG
2. RECEIVER TEMPERATURE . . . 72 . . . DEG.
3. TIME TAKEN FROM PRESS. TIME
RECORDER . . . 4:45 . . .
- (E) AT 3700 PSIG RECEIVER PRESS. (WHEN BOTH COMPRESSORS
STOP)
1. RECEIVER PRESSURE . . . 3700 . . . PSIG
2. RECEIVER TEMPERATURE . . . 91 . . . DEG.
3. TIME TAKEN FROM PRESS. TIME
RECORDER . . . 6:30 . . .
- IF TOTAL CHARGING TIME EXCEEDS 6 HOURS-20 MIN. FOR GRP-1896 OR
4 HOURS - - - - - GRP-1918
NOTIFY FOREMAN BEFORE PROCEEDING.
- (F) 5 HOURS AFTER BOTH COMPRESSORS HAVE STOPPED
1. RECEIVER PRESSURE . . . 3580 . . . PSI
2. RECEIVER TEMPERATURE . . . 74 . . . deg
3. TIME TAKEN FROM PRESS. TIME
RECORDER . . . 11:30 ¹³² . . .
- (G) ELAPSED TIME BETWEEN START-UP AND SHUT DOWN AT 3700 PSIG 2 hr 45 min
- (H) ELAPSED TIME BETWEEN RECEIVER PRESSURE OF 1400 PSIG AND 3700 PSIG.
1 hr 45 min

continued



(I) DROP IN RECEIVER PRESSURE DURING (5) HOUR PERIOD

120 .PS

(J) MAXIMUM ALLOWABLE RECEIVER DROP

ALLOWABLE PRESSURE DROP- - - - -37 PSIG

ADDITIONAL PRESS. DROP CAUSED BY TEMP. CHANGE

6.8 x (RECEIVER TEMP. DROP)- - - - -

118 .PS
2 .PS

(K) RECEIVER PRESS. DROP PER ITEM (I) IS LESS THAN
MAXIMUM ALLOWABLE PER ITEM (J), IF NOT, NOTIFY
FOREMAN BEFORE PROCEEDING.- - - - -

0.54%

11. COMPRESSOR FREE OF OIL LEAKS. *yes*

12. CHECK FOR PROPER OPERATION OF MOMENTARY CONTACT "TEST" BUTTON.

13. CUT-IN PRESSURE SWITCH SETTINGS- - - - - 3500 .PS

14. CUT-OUT PRESSURE SWITCH SETTINGS- - - - - 3700 .PS

15. CONDENSATE EJECTION HEATER CURRENT
COMPRESSOR RANGE 0.5 TO 0.9

16. ALLOW UNIT TO RUN FOR A TOTAL OF 15 HOURS FROM TIME RECORDED
STEP (5) ABOVE. RECORD FOLLOWING AT CONCLUSION.

HOURMETER 50.

OIL PRESSURE 70

MOTOR AMPERAGE LINE A 16.9

LINE B 16.2

LINE C 15.2

MOTOR VOLTAGE LINE AB. 488

LINE AC. 488

LINE BC. 487

4TH STAGE DISCHARGE PRESS. 3500

AMBIENT TEMPERATURE 64

BLOWBY 1.3

COMPRESSOR R.P.M. 920

17. OIL CONSUMPTION (A) OIL ADDED- - - - - 0-30 .OZ.

(B) HOURS RUN- - - - - 20 .HRS.

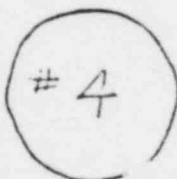
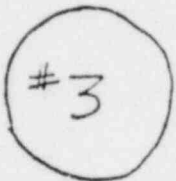
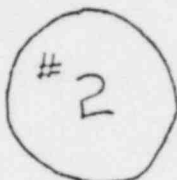
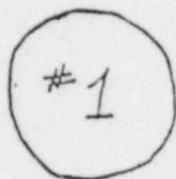
(C) CALCULATE OZ./HR. (.55 OZ./HR) AVG. MAX.) .OZ./HRS

continued



18. CHECK BELT TENSION BY C.A. *yes*
 CLEAN OIL FILTER AND CHECK FOR LEAKS. *yes*
20. CHECK FOR PROPER OPERATION OF LOW OIL PRESS. CUT
 OUT SWITCH. RECORD CUT-OUT PRESS. - - - - - *15* PSIG
21. UNIT PRESERVATION WITH P-10 *yes*
22. RETORQUE BOLTS AND NUTS. *yes*
23. RECORD RECEIVER IDENTICAL BOARD NUMBERS

RECEIVER LOCATION



VIEWED FROM
 SHUT OFF
 VALVE END

#1

34263

#2

34260

#3

#4

FOREMAN'S APPROVAL AND REMARKS

Castillo

4-25-80



K-MP-334

MANUFACTURING PROCEDURE

COMPRESSOR PACKAGE FOR AIR BLAST CIRCUIT BREAKERS

BREAK-IN AND 18 HOUR TEST RUN DATA

1. THIS LOG OF TEST DATA SHALL BE ENTERED IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
 - (A) K-MP-333, BREAK-IN AND 18 HOUR TEST PROCEDURE.
 - (B) K-MP-215, TORQUE VALUES.
2. THIS LOG OF TESTS IS TO ACCOMPANY THE MACHINE THROUGH ALL THE TESTS PERFORMED AND DATA SHALL BE ENTERED AS FOLLOWS:
 - (A) ALL BLANK SPACES MUST BE FILLED IN WITH A FIGURE OR INITIALED, AS SPECIFIED.
 - (B) THE LAST COLUMN OF THE 18 HOUR TEST SHEET MUST BE WITHIN THE SPECIFIED LIMITS EXCEPT WHEN ENGINEERING AUTHORIZES A DEVIATION.
 - (C) ALL OTHER TEST DATA RECORDS MUST BE WITHIN THE SPECIFIED LIMITS EXCEPT WHEN A DEVIATION IS AUTHORIZED BY THE FOREMEN AND INITIALED.
3. UPON COMPLETION OF THIS LOG:
 - (A) ORIGINAL IS TO BE RETAINED BY QUALITY ASSURANCE.
 - (B) COPY IS TO BE SENT TO ENGINEERING.
4. THIS LOG HAS BEEN EXAMINED FOR COMPLETENESS AND ACCURACY AND FOUND TO BE WITHIN LIMITS SPECIFIED WHERE A DEVIATION HAS BEEN AUTHORIZED.
 - (A) FOREMAN'S SIGNATURE J. Castella DATE 5-17-80
 - (B) Q.A. ANALYST SIGNATURE _____ DATE _____

COMPRESSOR SERIAL NUMBER 1111111111

- OVER -



K-MP-334

UNIT BREAK-IN TEST DATA WITHOUT ENCLOSURE (SEE K-MP-233)

WORTHINGTON SALES ORDER # 1-50855 COMPRESSOR SERIAL # 267-C-1192
 MOTOR SERIAL # _____ MOTOR H.P. 10 H.P.
 MOTOR VOLTAGE 220 - 460 UNIT WIRING DIAG. # _____

1. TESTER'S NAME AND CLOCK NO. # 157 T. Lavelle DATE 5-9-1950
 2. SOLENOID VALVE: 240 VOLT
 NAMEPLATE VOLTAGE _____
 3. POWER SUPPLY UNIT TESTED ON (3 PHASE 60 CYCLES) 230 VOLTS
 4. OIL PRESSURE (A) AT START UP..... 48 PSIG.
 (B) PRESSURE GAUGE NEEDLE FLUCTUATION(5 PSIG MAX.) 0 PSIG.
 5. TORQUE 3RD STAGE HEAD 50 FT/LBS..... 570 FT./LB.
 6. TIME DELAY AT START UP (30-50 SECONDS BEFORE COMPRESSOR LOADS) 50 SECONDS
 7. OIL PRESSURE: (A) AFTER 2½ HRS. RUNNING 38 PSIG. (B) PRESS. DROP 10 PSIG.
 (35-50 PSIG) IN 2½ HRS.
 (10 PSIG MAX.)

PERFORMANCE DATA	1-1/2 HR.	1/2 HR.	1/2 HR.	1/2 HR.	1 1/2
HOURLY METER <u>.5</u>	<u>2.</u>	<u>2.5</u>	<u>3.</u>	<u>3.5</u>	<u>4.</u>
1ST STAGE DISCHARGE PRESSURE PSIG	<u>46</u>	<u>49</u>	<u>50</u>	<u>53</u>	<u>52-60</u>
2ND STAGE DISCHARGE PRESSURE PSIG	<u>245</u>	<u>270</u>	<u>300</u>	<u>330</u>	<u>300-400</u>
3RD STAGE DISCHARGE PRESSURE PSIG	<u>680</u>	<u>800</u>	<u>920</u>	<u>1110</u>	<u>1100-1300</u>
4TH STAGE DISCHARGE PRESSURE PSIG	<u>1000</u> 1000	<u>1500</u> 1500	<u>2000</u> 2000	<u>3000</u> 3000	<u>3700</u>
BLOW BY (CFM)	<u>1.32</u>	<u>1.3</u>	<u>1.35</u>	<u>1.25</u>	<u>1.25</u>
COMPRESSOR (RPM) <u>920-950</u>	<u>920</u>	<u>920</u>	<u>920</u>	<u>920</u>	<u>920</u>
CAPACITY (CFM)	<u>11.</u>	<u>11</u>	<u>11</u>	<u>10.8</u>	<u>10</u>

FOREMAN'S APPROVAL AND REMARKS

DATE 5-17-50

9.

(A) HOURMETER					
(B) AMPS (MOTOR)	LINE A	25	25	25	
	LINE B	23	23	23	
	LINE C	21	21	21	
(C) VOLTS	LINE AB	200	200	200	
	LINE AC	200	200	200	
	LINE BC	200	200	200	
(D) 1ST STAGE DISCH. PRESS. PSIG.	RUNNING, MAX. 60	54	54	54	
	DRAINED, 0-30	19	19	19	
(E) 2ND STAGE DISCH. PRESS. PSIG.	RUNNING, MAX. 400	345	345	345	
	DRAINED 35-85	35	35	35	
(F) 3RD STAGE DISCH. PRESS. PSIG.	RUNNING, MAX. 1300	1200	1200	1200	
	DRAINED, 100-250	140	140	140	
(G) 4TH STAGE DISCH. PRESS. PSIG.	RUNNING, MAX. 3750	3650	3650	3650	
	DRAINED, 200-500	310	310	310	
(H) SUCTION TEMPERATURE					
(I) 4TH STAGE DISCH. TEMP.	AMBIENT TEMPERATURE PLUS 320° F. MAX.	55	55	55	
(J) AMBIENT TEMPERATURE		54	54	54	
(K) SHUTTER - OPEN OR CLOSED					
(L) CAPACITY (CFM) 10 CFM MIN. AT 3700 PSIG.		10.5	10.5	10.5	
(M) BLOW BY (CFM) 1.5 CFM AT 3700 PSIG		1.25	1.25	1.25	
(N) COMPRESSOR (RPM) 900-950					



10. HEATER CHECK:

A. SPACE HEATERS 4.9 AMPS 70 VOLTS
 B. COOLER HEATER 3.4 AMPS 200 VOLTS
 C. OIL HEATER 1 AMPS

11. HIGH TEMPERATURE SWITCH CHECK.

INITIALS T.L.

12. RECORD ALL OIL AND AIR LEAKS AND INDICATE WHAT WAS DONE TO CORRECT CONDITION:

13. OIL CONSUMPTION (A) OIL ADDED 0 OZ. (B) HOURS RUN 27 HRS.
 (C) CALCULATE OZ/HR. (.70 OZ. PER HR. AVERAGE MAX.) 0 OZ/HR.

14. CHECK OF PRESSURE SWITCH SETTING AND CONSISTENCY OF OPERATION.

RECORD OPERATIONAL PRESSURE EACH CYCLE

PRESSURE SWITCH	CYCLE #1		CYCLE #2		CYCLE #3	
	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT
PS (3700 PSIG)	3200	3700	3200	3700	3200	3700

15. PISTON BOLT TORQUE _____
 (25 FT./LBS.)

25 FT.LBS.

THIRD STAGE HEAD TORQUE 50 FT. L.
 (50 FT/LBS)

16. SEPARATORS DRAINED _____ TESTER'S INITIALS T.L.17. COMPRESSOR BOLTS AND NUTS TORQUED _____ TESTER'S INITIALS T.L.

18. TUBES & FITTINGS LEAK TIGHT, SECURED, AND INTERFERENCE FREE.

TESTER'S INITIALS T.L.FOREMAN'S APPROVAL AND REMARKS J. Costello DATE 5-17-80

REVISED 5/16/79 RFR/NT



WORTHINGTON COMPRESSORS, INC.
 HOLYOKE, MASSACHUSETTS

MANUFACTURING PROCEDURE
AIR PLANT TEST Y-MP-338

CUSTOMER P.O.# _____ NORTH. SALES ORDER # 1-5285

CUSTOMER SPEC.# _____ PACKAGE VOLTAGE 460

UNIT SERIAL # 767C-1192

1. TESTER'S NAME & CLOCK # For 42, 11/10 DATE 3/12/60
2. OIL LEVEL OF EACH COMPRESSOR AT 1/2 FULL MARK ✓
3. CHECK MOTOR WIRING FOR PROPER PACKAGE VOLTAGE ✓
4. CHECK FOR CORRECT ROTATION FOR EACH MOTOR ✓
5. STARTING TIME DELAY ✓
6. HOURMETER READING 37.
7. PERFORMANCE

	START UP	MID-POINT	CONCLUSION	1 HR. AFTER START LEAKAGE RATE TEST
HOURLMETER	<u>38.9</u>	<u>53.4</u>	<u>50.</u>	<u>41.0</u>
OIL PRESSURE	<u>20</u>	<u>26</u>	<u>36</u>	<u>36</u>
MOTOR VOLTAGE-LINES AB	<u>484</u>	<u>499</u>	<u>498</u>	<u>487</u>
LINES AC	<u>480</u>	<u>481</u>	<u>480</u>	<u>488</u>
LINES BC	<u>489</u>	<u>490</u>	<u>482</u>	<u>485</u>
MOTOR AMPERAGE LINE A	<u>16.5</u>	<u>13.8</u>	<u>16.8</u>	<u>16.6</u>
LINE B	<u>13.7</u>	<u>14.0</u>	<u>12.1</u>	<u>12.5</u>
LINE C	<u>11.2</u>	<u>13.0</u>	<u>12.1</u>	<u>12.1</u>
4TH STAGE DISCHARGE PRESS. PSIG	<u>2200</u>	<u>2200</u>	<u>2340</u>	<u>3800</u>
AMBIENT TEMP.	<u>63</u>	<u>59</u>	<u>70</u>	<u>64</u>
BLOWBY	<u>1.25</u>	<u>1.25</u>	<u>1.24</u>	<u>1.24</u>
COMPRESSION R.P.M.	<u>820</u>			

8. SYSTEM FREE OF LEAKS _____

continued



58

K-MP-537

9. SET PRESSURE TIME RECORDER TIME AT ACTUAL TIME
10. RECORD DATA ONE HOUR AFTER START UP IN STEP 7 ABOVE,
ALSO RECORD THE FOLLOWING DATA.
- (A) CYCLING TIME BETWEEN DRAINS (20 MIN. PLUS OR MINUS 2 MIN. *21*) MIN.
- (B) TIME DELAY TO LOAD AFTER COMPRESSOR STARTS. *Same AS A* *40* SEC.
- (C) AT START, AFTER BOTH COMPRESSORS HAVE LOADED
1. RECEIVER PRESSURE PSIG PSIG
 2. RECEIVER TEMPERATURE DEG. F. DEG.
 3. TIME TAKEN FROM PRESS. TIME RECORDER
- (D) AT 1400 PSIG RECEIVER PRESSURE
1. RECEIVER PRESSURE psig
 2. RECEIVER TEMPERATURE DEG.
 3. TIME TAKEN FROM PRESS. TIME RECORDER
- (E) AT 3700 PSIG RECEIVER PRESS. (WHEN BOTH COMPRESSORS STOP)
1. RECEIVER PRESSURE PSIG
 2. RECEIVER TEMPERATURE DEG.
 3. TIME TAKEN FROM PRESS. TIME RECORDER
- IF TOTAL CHARGING TIME EXCEEDS 6 HOURS-20 MIN. FOR GRP-1896 OR
4 HOURS - - - - - GRP-1918
NOTIFY FOREMAN BEFORE PROCEEDING.
- (F) 5 HOURS AFTER BOTH COMPRESSORS HAVE STOPPED
1. RECEIVER PRESSURE PSIG
 2. RECEIVER TEMPERATURE deg
 3. TIME TAKEN FROM PRESS. TIME RECORDER
- (G) ELAPSED TIME BETWEEN START-UP AND SHUT DOWN AT 3700 PSIG
- (H) ELAPSED TIME BETWEEN RECEIVER PRESSURE OF 1400 PSIG AND 3700 PSIG.

continued



(I) DROP IN RECEIVER PRESSURE DURING (5) HOUR PERIODPS

(J) MAXIMUM ALLOWABLE RECEIVER DROP
ALLOWABLE PRESSURE DROP- - - - -57 PSIG
ADDITIONAL PRESS. DROP CAUSED BY TEMP. CHANGE
6.8 x (RECEIVER TEMP. DROP)- - - - -PS
MAXIMUM ALLOWABLE PRESS. DROP, SUM OF ABOVEPS

(K) RECEIVER PRESS. DROP PER ITEM (I) IS LESS THAN
MAXIMUM ALLOWABLE PER ITEM (J), IF NOT, NOTIFY
FOREMAN BEFORE PROCEEDING.- - - - -

11. COMPRESSOR FREE OF OIL LEAKS. *Same as A*

12. CHECK FOR PROPER OPERATION OF MOMENTARY CONTACT "TEST" BUTTON.

13. CUT-IN PRESSURE SWITCH SETTINGS- - - - -PSI

14. CUT-OUT PRESSURE SWITCH SETTINGS- - - - -PS

15. CONDENSATE EJECTION HEATER CURRENT
COMPRESSOR RANGE 0.5 TO 0.80.6

16. ALLOW UNIT TO RUN FOR A TOTAL OF 15 HOURS FROM TIME RECORDED
STEP (5) ABOVE. RECORD FOLLOWING AT CONCLUSION.

HOURLY METER *58.*

OIL PRESSURE *33*

MOTOR AMPERAGE LINE A *13.2*

LINE B *17.1*

LINE C *13.1*

MOTOR VOLTAGE LINE AB. *488*

LINE AC. *482*

LINE BC. *489*

4TH STAGE DISCHARGE PRESS. *1100*

AMBIENT TEMPERATURE *73*

BLOWBY *1.2*

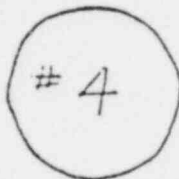
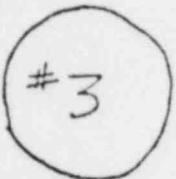
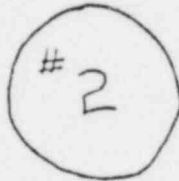
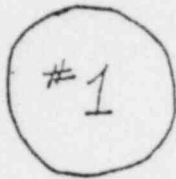
COMPRESSOR R.P.M. *17*

17. OIL CONSUMPTION (A) OIL ADDED- - - - -PS
(B) HOURS RUN- - - - -21.HRS.
(C) CALCULATE OIL/HR. (.55 OZ/HR) AVG. MAX.)OZ/HR



18. CHECK BELT TENSION BY C.A.
19. CLEAN OIL FILTER AND CHECK FOR LEAKS.
20. CHECK FOR PROPER OPERATION OF LOW OIL PRESS. CUT
OUT SWITCH. RECORD CUT-OUT PRESS. - - - - - .PSIG ✓
21. UNIT PRESERVATION WITH P-10
22. RETORQUE BOLTS AND NUTS.
23. RECORD RECEIVER TANTONAL BOARD NUMBERS

RECEIVER LOCATION



VIEWED FRONT
SHUT OFF
VALVE END

#1

33994

#2

34261

#3

34261

#4

FOREMAN'S APPROVAL AND SIGNATURE

5-17-80

J. Costello

A-50022

K-MP-334

MANUFACTURING PROCEDURE

COMPRESSOR PACKAGE FOR AIR BLAST CIRCUIT BREAKERS

BREAK-IN AND 18 HOUR TEST RUN DATA

1. THIS LOG OF TEST DATA SHALL BE ENTERED IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
 - (A) K-MP-333, BREAK-IN AND 18 HOUR TEST PROCEDURE.
 - (B) K-MP-215, TORQUE VALUES.
2. THIS LOG OF TESTS IS TO ACCOMPANY THE MACHINE THROUGH ALL THE TESTS PERFORMED AND DATA SHALL BE ENTERED AS FOLLOWS:
 - (A) ALL BLANK SPACES MUST BE FILLED IN WITH A FIGURE OR INITIALED, AS SPECIFIED.
 - (B) THE LAST COLUMN OF THE 18 HOUR TEST SHEET MUST BE WITHIN THE SPECIFIED LIMITS EXCEPT WHEN ENGINEERING AUTHORIZES A DEVIATION.
 - (C) ALL OTHER TEST DATA RECORDS MUST BE WITHIN THE SPECIFIED LIMITS EXCEPT WHEN A DEVIATION IS AUTHORIZED BY THE FOREMEN AND INITIALED.
3. UPON COMPLETION OF THIS LOG:
 - (A) ORIGINAL IS TO BE RETAINED BY QUALITY ASSURANCE.
 - (B) COPY IS TO BE SENT TO ENGINEERING.
4. THIS LOG HAS BEEN EXAMINED FOR COMPLETENESS AND ACCURACY AND FOUND TO BE WITHIN LIMITS SPECIFIED WHERE A DEVIATION HAS BEEN AUTHORIZED.
 - (A) FOREMAN'S SIGNATURE J. C. Stille DATE 5-17-80
 - (B) Q.A. ANALYST SIGNATURE _____ DATE _____

COMPRESSOR SERIAL NUMBER 767-C-1176

- OVER -



K-MP-334

UNIT BREAK-IN TEST DATA WITHOUT ENCLOSURE (SEE K-MP-233)

WORTHINGTON SALES ORDER # W 50855 COMPRESSOR SERIAL # 767-C-1196
 MOTOR SERIAL # _____ MOTOR H.P. 10
 MOTOR VOLTAGE 230-60 UNIT WIRING DIAG. # _____

1. TESTER'S NAME AND CLOCK NO. #157 T. L. 110 DATE 5-8-80
 2. SOLENOID VALVE: 240 VOLT
 NAMEPLATE VOLTAGE _____
 3. POWER SUPPLY UNIT TESTED ON (3 PHASE 60 CYCLES) 230 VOLTS
 4. OIL PRESSURE (A) AT START UP..... 46 PSIG.
 (B) PRESSURE GAUGE NEEDLE FLUCTUATION(5 PSIG MAX.) 0 PSIG.
 5. TORQUE 3RD STAGE HEAD 50 FT/LBS..... 50 FT./LBS.
 6. TIME DELAY AT START UP (30-50 SECONDS BEFORE COMPRESSOR LOADS) 40 SECONDS
 7. OIL PRESSURE: (A) AFTER 2½ HRS. RUNNING 37 PSIG. (B) PRESS. DROP 9 PSIG.
 (35-50 PSIG) IN 2½ HRS.
 (10 PSIG MAX.)

8. PERFORMANCE DATA	1-1/2 HR.	1/2 HR.	1/2 HR.	1/2 HR.	1 HR.	
HOURMETER	.5	2.	2.5	3.	3.5	4.5
1ST STAGE DISCHARGE PRESSURE PSIG	47	49	51	54	57	52-60
2ND STAGE DISCHARGE PRESSURE PSIG	255	270	270	330	330	300-400
3RD STAGE DISCHARGE PRESSURE PSIG	770	800	810	1130	1130	1100-1150
4TH STAGE DISCHARGE PRESSURE PSIG	1000 1000	1500 1500	2100 2000	3000 3000	3200 3700	3200-3700
BLOW BY (CFM)	1.22	1.35	1.32	1.3	1.2	1.2
COMPRESSOR (RPM) 900-950	910	910	910	910	910	910
CAPACITY (CFM)	11.5	11.1	11.2	11	11.10	11.10

FOREMAN'S APPROVAL AND REMARKS

DATE 5-17-80

9.

(A) HOURMETER					
(B) AMPS (MOTOR)	LINE A	26	26	26	
	LINE B	23	23	23	
	LINE C	27	26	26	
(C) VOLTS	LINE AB	220	220	220	
	LINE AC	220	220	220	
	LINE BC	220	220	220	
(D) 1ST STAGE DISCH. PRESS. PSIG.	RUNNING, MAX. 60	55	55	55	
	DRAINED, 0-30	18	18	18	
(E) 2ND STAGE DISCH. PRESS. PSIG.	RUNNING, MAX. 400	350	350	350	
	DRAINED 35-85	50	50	50	
(F) 3RD STAGE DISCH. PRESS. PSIG.	RUNNING, MAX. 1300	1240	1240	1240	
	DRAINED, 100-250	150	150	150	
(G) 4TH STAGE DISCH. PRESS. PSIG.	RUNNING, MAX. 3750	3700	3700	3700	
	DRAINED, 200-500	500	500	500	
(H) SUCTION TEMPERATURE					
(I) 4TH STAGE DISCH. TEMP.	AMBIENT TEMPERATURE PLUS 320° F. MAX.	377	386	390	
(J) AMBIENT TEMPERATURE		57	66	70	
(K) SHUTTER - OPEN OR CLOSED					
(L) CAPACITY (CFM) 10 CFM MIN. AT 3700 PSIG.		11	11	11	
(M) BLOW BY (CFM) 1.5 CFM AT 3700 PSIG		1.1	1.1	1.1	
(N) COMPRESSOR (RPM) 900-950		910	910	910	



K-MP-334

10. HEATER CHECK:

A. SPACE HEATERS 4.5 AMPS 220 VOLTS
 B. COOLER HEATER 3.2 AMPS 220 VOLTS
 C. OIL HEATER .9 AMPS

11. HIGH TEMPERATURE SWITCH CHECK.

INITIALS T.L.

12. RECORD ALL OIL AND AIR LEAKS AND INDICATE WHAT WAS DONE TO CORRECT CONDITION:

None

13. OIL CONSUMPTION (A) OIL ADDED 0 OZ. (B) HOURS RUN 31.1 HRS.(C) CALCULATE OZ/HR. (.70 OZ. PER HR. AVERAGE MAX.) 0 OZ/HR

14. CHECK OF PRESSURE SWITCH SETTING AND CONSISTENCY OF OPERATION.

RECORD OPERATIONAL PRESSURE EACH CYCLE

PRESSURE SWITCH	CYCLE #1		CYCLE #2		CYCLE #3	
	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT
PS (3700 PSIG)	<u>3400</u>	<u>3700</u>	<u>3400</u>	<u>3700</u>	<u>3400</u>	<u>3700</u>

15. PISTON BOLT TORQUE _____
(25 FT./LBS.)25 FT.LBS.THIRD STAGE HEAD TORQUE _____
(50 FT/LBS)50 FT. LBS.

16. SEPARATORS DRAINED _____

TESTER'S INITIALS T.L.

17. COMPRESSOR BOLTS AND NUTS TORQUED _____

TESTER'S INITIALS T.L.

18. TUBES & FITTINGS LEAK TIGHT, SECURED, AND INTERFERENCE FREE.

TESTER'S INITIALS T.L.FOREMAN'S APPROVAL AND REMARKS T.L. StillDATE 5-17-80

REVISED 5/16/79 RFR/NT


 WORTHINGTON COMPRESSORS, INC.
 HOLYOKE, MASSACHUSETTS

K-MP-337
MANUFACTURING PROCEDURE
AIR PLANT TEST Y-MP-338

CUSTOMER P.O.# _____ WORTH. SALES ORDER # 1-50855

CUSTOMER SPEC.# _____ PACKAGE VOLTAGE 440

UNIT SERIAL # 761-1198

1. TESTER'S NAME & CLOCK # 56 DATE 5/17/82
2. OIL LEVEL OF EACH COMPRESSOR AT 1/2 FULL MARK ✓
3. CHECK MOTOR WIRING FOR PROPER PACKAGE VOLTAGE ✓
4. CHECK FOR CORRECT ROTATION FOR EACH MOTOR ✓
5. STARTING TIME DELAY 31.1
6. HOURMETER READING
7. PERFORMANCE

	START UP	MID-POINT	CONCLUSION	1 HR. AFTER START LEAKAGE RATE TEST
HOURLMETER	48.2	48.8	51.3	48.8
OIL PRESSURE	38	37	37	38
MOTOR VOLTAGE-LINES AB	488	488	488	488
LINES AC	488	488	488	488
LINES BC	488	488	488	488
MOTOR AMPERAGE LINE A	16	16.1	16.1	16.1
LINE B	15.6	16.1	16.1	16.1
LINE C	15.0	16.2	16.3	16.2
4TH STAGE DISCHARGE PRESS. PSIG	3222	3300	3300	3200
AMBIENT TEMP.	63	68	70	64
BLOWBY	1.1	1.1	1.1	1.1
COMPRESSION R.P.M.	921	921	921	921

8. SYSTEM FREE OF LEAKS ✓

continued



9. SET PRESSURE TIME RECORDER TIME AT ACTUAL TIME. 8.00
10. RECORD DATA ONE HOUR AFTER START UP IN STEP 7. ABOVE,
ALSO RECORD THE FOLLOWING DATA.
- (A) CYCLING TIME BETWEEN DRAINS (20 MIN. PLUS OR MINUS
2 MIN. 2.1 MIN.
- (B) TIME DELAY TO LOAD AFTER COMPRESSOR STARTS.
(30-50 SEC.) 4.0 SEC.
- (C) AT START, AFTER BOTH COMPRESSORS HAVE LOADED
1. RECEIVER PRESSURE PSIG 0 PSIG
2. RECEIVER TEMPERATURE DEG. F. 32.3 DEG.
3. TIME TAKEN FROM PRESS. TIME
RECORDER 8.10.0
- (D) AT 1400 PSIG RECEIVER PRESSURE
1. RECEIVER PRESSURE 1400 PSIG
2. RECEIVER TEMPERATURE 68 DEG.
3. TIME TAKEN FROM PRESS. TIME
RECORDER 9.20
- (E) AT 3700 PSIG RECEIVER PRESS. (WHEN BOTH COMPRESSORS
STOP)
1. RECEIVER PRESSURE 3675 PSIG
2. RECEIVER TEMPERATURE 76 DEG.
3. TIME TAKEN FROM PRESS. TIME
RECORDER 11.00
- IF TOTAL CHARGING TIME EXCEEDS 6 HOURS-20 MIN. FOR GRP-1896 OR
4 HOURS - - - - - GRP-1918
NOTIFY FOREMAN BEFORE PROCEEDING.
- (F) 5 HOURS AFTER BOTH COMPRESSORS HAVE STOPPED
1. RECEIVER PRESSURE 3625 PSIG
2. RECEIVER TEMPERATURE 75 DEG.
3. TIME TAKEN FROM PRESS. TIME
RECORDER 4.00
- (G) ELAPSED TIME BETWEEN START-UP AND SHUT DOWN AT 3700 PSIG 3.00
- (H) ELAPSED TIME BETWEEN RECEIVER PRESSURE OF 1400 PSIG AND 3700 PSIG.
1.40

continued



(I) DROP IN RECEIVER PRESSURE DURING (5) FOUR PERIOD

50

(J) MAXIMUM ALLOWABLE RECEIVER DROP
ALLOWABLE PRESSURE DROP - - - - - 37 PSIG
ADDITIONAL PRESS. DROP CAUSED BY TEMP. CHANGE
6.8 x (RECEIVER TEMP. DROP) - - - 14.2 - -
MAXIMUM ALLOWABLE PRESS. DROP, SUM OF ABOVE

37

27.2

64.2

(K) RECEIVER PRESS. DROP PER ITEM (I) IS LESS THAN
MAXIMUM ALLOWABLE PER ITEM (J), IF NOT, NOTIFY
FOREMAN BEFORE PROCEEDING. - - - - -

11. COMPRESSOR FREE OF OIL LEAKS.
12. CHECK FOR PROPER OPERATION OF MOMENTARY CONTACT "TEST" BUTTON.

13. CUT-IN PRESSURE SWITCH SETTINGS - - - - -

14. CUT-OUT PRESSURE SWITCH SETTINGS - - - - -

15. CONDENSATE EJECTION HEATER CURRENT
COMPRESSOR RANGE 0.5 TO 0.9

16. ALLOW UNIT TO RUN FOR A TOTAL OF 15 HOURS FROM TIME RECORDED
STEP (5) ABOVE. RECORD FOLLOWING AT CONCLUSION.

HOURLY METER 52.1

OIL PRESSURE 37

MOTOR AMPERAGE LINE A 16.2

LINE B 16.1

LINE C 16.3

MOTOR VOLTAGE LINE AB. 482

LINE AC. 489

LINE BC. 481

4TH STAGE DISCHARGE PRESS. 2200

AMBIENT TEMPERATURE 76

BLOWBY 1.1

COMPRESSOR R.P.M. 22

17. OIL CONSUMPTION (A) OIL ADDED - - - - -
(B) HOURS RUN - - - - -
(C) CALCULATE OZ./HR. (.55 OZ./HR) AVG. MAX.) 217 OZ. HRS.
OZ./HR.

continued



- CHECK BELT TENSION BY C.A.
19. CLEAN OIL FILTER AND CHECK FOR LEAKS.
20. CHECK FOR PROPER OPERATION OF LOW OIL PRESS. CUT
OUT SWITCH. RECORD CUT-OUT PRESS. - - - - - .PSIG
21. UNIT PRESERVATION WITH P-10
22. RETORQUE BOLTS AND NUTS.
23. RECORD RECEIVER NATIONAL BOARD NUMBERS

RECEIVER LOCATION

#1

#2

#3

#4

VIEWED FROM
SHUT OFF
VALVE END

#1
33,000

#2
34,000

#3
74,261

#4

FOREMAN'S APPROVAL AND SIGNATURE

DATE 5-18-80

[Signature]



K-MP-334

MANUFACTURING PROCEDURE

COMPRESSOR PACKAGE FOR AIR BLAST CIRCUIT BREAKERS
BREAK-IN AND 18 HOUR TEST RUN DATA

1. THIS LOG OF TEST DATA SHALL BE ENTERED IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
 - (A) K-MP-333, BREAK-IN AND 18 HOUR TEST PROCEDURE.
 - (B) K-MP-215, TORQUE VALUES.
2. THIS LOG OF TESTS IS TO ACCOMPANY THE MACHINE THROUGH ALL THE TESTS PERFORMED AND DATA SHALL BE ENTERED AS FOLLOWS:
 - (A) ALL BLANK SPACES MUST BE FILLED IN WITH A FIGURE OR INITIALED, AS SPECIFIED.
 - (B) THE LAST COLUMN OF THE 18 HOUR TEST SHEET MUST BE WITHIN THE SPECIFIED LIMITS EXCEPT WHEN ENGINEERING AUTHORIZES A DEVIATION.
 - (C) ALL OTHER TEST DATA RECORDS MUST BE WITHIN THE SPECIFIED LIMITS EXCEPT WHEN A DEVIATION IS AUTHORIZED BY THE FOREMEN AND INITIALED.
3. UPON COMPLETION OF THIS LOG:
 - (A) ORIGINAL IS TO BE RETAINED BY QUALITY ASSURANCE.
 - (B) COPY IS TO BE SENT TO ENGINEERING.
4. THIS LOG HAS BEEN EXAMINED FOR COMPLETENESS AND ACCURACY AND FOUND TO BE WITHIN LIMITS SPECIFIED WHERE A DEVIATION HAS BEEN AUTHORIZED.
 - (A) FOREMAN'S SIGNATURE [Signature] DATE 4-25-80
 - (B) Q.A. ANALYST SIGNATURE _____ DATE _____

COMPRESSOR SERIAL NUMBER 767-C-1175

- OVER -



K-MP-334

UNIT BREAK-IN TEST DATA WITHOUT ENCLOSURE (SEE K-MP-233)

WORTHINGTON SALES ORDER # A-50856 COMPRESSOR SERIAL # 767-1175
 MOTOR SERIAL # _____ MOTOR H.P. _____
 MOTOR VOLTAGE 230/420 UNIT WIRING DIAG. # _____

1. TESTER'S NAME AND CLOCK NO. # 157 T. Lavelle DATE 5-20-1980
 2. SOLENOID VALVE: 240 VOLT
 NAMEPLATE VOLTAGE _____
 3. POWER SUPPLY UNIT TESTED ON (3 PHASE 60 CYCLES) 220 VOLT
 4. OIL PRESSURE (A) AT START UP..... 54 PSIG.
 (B) PRESSURE GAUGE NEEDLE FLUCTUATION(5 PSIG MAX.) 0 PSIG.
 5. TORQUE 3RD STAGE HEAD 50 FT/LBS..... 50 FT./LBS.
 6. TIME DELAY AT START UP (30-50 SECONDS BEFORE COMPRESSOR LOADS) 42 SECS.
 7. OIL PRESSURE: (A) AFTER 2½ HRS. RUNNING 48 PSIG. (B) PRESS. DROP 6 PSIG.
 (35-50 PSIG) IN 2½ HRS.
 (10 PSIG MAX.)

8. PERFORMANCE DATA	1-1/2 HR.	1/2 HR.	1/2 HR.	1/2 HR.	1/2 HR.
HOURMETER	<u>1.5</u>	<u>2.</u>	<u>2.5</u>	<u>3.</u>	<u>3.5</u>
1ST STAGE DISCHARGE PRESSURE PSIG	<u>48</u>	<u>50</u>	<u>52</u>	<u>53</u>	<u>55</u> 52-60
2ND STAGE DISCHARGE PRESSURE PSIG	<u>254</u>	<u>275</u>	<u>270</u>	<u>315</u>	<u>340</u> 300-400
3RD STAGE DISCHARGE PRESSURE PSIG	<u>660</u>	<u>790</u>	<u>700</u>	<u>1080</u>	<u>1100</u> 1100-1200
4TH STAGE DISCHARGE PRESSURE PSIG	<u>1000</u> 1000	<u>1500</u> 1500	<u>2000</u> 2000	<u>3000</u> 3000	<u>3700</u> 3700
BLOW BY (CFM)	<u>1.4</u>	<u>1.2</u>	<u>1.3</u>	<u>1.3</u>	<u>1.2</u>
COMPRESSOR (RPM) 900-950	<u>900</u>	<u>900</u>	<u>900</u>	<u>900</u>	<u>900</u>
CAPACITY (CFM) 900-950	<u>11.4</u>	<u>11.2</u>	<u>11.3</u>	<u>11.3</u>	<u>11.0</u>

FOREMAN'S APPROVAL AND REMARKS

DATE 4-25-80

9.

(A) HOURMETER					
(B) AMPS (MOTOR)	LINE A	26	26	26	
	LINE B	26	26	26	
	LINE C	26	26	26	
(C) VOLTS	LINE AB	220	220	220	
	LINE AC	220	220	220	
	LINE BC	220	220	220	
(D) 1ST STAGE	RUNNING, MAX. 60	54	54	54	
	DISCH. PRESS. PSIG. DRAINED, 0-30	20	20	20	
(E) 2ND STAGE	RUNNING, MAX. 400	355	355	355	
	DISCH. PRESS. PSIG. DRAINED 35-85	60	60	60	
(F) 3RD STAGE	RUNNING, MAX. 1300	1170	1170	1170	
	DISCH. PRESS. PSIG. DRAINED, 100-250	150	150	150	
(G) 4TH STAGE	RUNNING, MAX. 3750	3750	3750	3750	
	DISCH. PRESS. PSIG. DRAINED, 200-500	400	400	400	
(H) SUCTION TEMPERATURE					
(I) 4TH STAGE	AMBIENT TEMPERATURE				
DISCH. TEMP.	PLUS 320° F. MAX.	394	400	406	
(J) AMBIENT TEMPERATURE		74	80	86	
(K) SHUTTER - OPEN OR CLOSED					
(L) CAPACITY (CFM) 10 CFM MIN. AT 3700 PSIG.		11.4	11.3	11.3	
(M) BLOW BY (CFM) 1.5 CFM AT 3700 PSIG.		1.2	1.1	1.1	
(N) COMPRESSOR (RPM) 900-950		920	920	920	



10. HEATER CHECK:

A. SPACE HEATERS 4.8 AMPS 220 VOLTS
 B. COOLER HEATER 3.4 AMPS 220 VOLTS
 C. OIL HEATER 1. AMPS

11. HIGH TEMPERATURE SWITCH CHECK.

INITIALS T.L.

12. RECORD ALL OIL AND AIR LEAKS AND INDICATE WHAT WAS DONE TO CORRECT CONDITION:

NO LEAKS

13. OIL CONSUMPTION (A) OIL ADDED 0 OZ. (B) HOURS RUN 91 HRS.
 (C) CALCULATE OZ/HR. (.70 OZ. PER HR. AVERAGE MAX.) 0 OZ/HR

14. CHECK OF PRESSURE SWITCH SETTING AND CONSISTENCY OF OPERATION.

RECORD OPERATIONAL PRESSURE EACH CYCLE

PRESSURE SWITCH	CYCLE #1		CYCLE #2		CYCLE #3	
	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT
PS (3700 PSIG)	3350	3700	3350	3700	3350	3700

15. PISTON BOLT TORQUE 25 FT.LBS. (25 FT./LBS.) THIRD STAGE HEAD TORQUE 50 FT. LB. (50 FT/LBS)

16. SEPARATORS DRAINED YES TESTER'S INITIALS T.L.

17. COMPRESSOR BOLTS AND NUTS TORQUED YES TESTER'S INITIALS T.L.

18. TUBES & FITTINGS LEAK TIGHT, SECURED, AND INTERFERENCE FREE.

TESTER'S INITIALS T.L.

FOREMAN'S APPROVAL AND REMARKS [Signature] DATE 7-25-80

RECEIVED 5/16/79 RFR/NT



WORTHINGTON COMPRESSORS, INC.
 HOLYOKE, MASSACHUSETTS

APPENDIX F

PHOENIX ELECTRIC CORP.

TEST AND INSPECTION REPORT

BROWN BOVERI CORPORATION PNEUMATIC CONTROL CABINET

CUSTOMER/CONTRACT NO. VIRGINIA ELECT. & POWER CO. JOB NO. 12050.47

DRAWING NO. 6BB 80-4-004, 80-4-003

BBC ORDER NO. 1128-1P PEC ORDER NO. 1128

CABINET SERIAL NUMBER: 1128-1P READY FOR SHIPMENT: 5-29-80

TESTS AND INSPECTION

	INITIALS	DATE
1. General Assembly inspection	<u>Jma</u>	<u>5-27-80</u>
2. Adjust LP pressure switch and leak test manifold	<u>N/A</u>	<u>—</u>
- attach detailed test sheet		
3. Adjust HP pressure switch and leak test manifold	<u>Jma</u>	<u>5-28-80</u>
- attach detailed test sheet		
4. Leak test main piping	<u>Jma</u>	<u>5-27-80</u>
5. Valve Operation	<u>Jma</u>	<u>5-27-80</u>
6. Heater Resistance	<u>Jma</u>	<u>5-28-80</u>
<u>CHA</u> <u>314</u> OHM <u>CHB</u> <u>318</u> OHM		
7. Check marking strips in place on terminal blocks	<u>Jma</u>	<u>5-28-80</u>
8. Check component nametags in place	<u>Jma</u>	<u>5-28-80</u>
9. Point to point wiring check	<u>Jma</u>	<u>5-28-80</u>
10. High voltage test control wire	<u>Jma</u>	<u>5-28-80</u>
11. All openings in piping and cabinet closed		



PHOENIX ELECTRIC CORP.

TEST REPORT

PRESSURE SWITCHES

~~63-HP~~ 63-HP

Switch	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
Designation	<u>63RA</u>	<u>63NA</u>	<u>63RB</u>	<u>63NB</u>	_____	_____	_____	_____
Set Press. (Falling)	<u>2070</u>	<u>2140(R)</u>	<u>2070</u>	<u>2140(R)</u>	_____	_____	_____	_____
Sw. Opens/Closes	<u>CL</u>	_____	_____	_____	_____	_____	_____	_____
Reset Press. (Rising)	<u>2100</u>	<u>2110</u>	<u>2100</u>	<u>2110</u>	_____	_____	_____	_____
Differential	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	_____	_____	_____	_____
Actual Set	<u>2070</u>	<u>2140(R)</u>	<u>2070</u>	<u>2140(R)</u>	_____	_____	_____	_____
Actual Reset	<u>2100</u>	<u>2115</u>	<u>2090</u>	<u>2110</u>	_____	_____	_____	_____

(LP) Common - 2 NC (no press.) - 3 NO (no press.) - 1

(HP) Common - (P) Purple - (BR) Brown

NC (w/o pressure) - (B) Blue - (O) Orange

NO (w/o pressure) - (R) Red - (Y) Yellow

REMARKS: LEAK TEST - OK - JMA 5-28-80

CUSTOMER: (G-BB) FOR U.E.R.CO. P.E.C. ORDER NO.: 1128

DATE: 5-28-80 BY: JMA

CABINET SERIAL NO.: 1128-1P

PHOENIX ELECTRIC CORP.

TEST AND INSPECTION REPORT

BROWN BOVERI CORPORATION PNEUMATIC CONTROL CABINET

CUSTOMER/CONTRACT NO. VIRGINIA ELECT. + POWER CO. JOB NO. 12050.47

DRAWING NO. GBB 80-4-003, 80-4-004

BBC ORDER NO. _____

PEC ORDER NO. 1128

CABINET SERIAL NUMBER: 1128-2P

READY FOR SHIPMENT: 5-29-80

TESTS AND INSPECTION

1. General Assembly inspection
2. Adjust LP pressure switch and leak test manifold
- attach detailed test sheet
3. Adjust HP pressure switch and leak test manifold
- attach detailed test sheet
4. Leak test main piping
5. Valve Operation
6. Heater Resistance

INITIALS

DATE

Jma

5-29-80

NA

Jma

5-29-80

Jma

5-29-80

Jma

5-29-80

Jma

5-29-80

CHA 298 OHM

CHB 315 OHM

7. Check marking strips in place on terminal blocks
8. Check component nametags in place
9. Point to point wiring check
10. High voltage test control wire
11. All openings in piping and cabinet closed

Jma

5-29-80

Jma

5-29-80

Jma

5-29-80

Jma

5-29-80



PHOENIX ELECTRIC CORP.

63-LP/63-HP

TEST REPORT

PRESSURE SWITCHES

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
Switch								
Designation	<u>63RA</u>	<u>63NA</u>	<u>63RB</u>	<u>63NB</u>	—	—	—	—
Set Press. (Falling)	<u>2070</u>	<u>2140(R)</u>	<u>2070</u>	<u>2140(R)</u>	—	—	—	—
Sw. Opens/Closes	<u>CL</u>	—	—	—	—	—	—	—
Reset Press. (Rising)	<u>2100</u>	<u>2110</u>	<u>2100</u>	<u>2110</u>	—	—	—	—
Differential	—	—	—	—	—	—	—	—
Actual Set	<u>2070</u>	<u>2140(R)</u>	<u>2070</u>	<u>2140(R)</u>	—	—	—	—
Actual Reset	<u>2100</u>	<u>2115</u>	<u>2095</u>	<u>2110</u>	—	—	—	—

(LP) Common - 2 NC (no press.) - 3 NO (no press.) - 1

(HP) Common - (P) Purple - (BR) Brown

NC (w/o pressure) - (B) Blue - (O) Orange

NO (w/o pressure) - (R) Red - (Y) Yellow

REMARKS: LEAK TEST OK JMC

CUSTOMER: GBB FOR V.E.P. CO.

P.E.C. ORDER NO.: 1128

DATE: 5-29-80

BY: J M Altoni

CABINET SERIAL NO.: 1128-2P



APPENDIX G

9

VEPCO ELECTRIC AND POWER COMPANY

80-0456

Generator Breaker Addition

DESIGN CHANGE NO 80-S45E, G & H

REVISION NO

REVIEWED BY
PROJECT ENGINEER

P. H. Griffin

DATE
1/21/81

REVIEWED BY DESIGN
CONTROL ENGINEER

J. J. Terminiella

DATE
1/21/81

REVIEWED BY
ENGINEERING SUPERVISOR

J. J. Terminiella

DATE
1/22/81

REVIEWED BY STATION NUCLEAR SAFETY AND OPERATING COMMITTEE

CHAIRMAN'S SIGNATURE

W. R. Cartwright

DATE
1/22/81

FIELD CHANGE DESCRIPTION THE DESCRIPTION SHALL CONSIST OF REASON FOR CHANGE AND DESCRIPTION OF CHANGE

1.0 REASON FOR CHANGE

TO INCORPORATE THE FINAL DESIGN TESTING SECTION AND SCOPE OF TESTING REQUIREMENTS TO DESIGN CHANGE PACKAGE DC - 80-S45E, G & H

2.0 DESCRIPTION OF CHANGE

REFER TO ATTACHED FINAL DESIGN TESTING SECTION WHICH INCLUDES TEST MATRIX AND SPECIAL TEST PROCEDURES (AS REQUIRED).

3.0 All testing will be coordinated with the Brown Boveri representative, Vepco Instrument, and Vepco Electric Shops. All special testing by Vepco Automation and Control, Vepco Electric Equipment Specialists will be coordinated through the Stone & Webster Advisory Operations Test Engineer.

4.0 Vepco QA to witness all Special Test Procedures.

QA Review:

W. R. Cartwright 1/22/81

FINAL DESIGN TESTING PROCEDURE CONSISTS OF:

<u> X </u>	MECHANICAL TESTING	<u> X </u>	ELECTRICAL TESTING
<u> </u>	CHEMICAL TESTING	<u> A </u>	INSTRUMENT TESTING

1.0 PURPOSE

The purpose of this testing procedure is to ensure the acceptability of the above-mentioned design installed in accordance with Controlling Procedure No. DC-80-S45E, G & H.

2.0 REFERENCES

- 2.1 Final Design Controlling Procedure No. DC-80-S45E, G, & H
- 2.2 VEPCO "Accident Prevention Manual"
- 2.3 NAS-1009 "Specification for Piping and Mechanical Equipment", Sections 4.1 and 4.2
- 2.4 NAS-1010 "Specification for Electrical Installation", Sections 4.3, 4.4 and 4.5
- 2.5 NAS-1011 "Installation of Instrumentation", Sections 3.1, 3.2, 3.3, 3.4 and 3.5
- 2.6 AT-TAP-1 - Administrative Procedure for the Performance of the Station Projects Test Program
- 2.7 AT-TEP-1 - Insulation Resistance Measurements Electrical Equipment
- 2.8 AT-TEP-2 - Control Circuitry Checkout/Initial Energization of Electrical Equipment
- 2.9 AT-TEP-3 - Medium and Low Voltage Switchgear
- 2.10 AT-TEP-5 - Molded Case Circuit Breakers and Motor Overload Relays
- 2.11 AT-TEP-7 - A-C Electric Motors
- 2.12 AT-TEP-9 - 480 Volt Motor Control Centers
- 2.13 AT-TEP-10 - Annunciator and Sequence-of-Events Systems
- 2.14 AT-TEP-11 - Machinery Vibration Analysis
- 2.15 AT-TEP-12 - Station Computer

- 2.16 AT-TIP-1 - Instruments and Controls Circuit Installation Checkout
- 2.17 AT-TIP-2 - Instruments and Controls Mechanical Installation Checkout
- 2.18 AT-TIP-3 - Instruments and Controls Functional Loop Checkout
- 2.19 AT-TIP-5 - Instrument Leak Test
- 2.20 AT-TMP-3 - Pump Head Curve Verification
- 2.21 AT-TMP-4 - Hydrostatic Testing
- 2.22 Veeco Instrument Calibration Procedures
- 2.23 Veeco Electrical Checkout/Calibration Procedures
- 2.24 Vendor Instruction Manuals
 - 2.24.1 Brown Boveri - Self-Contained Water Cooling Plant DRK-80
 - 2.24.2 Brown Boveri - Generator Circuit Breaker
 - 2.24.3 Worthington Compressor Plant

3.0 INITIAL CONDITIONS

- 3.1 Cables, conductors, and/or electrical components installation completed in accordance with Final Design Procedure.
- 3.2 Instruments, process piping, supply air and installation completed in accordance with Final Design Procedure.
- 3.3 Mechanical equipment, piping changes and additions completed in accordance with Final Design Procedure.
- 3.4 Communications have been established between work stations.

3.5 *Measuring and Test Equipment used during these tests shall be in current calibration **

4.0 PRECAUTIONS

- 4.1 All tests are to be performed in compliance with VEPCO Accident Prevention Manual and applicable OSHA requirements.
- 4.2 Observe VEPCO's tagging procedure.
- 4.3 Notify Shift Supervisor prior to testing.
- 4.4 Notify VEPCO QC prior to testing. The equipment in this design change is safety related and is not Tech. Spec. related. Minimum coverage for QC Inspection of testing is detailed in AT-TAP-1.

* *Some Test Equipment used by VEPCO's Equipment Department may not be included in a formal recognized calibration program. This is acceptable.*

MC 1/22/01

TESTING PROCEDURE

- 4.5 All Generator Breaker testing to be done under the direction of a Brown Boveri representative.
- 4.6 Breaker opening and closing is very loud - ear protection is required and is to be used by test personnel.

5.0 INSTRUCTIONS

5.1 Electric Cables and Buswork

- 5.1.1 Each electrical cable shall be tested in accordance with Sections 4.3, 4.4 and 4.5 of NAS-1010. Testing is documented and signed off on Cable Termination Ticket.
- 5.1.2 Each isophase bus duct shall be "Megger" and Hi-Potential tested by the Vepco Electrical Department and documented in accordance with Vepco Procedures. Status of this testing shall be detailed on Test Matrix.

5.2 Control Circuits

- 5.2.1 Each electrical control circuit shall be tested in accordance with AT-TEP-1 (Section 8.8) and AT-TEP-2.

5.3 Initial Energization of Electrical Equipment and Instrument Power Feeds (other than rotating equipment)

- 5.3.1 Each power feed shall be tested in accordance with AT-TEP-1 (Section 8.7) and AT-TEP-2 (Section 8.10).

5.4 Transformers

- 5.4.1 Each transformer shall be tested in accordance with AT-TEP-1 (Section 8.6).

5.5 Circuit Breakers and Motor Overloads

- 5.5.1 Each molded case circuit breaker shall be tested in accordance with AT-TEP-5 (Sections 8.4, 8.10 and 8.11).
- 5.5.2 Each motor control center circuit breaker shall be tested in accordance with AT-TEP-5 (Sections 8.4, 8.9 and 8.11).
- 5.5.3 Each overload relay shall be tested in accordance with AT-TEP-5 (Sections 8.4 and 8.8).

Generator Breaker Addition

80-S45E, G & H

APPENDIX B - FINAL DESIGN CONTINUING PROCEDURE

TESTING PROCEDURE

5.6 A-C Electric Motors

- 5.6.1 Each motor shall be tested in accordance with AT-TEP-1 (Sections 8.3 or 8.4) and AT-TEP-7.

5.7 480 Volt Motor Control Centers

- 5.7.1 Each 480 volt motor control center cubicle shall be tested in accordance with AT-TEP-1 (Section 8.2.4) and AT-TEP-9 (Section 8.2).

5.8 Annunciator and Sequence-of-Events System

- 5.8.1 Each annunciator window and field input shall be tested in accordance with AT-TEP-10 (Sections 8.6 and 8.7).
- 5.8.2 Each sequence-of-events point shall be tested in accordance with AT-TEP-10 (Section 8.7).

5.9 Machinery Vibration Analysis

- 5.9.1 Each piece of rotating equipment with a continuous rating shall be tested in accordance with AT-TEP-11.

5.10 Station Computer

- 5.10.1 Each computer input point (address point) shall be checked in accordance with AT-TEP-12.

5.11 Electric Heaters

- 5.11.1 Each electric heater circuit shall be tested in accordance with AT-TEP-1 (Section 8.9) and AT-TEP-2 (Section 8.10).

5.12 Instrument and Controls Circuit Installation Checkout

- 5.12.1 All instrumentation - electrical - and electronic circuits and accessories shall be tested in accordance with AT-TIP-1.

5.13 Instrument and Controls Mechanical Installation Checkout

- 5.13.1 Each instrument, and its associated piping, mounts, racks and accessories shall be tested in accordance with AT-TIP-2.

5.14 Instrument and Controls Functional Loop Checks

- 5.14.1 Each instrument loop shall be tested in accordance with AT-TIP-3.

5.15 Instrument Leak Test

- 5.15.1 Each instrument which is piped to a primary or secondary system shall be tested in accordance with AT-TIP-5.

5.16 Pump Head Curve Verification

- 5.16.1 Pump performance shall be tested in accordance with AT-TMP-3.

5.17 Hydrostatic Tests

- 5.17.1 Each hydrostatic test shall be performed in accordance with AT-TMP-4.

5.18 Special Requirements/Procedures

- 5.18.1 Test Procedure - "Generator Breaker - Air Compressor Plant"
- 5.18.2 Test Procedure - "Generator Breaker - Water Cooling Plant"
- 5.18.3 Test Procedure - "Generator Breaker - Breaker Poles Phase A, B, C"
- 5.18.4 Copy of Brown Boveri on site test report to be attached to Design Change Package when completed.

5.19 Instrument Calibration and Functional Testing

- 5.19.1 All instrument calibration and functional testing shall be performed by the Vepco Instrument Department and documented in accordance with Vepco Procedures. Status of Calibration and Functional testing shall be detailed on Test Matrix.

5.20 Electrical Calibration

- 5.20.1 Calibration of all protection relays (including PT's, CT's) shall be performed by the Vepco Electrical Equipment and/or Automation and Control Department and documented in accordance with Vepco Procedures. Status of calibration shall be detailed on Test Matrix.

6.0 ACCEPTANCE CRITERIA

- 6.1 The acceptance criteria for each test are as stated in the applicable testing procedure.
- 6.2 The Test Data and Matrix have been reviewed and verified all referenced testing complete and satisfactory.

Reviewed by: *[Signature]* Date: _____
Design Control Engineer

- 6.3 Test Data for referenced Design Change has been reviewed and found complete.

Reviewed by: _____ Date: _____
Vepco QA

GENERATOR BREAKER - AIR COMPRESSOR PLANT

INITIALS/DATE

1.0 PURPOSE

- 1.1 The purpose of this Field Change is to provide instructions for the start-up, test and operating procedure for the Generator Breaker Air Compressor Plant.

2.0 INITIAL CONDITIONS

- 2.1 Notify the Vepco Quality Control Department prior to commencing work.
- 2.2 The Unit is in Mode 2 or lower.
- 2.3 Notify the Shift Supervisor on duty of the impending work and coordinate all activities through him.
- 2.4 Vepco Instrumentation and Electrical Departments to be notified to provide technicians to provide testing support to the Brown Boveri representative, and to make all necessary Functional Calibrations.
- 2.5 Where ^{applicable per 1-22-81} possible, Station Approved Test Procedures will be used to obtain test data.

3.0 PRECAUTIONS

- 3.1 Ensure that both compressor cubicles are clear and ready for testing.

4.0 INSTRUCTIONS

- 4.1 Record Serial Numbers

A # CA-SEF-KJXX

B # SAME

- 4.2 Hour meter before start

A 52.1

B 58.0

DBP 1-27-81

DBP 1-27-81

DBP 1-27-81

DBP 1-27-81

DBP 1-27-81

DBP 1-27-81

DBP 1-27-81

DBP 1-27-81

DBP 1-27-81

INITIALS/DATE

GBP 1-27-81

GBP 1-27-81

GBP 1-27-81

GBP 1-27-81

GBP 1-27-81

GBP 1-27-81

GBP 1-27-81

GBP 1-27-81

4.3 Close Breaker, energize Compressor.

4.4 Motor Current

A 10.89 AMPS

B 10.08 AMPS

4.5 Oil Pressure

A 38.5 PSI Cold 57 PSI

B 37 PSI 58 PSI

4.6 Cycle timer operates every

A 20 MIN.

B 19 MIN.

4.7 Dump Valve opens

A 37 SEC.

B 43 SEC.

4.8 Ambient Temperature

A 83.3 °F.

B 83.3 °F.

4.9 Compressor tubicle inside temperature after one (1) hour running time.

A 141 °F.

B 141 °F.

4.10 Shutters open at

A 98-100 °F.

B 94.7 °F.

INITIALS/DATE

OSP 1-27-81

4.11 Measured pumping capacity as per AT-TMP-3
DC-80-S45G.

A 10.58 CU/FT

B 10.58 CU/FT

OSP 1-27-81

4.12 Size of Air-Receiver

A 17.5 CU/FT

B SAME CU/FT

OSP 1-27-81

4.13 Time, pressure and temperature at start of test

A 8:50 PM 36.90 PSI 83 °F

B same

OSP 1-28-81

4.14 Time, pressure and temperature at stop of test

A 9:00 PM 35.90 PSI 87 °F Δ P. 20 PSI

B same

OSP 1-27-81

4.15 Oil Pressure switch operates between 12 and
15 PSI.

A 12.5 PSI

B 13 PSI

OSP 1-27-81

4.16 Pressure switches - Compressor start

A 34.50 PSI

B 32.50 PSI

OSP 1-28-81

4.17 Compressor Stop

A 36.90 PSI

B 35.10 PSI

OSP 1-28-81

4.18 Leakage rate: Delta P Abs/24 Hours

A 43.8 PSI

B same PSI

INSTRUMENT/DATE

IT-1 1-27-81

4.19 Leakage rate -

Start Time

A 5:50 PM

B same

DATE

A 1-27-81

B same

TEMPERATURE (T1)

A 83 °F.

B same °F.

IT-2 1-28-81

4.20 Leakage Rate -

Stop Time

A 9:00 AM

B same

DATE

A 1-28-81

B same

TEMPERATURE (T2)

A 87 °F.

B same °F.

Delta P (Pressure)

A 20 PSI

B same PSI

INITIALS/DATE

1-28-81

4.21 Calculations

$$\Delta P (\text{temp}) = \frac{P (\text{abs}) (T_1 - T_2)}{273 + T_1}$$

$$\Delta P (\text{abs}) = P \text{ Total} - P (\text{temp})$$

A 43.8 PSI

B Same PSI

1-28-81

4.22 Veeco QC has witnessed the above tests and
~~approve same.~~ 3-27-81

QC Sign W. G. Harris Date 3-27-81

4.23 Remarks

GENERATOR BREAKER - WATER COOLING PLANT

INITIALS/DATE

1.0 PURPOSE

- 1.1 The purpose of this procedure is to provide instructions for the check-out and testing of the DRK-80 Water Cooling Skid for Generator Breaker Package.

2.0 INITIAL CONDITIONS

- 2.1 Notify the Vepco Quality Control Department prior to commencing test.
- 2.2 The Unit is in Mode 2 or lower.
- 2.3 Notify the Shift Supervisor on duty of the impending test and coordinate all activities through him.
- 2.4 Vepco Instrument and Electrical Departments to be notified to provide technicians to provide testing support to the Brown Boveri representative, and to make all necessary Functional Calibrations.
- 2.5 Where ^{applicable 7/5/81} possible, Station Approved Test Procedures will be used to obtain test data.

3.0 PRECAUTIONS

- 3.1 Ensure that all Fittings and Local Instruments are tightened down, and that all water hose terminations have been completed. Do not run pump even for a short time without water.

4.0 INSTRUCTIONS

- 4.1 Record serial number of Unit.

HA188

5.0 INITIAL START-UP

- 5.1 Fill the breaker circuit with D.I. water and check that breaker water circuit is clean.

LRP 1-25-81

LRP 1-25-81

LRP 1-25-81

LRP 1-25-81

LRP 1-25-81

LRP 1-25-81

LRP 1-25-81

LRP 1-25-81

LRP 1-27-81

INITIALS/DATE

GBP 1-25-81

GBP 1-25-81

GBP 1-27-81

GBP 1-27-81

GBP 1-27-81

GBP 1-26-81

GBP 1-26-81

6.0 Energize Water Cooling Plant - reference AT-TMP-4 DC-80-S45B.

6.1 Main power voltage check

Nom value 480V

Actual value measured 480 V

6.2 Check that both control circuits have voltage

Nom value 125V

Actual value measured 125 V

6.3 Check DC control voltage

Nom value 25 VDC

Actual value measured 28 VDC

6.4 Energize and check pumps for proper operation and rotation - reference AT-TMP-4 DC-80-S45B.

6.5 Load - Motor A 4.3 AMP

Load - Motor B 4.25 AMP

7.0 Test pressure and leakage rate - reference AT-TMP-4 DC-80-S45B.

7.1 Pressurize system to 230 PSI.

Record - Start time (T1) 12:55 MIN/HR

Temperature 82 °F

Pressure 230 PSI

7.2 Maintain the test pressure as per Hydro Static Test AT-TMP-4 DC-80-S45B and C.

Record - Stop Time (T2) 1:05 MIN/HR

Temperature 82 °F

Pressure 230 PSI

Total Hydro Time (T1) - (T2)

INITIALS/DATE

DAP 1-26-81

8.0 Check setting of measuring and controlling devices -
to be done by vendor representative from Brown Boveri.

9.0 Check outlet water flow from circuit breaker.

DAP 1-26-81

9.1 Pole A

Nom flow 6 GPM

Measured flow 6.6 GPM

DAP 1-26-81

9.2 Pole B

Nom flow 6 GPM

Measured flow 6.6 GPM

DAP 1-26-81

9.3 Pole C

Nom flow 6 GPM

Measured flow 6.6 GPM

DAP 1-26-81

9.4 Breaker Enclosure -

Nom flow 6 GPM

Measured flow 6.6 GPM

10.0 Conductivity Checks

DAP 2-2-81

10.1 Conductivity First Signal -

Nom 2 $\mu\text{S}/\text{CM}$

Actual 2 $\mu\text{S}/\text{CM}$

DAP 2-2-81

10.2 Conductivity Alarm -

Nom - Set 7 $\mu\text{S}/\text{CM}$

Actual 7 $\mu\text{S}/\text{CM}$

DAP 2-2-81

10.3 Measurement of Conductivity Failed

Nom .1 MA

Actual .4 MA

INITIALS/DATE

11.0 Compensating Tank

DWP 1-27-81

11.1 High alarm switch setting six (6) inches from top of tank.

Alarm setting 6 INCHES

DWP 1-27-81

11.2 Low alarm switch setting 16 inches from top of tank.

Actual setting 16 INCHES

12.0 Temperature checks of Breaker Cooling System at full load (100% Power).

DWP 4-27-81

12.1 Pole A

Outlet Temp - Nom 113 °F

Actual Temp 92 °F

DWP 4-27-81

12.2 Pole B

Outlet Temp - Nom 113 °F

Actual Temp 92 °F

DWP 4-27-81

12.3 Pole C

Outlet Temp - Nom 113 °F

Actual Temp 92 °F

13.0 Raw water to cooling plant at full load - reference AT-TMP-4 DC-80-S45B.

DWP 4-27-81

13.1 Quantity of water at full load.

Nom flow rate 48 GPM

Actual flow rate 48 GPM

DWP 4-27-81

13.2 Inlet Temperature raw water.

Max Temp 104 °F

Actual Temp 70 °F

INITIALS/DATE

DJP 4-27-81

13.3 Outlet temperature raw water.

Max temp 113 °F

Actual temp 75 °F

DJP 4-27-81

13.4 Inlet pressure - raw water.

Max press 110 PSIG

Actual press 35 PSIG

DJP 4-27-81

13.5 Pressure drop through raw water side.

Nom 2.9 PSI

Actual 3 PSI

DJP 3-26-81

14.0 All thermostat set points are to be set and verified by the vendor representative from Brown Boveri.

DJP 3-26-81

14.1 Copy of the on site Brown Boveri test report to be attached.

DJP 5-12-81

15.0 Vepco QC has witnessed the above tests and approve same. FJJ 5/12/81

QC Sign

Date

5/12/81

16.0 Remarks

GENERATOR BREAKER - BREAKER POLES PHASE A - B - C

INITIALS/DATE

1.0 PURPOSE

- 1.1 The purpose of this test procedure is to provide instructions for the start-up, test and commissioning of the Brown Boveri circuit breakers.

2.0 INITIAL CONDITIONS

- 2.1 Notify the Vepco Quality Control Department prior to commencing test.
- 2.2 The Unit is in Mode 2 or lower.
- 2.3 Notify the Shift Supervisor on duty of the impending test and coordinate all activities through him.
- 2.4 Vepco Instrument and Electrical Departments to be notified to provide technicians to provide testing support to the Brown Boveri representative, and to make all necessary Functional Calibrations.
- 2.5 Where ^{applicable FTT-22-81} possible, Station Approved Test Procedures will be used to obtain test data.
- 2.6 *Measuring and Test Equipment used during these tests shall be in current calibration FTT-22-81*

3.0 PRECAUTIONS

- 3.1 Inspect breaker poles for damage during installation.
- 3.2 Clean breaker, remove any dust, dirt or debris resulting from installation work.
- 3.3 Clean tubular contact assemblies of isolator and relubricate with silicone grease DC55M.
- 3.4 Check whether fixed bearings are welded to guide rails.
- 3.5 Check ground connections.
- 3.6 Make sure all tubing and hose connections are properly tightened.

JNP 1-28-81

JNP 1-28-81

JNP 1-28-81

JNP 1-28-81

JNP 1-28-81

JNP 1-28-81

JNP 1-28-81

JNP 1-28-81

JNP 2-2-81

JNP 2-24-81

JNP 1-28-81

JNP 1-28-81

INITIALS/DATE

1-28-81

283P 1-28-81

3.7 Make sure that water drains plugs on low-pressure receivers, high pressure receivers and resistor chamber receivers are closed.

3.8 Make sure that test personnel have ear protection and that unnecessary personnel are clear of the breakers.

4.0 INSTRUCTIONS

283P 1-28-81

4.1 Record serial numbers of each Pole.

A # HA 1885645

B # HA 1885644

C # HA 1885643

283P 1-28-81

4.2 Trip counter before testing.

999 61 Counter Indication

283P 1-28-81

4.3 Control voltage to breaker control cabinet is OFF.

283P 1-28-81

4.4 Close shut-off valves (high and low pressure inlet to control cabinet and drain valves).

283P 1-28-81

4.5 Turn on Air Compressor Plant and charge storage cylinders to normal pressure and wait for pressure and temperature to settle.

5.0 Pressurizing the Breaker Poles

283P 1-28-81

5.1 Pressurize H.P. receivers on breakers to approximately 725 PSIG.

283P 1-28-81

5.2 Check all H.P. lines and joints for leaks.

283P 1-28-81

5.3 Pressurize H.P. receivers to full pressure approximately 2132 PSIG (gradual escalation).

283P 1-28-81

5.4 Switch on Control Voltage

INITIALS/DATE

DBP 1-28-81

5.5 Pressurize L.P. receivers on breakers to approximately 75 PSIG. To do this the pressure switch in Control Cabinet must be depressed.

DBP 1-28-81

5.6 Check all L.P. lines and joints for leaks.

DBP 1-28-81

5.7 Open low-pressure discharge valve (drain valve) and lower pressure to approximately 22 PSIG. Repeat this filling and emptying sequence four (4) times.

DBP 1-28-81

5.8 Pressurize breaker to operating pressure. The pressure on the high-pressure side must not fall below two-thirds of its normal value of 2130 PSI. When this is done, wait for about fifteen minutes before pressurizing further. If necessary, the breakers must be brought up to operating pressure in stages. The pressure switch 63LP must remain depressed until automatic refill begins.

6.0 Check-out of Low Pressure, Pressure Switches

DBP 1-30-81

6.1 The low pressure switch monitors the breaker blocking pressure. The breaker is in the "OPEN" position. Breaker L.P. tank is at 423 PSIG.

DBP 1-30-81

6.2 Close low pressure inlet to Control Cabinet.

DBP 1-30-81

6.3 Slowly open L.P. discharge valve. This will permit taking pressure readings to verify pressure switch settings.

OPERATING PRESSURE	8 POLE PRESSURE SWITCH	CONTACT	CHECK INITIAL
423 PSIG	Replenishing valve closes	MRP(C-0) Y	428 PSI
416 PSIG	Replenishing valve opens	MRP1(C-0) E	417 "
412 PSIG	Closing command is blocked	MCP C	410 "
324 PSIG	Replenishing valve closes	MRP (0) F	329 "
317 PSIG	Replenishing valve opens	MRP1(0) X	319 "
313 PSIG	Opening command is blocked	MRP1 A	309 + PSI
313 PSIG	Opening command is blocked	MRP2 b	310 + PSI
	Reserve, adjustable, as required	Z	

INITIALS/DATE

OSP 2-2-81

6.4 The pressure switch setting must also be carried out with slowly rising pressure. The values may then be up to 4.4 PSIG higher than stated in the table. The switches are pre-set at factory. If a deviation is indicated, switches are to be set under the direction of the Brown Boveri representative. Deviations of $\pm 1\%$ of maximum scale value are acceptable.

OSP 2-2-81

6.5 The two H.P. pressure switches (Bourbon-tube switches) monitor the high-pressure blocking pressures. The switches are adjusted at the factory. Any changes of settings will be done under the direction of the Brown Boveri representative.

OPERATING PRESSURE	HIGH-PRESSURE SWITCH (BOURDON TUBE - SWITCH)	CONTACT		CHECK/ INITIALS
2060 PSIG	Blocking Open 1	MTP1	A	2050 PSI
2060 PSIG	Blocking Open 11	MTP2	b	2050 PSI
2060 PSIG	Blocking Close	MCP	C	2050 PSI
	RESERVE, ADJUSTABLE AS REQUIRED	MT	X	

OSP 2-2-81

6.6 The check must be repeated with slowly rising pressure. The value can be up to 36.3 PSIG higher.

7.0 Checking of minimum closing and opening pressures, and electrically controlled trial switching operations. Times and pressures are to be recorded.

OSP 1-31-81

7.1 Determine minimum pressure for closing and opening. Measure opening time ("T1") from control command to "OPEN" and SOV until separation of arcing contact using appropriate test equipment supplied by Vepco Electric Equipment Specialists. Measure delay time (T2) from separation of arcing contact to separation of tubular contact assembly. Check blast time (T3) from separation of arcing contact to closure of arcing contact. Check pneumatic delay (T4) from separation of arcing contact to separation of contacts in both resistor chambers.

INITIALS/DATE

C.O. 1-31-81

7.2 Measure close time (T5) from control command to "Close" coils of master control valve "Close" and SOV until closure of arcing contact. Measure delay time (T6) from separation of arcing contact until separation of contacts in both resistor chambers. Measure closing time (T7) from control command to coils until separation of tubular contact assembly. Measure closing time (T8) from control command to coils until separation of arcing contact. Check blast time (T9) between separation and closure of arcing contact.

DBP 1-31-81

7.3 Check opening delay (T open delay). The opening time delay is set on the two time relays and is 350 m/Sec, during this time the pressure in the breaker poles must rise above the blocking pressure, so that opening can take place.

ELECTRICALLY TRIAL SWITCHING OPERATION						
PHASE	PRESSURE PSIG	TRIP NOMINAL 1-2 VALUE MS	DELAY TIMES OF THE OPENING POLES			
			C-0 MS-#1	TRIP II	C-0 MS-#2	O-0 MS
A	425	300-320	310	305		N/A
B	"	"	310	305		N/A
C	"	"	311	305		N/A
A-B	NORMAL	N/A	299	299		238
A-C	CRITICAL	N/A	"	"		"
B-C	PRESSURE	N/A	"	"		"

8.0 Checking enforced simultaneous action

DBP 1-31-81

8.1 If the three poles do not operate simultaneously, the poles open following a time lag. The time lags are measured at the operating pressure. To do this, interrupt the electrical close and open leads, according to the sequence specified by the Brown Boveri representative.

9.0 Measuring air consumption and re-fill times of each pole

INITIALS/DATE

DJP 2-1-81

9.1 Before and after switching, the pressure gauge reading must not be taken until the receiver air has regained ambient temperature (approximately five (5) minutes). Calculate air consumption as follows:

DJP 2-1-81

(a) Operations close or normal open
Air consumption = pressure drop LP x breaker pole Volume LP

DJP 2-1-81

(b) Operation short-circuit open
Air consumption = pressure drop LP x breaker pole volume LP
+ pressure drop HP x HT receiver volume

DJP 2-1-81

(c) Operation Close - Open (C-O)
Air consumption = pressure drop LP x breaker pole volume LP + pressure drop LP x breaker pole volume LP
+ pressure drop HP x HP receiver volume

DJP 2-1-81

9.2

OPERATION	INITIAL PRESSURE	AIR CONSUMPTION IN CU. FT.
CLOSE	APPROX 423 PSIG	APPROX 88.5 - 102.5 CU. FT.
OPEN	APPROX 325 PSIG	70.5 - 84.5 CU. FT.
OPEN SHORT - C	APPROX 325/508 PSIG	99 - 106 CU. FT.
C-O	APPROX 423 PSIG	194 - 205 CU. FT.

Breaker Pole Vol. LP = 17.1 CU. FT.
HP receiver volume = .35 CU. FT.

DJP 2-3-81

9.3

RE-FILL TIME 3 PHASES	NOMINAL VALUE IN SEC.	UNLOCKED SEC	SERVICE PRESSURE	STARTING PRESSURE
CLOSE	NO REFILL	N/A	350 PSI	425 PSI
OPEN	10-60	NO. 1000 45 REFILL	330 PSI	330 PSI
CLOSE/OPEN	10-60	330 PSI	330 PSI	330 PSI

INITIALS/DATE

11.0 Testing for leaks

BRP 1-31-81

11.1 All joints in compressed air lines on breaker poles and control cabinet, and also the supporting insulator flanges must be checked for leaks.

BRP 1-31-81

11.2 Permissible loss from breaker is 7 PSIG in 10 hours.

BRP 1-31-81

11.3 Permissible loss from enclosure is .7 PSIG in five (5) minutes. To check the enclosure for leaks the breaker pole must be under service pressure and fully enclosed.

BRP 2-1-81

11.4 Pressure drop - low pressure side 10 hour test.

BREAKER POSITION O-C	NOMINAL PRESSURE PSIG	READINGS				
		DATE	HOUR	TEMP ° F	PRESSURE PSIG	ENG INITIALS
CLOSED	420 PSIG	1-31-81	1800	77	418 PSI	BRP
CLOSED	420 PSIG	2-1-81	0900	71	410	BRP
LOSS			15 hr.	6°	8 PSI	BRP
OPEN						
OPEN		N/A	N/A	N/A	N/A	
LOSS						

$$15 \text{ hr. } \Delta p_T = \text{L.P. } 4.2 \text{ PSI.}$$

$$15 \text{ hr. } \Delta p_{\text{abs}} = \text{L.P. } 3.8 \text{ PSI}$$

INITIALS/DATE

2-1-81 ADP

11.5 Pressure drop - high pressure side - one hour test.

BREAKER POSITION O-C	NOMINAL PRESSURE PSIG	READINGS				
		DATE	HOUR	TEMP °F	PRESSURE PSIG	ENG INITIALS
CLOSED	2100	1-31-81	1800	77	2070	ADP
CLOSED	2100	2-1-81	0900	71	1985	ADP
LOSS	2100	2-1-81	1500	6°	85	ADP
OPEN						
OPEN		N/A	N/A	N/A	N/A	
LOSS						

15 hr. $\Delta P = H/2$

15 hr. ΔP ab: 63 PSI

= $63 \div 15$ hr.

= 4.2 PSI/hr.

12.0 Final Checks

ADP 1-31-81

ADP 2-26-81

ADP 1-31-81

ADP 2-11-81

ADP 2-13-81

12.1 Remove all measuring leads and testing equipment.

12.2 Confirm that Veeco Automation and Control have completed testing.

12.3 Confirm that Veeco Electric Equipment Specialist has completed testing.

12.4 Reconnect flexible connections for reverse current and main current. All contact surfaces of aluminum are to be treated in the following manner immediately prior to fitting:

- Remove oxide film with wire brush. First grease brush or contact surface lightly with silicone grease DC55M. Always complete treatment of one surface before starting on the next. Contact surfaces to be joined must be bottled together immediately after treatment, and the joint covered with contact grease. Whenever the joints are disconnected the contact surfaces must be treated again in the manner described.

INITIALS/DATE

LRJ 2-13-81

LRP 2-13-81

LRP 2-13-81

(b) Silvered contact surfaces must be cleaned before fitting and treated with silicone grease DC55M.

12.5 One set of strip chart data for time settings will be attached to this procedure after time testing is completed.

12.6 One copy of the Brown Boveri test report will be attached to this procedure after testing is completed.

13.0 Vepco QC has witnessed the above test and approve
~~same~~ FJJ 1-22-81

QC Sign W. J. Harris Date 2-27-81

14.0 Remarks

AT - TEST

MARK NO.	CKT. NO. / PWR. SUPPLY	1	2	3	4	5	6	7	8	9	10	11	12
1-EP-CB-300	1-EP-100-22												
POWER FEED	GIL (90M)												
1-EP-CB-200	1-EP-CB-120												
G.E. CONTROL	#15												
PNL POWER FEED	AND 1-EP-CB-124												
GEN. BKR. G12 CONTROL	1SPGN07 8A0, 8AE												
	1-EP-CB-200												
	FU-1, 2, 4, 6												
GEN. BKR. CTR. PNL.	1SPGNK003 BKR. 5												
HTR.	1-EP-CB-300												
	ESK 1.44.2												
GEN. PNL. LITE/RECP.	FU-3												
	ESK 1.44.2												
GEN. PNL. ALARM PNL.	1-EP-CB-200												
	FU5												
VLV. REDUCT. CAB. CKT A	1SPGNK001												
	1-EP-CB-100												
1-EP-CB-201	#24												
	ESK 1.44.2.4												
VLV. REDUCT. CAB. CKT B	1SPGNK001												
	#24												
1-EP-CB-201	1-EP-CB-100												
	ESK 1.44.2.4												
AIR COMP. FEED TO	1-EP-CB-300												
	1SPGNK002												
ACB-A&B	#1												
1-EP-CB-202													
COMPRESSOR MOTOR A	1-EP-CB-202												
	ACB-A												
	CONTROL CKT												
	TN-A/FU-B												
	ESK-1.44.7												

REFTESTED 3-16-81

- REMARKS: 1. ANNUNCIATOR AND COMPUTER X-REF'S SHOWN ABOVE, AS REQUIRED.
 2. R - INDICATES RETEST REQUIRED.
 3. NAMEPLATE DATA ONLY.
 4. COMMON BREAKER (ONE TEST ONLY)

80-S45E-2 2023
 80-S45G-2 2235
 80-S45H-2 1730 16

INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH

PREPARED BY D. Croy DATE 1-20-81

REVIEWED BY TAC DATE 5/17/81

AWR

TEST MATRIX: ELECTRICAL

D.C.P. 80-S45E, G & H

M 2 OF 12

AT - TEP

EQUIP. MARK NO.	CKT.NO./ PWR.SUPPLY	1 2 3 4S 4D 5 7U 7C 8U 8C 9 11U 11C										
		1	2	3	4S	4D	5	7U	7C	8U	8C	9
COMPRESSOR "A" HTR'S HA	1-EP-CB-202 ACB-A											
THRU HK	TN-A/FU-C ESK 1.44.7											
COMPRESSOR MOTOR "B"	1-EP-CB-202 ACB-B											
	CONTROL CKT TN-B/FU-B											
	ESK-1.44.7											
COMPRESSOR "B"	1-EP-CB-202 ACB-B											
HTRS. HA THRU HK	TN-B/FU-C ESK-1.44.7											
G.B. COOL SKID	1-EP-CB-300 #2											
1-EP-CB-203 SUPPLY #1												
AND CONTROL T1												
G.B. COOL SKID	1-EP-CB-300 #4											
1-EP-CB-203 SUPPLY #2												
& CONTROL T2												
COOL PUMP D88A	1-EP-CB-203 SUPPLY 1/											
	BKR 8A CONT CKT BKR 8e											
	ESK-1.44.32											
COOL PUMP D88B	1-EP-CB-203 SUPPLY 2/											
	BKR 8b CONTROL CKT											
	BKR 8e ESK-1.44.32											

REMARKS: 1. ANNUNCIATOR AND COMPUTER X-REF'S SHOWN ABOVE, AS REQUIRED.
 2. R - INDICATES RETEST REQUIRED.
 3. NAMEPLATE DATA ONLY.

INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH

80-S45E-3
 80-S45G-1
 80-S45H-1

PAGE 29 of 39

PREPARED BY D. Crov

DATE 1-20-81

REVIEWED BY *[Signature]*

DATE 5/17/81

EQUIP. MARK NO.	INT. NO. / PWR. SUPPLY	1 2 3 4 5 6 7 8 9 10 11 12													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
COOL SKID CONTROL C	1-EP-CB-203 T1														
INSTRUMENT CKTS.	1-EP-CB-203 T2														
	1-EP-CB-203 8C														
	1-EP-CB-203 8d														
	1-EP-CB-203 8g														
	1-EP-CB-203 8h														
	1-EP-CB-203 8k														
	1-EP-CB-203 8M														
	1-EP-CB-203 8N														
	1-EP-CB-203 8P														
	1-EP-CB-203 8Q														
	1-EP-CB-203 8r														
	1-EP-CB-203 8S														
	1-EP-CB-203 8T														
	1-EP-CB-203 8U														
	1-EP-CB-203 8Y														
	1-EP-CB-203 8Z														
	1-EP-CB-203 8aa														
	1-EP-CB-203 8ab														

REMARKS: 1. ANNUNCIATOR AND COMPUTER X-REF'S SHOWN ABOVE, AS REQUIRED.
2. R - INDICATES RETEST REQUIRED.

80-S45E-3-23
80-S45G-1-235
80-S45H-1-33616

AWL

INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH

PREPARED BY D. Croy DATE 1-20-81

PAGE 30 of 39

REVIEWED BY *Pat H. Galt* DATE 3/28/81

galt
3-28

11

[illegible]

- REMARKS: 1. ANNUNCIATOR AND COMPUTER X-REF'S SHOWN ABOVE, AS REQUIRED.
2. R - INDICATES RETEST REQUIRED.

80-S45E-3
80-S45G-4
80-S45H-1

INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH

PREPARED BY D. Crov DATE 1-20-81

REVIEWED BY *M. E. J.* DATE *3/25/81*

PAGE 31 of 39

ANNUNCIATOR: SEQUENCE OF SELF-TESTING: AT-TER-10

COMPUTER: AT-TER-10

ANN. WINDOW	ANN. POINT	11.2-3	11.3	SELF-TEST EVENT INPUT	11.2-4	X-REF	A.P. NO.	11.3	X-REF
1H-50	667	3/1/81				1	R Y2835D	4-2-91	
1H-48	668	3/1/81		NEW		2	R Y7835D	5-12-91	B
1E-21	669	3/1/81		NEW		3	Y2835D	4-2-91	C
1E-9	43	NA	3/1/81			4	R Y2835D	4-2-81	D
1E-17	44	NA	3/1/81			5	R Y7836D	5-12-91	E
1E-25	45	NA	3/1/81			6	Y9004D	5-12-91	F
1E-1	46	NA	3/1/81			7	Y4112D		
1E-2	47	NA	3/1/81			8			
1H-33	421	PWR 3/17/81	DBP 3/17/81			9			
				388 121	gap	10			
				(AWR EC-6X5)	2-24-91				
				187	gap	11			
				186	2-24-91				
1K-35	461	3/17/81	3/17/81			12			
1K-43	462	3/17/81	3/17/81			13			
1B-44	670	3/17/81	3/17/81	NEW		14			
1B-11									
1K-63	671	3/17/81	3/17/81	NEW		15			
1J-46	601	3/18/81	3/18/81	WAS 1H-48	PSH-CW111				
				113	gap 3-24-91	16			

REMARKS: 1. R - INDICATES RETEST REQUIRED.

*** - VISUAL CHECK - AND PRINT OUT CHECK DONE.
AWAITING APPROVAL OF A NEW TEST PROCEDURE.

INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH

80-S45E-3/22 23
80-S45G-1/22 35
80-S45H-1/22 16

PREPARED BY D. Crov DATE 1-20-81

REVIEWED BY DATE

PAGE 32 of 39

3/25/81

SEQUENCE OF EVENTS RECORDED: AT-TEP-10

COMPUTER AT-TEP-10

ANN.	ANN. POINT	11.2-3	11.3	SEQ/EVENT INPUT	11.2-4	X-REF
1GB-7	1100	3/10/81	2-1-81			16
1GB-17	1101	3/10/81	2-1-81			17
1GB-2	1102	3/10/81	2-1-81			18
1GB-9	1103	3/10/81	2-1-81			19
1GB-10	1104	3/10/81	2-1-81			20
1GB-18	1105	3/10/81	2-1-81			21
1GB-3	1106	3/10/81	2-1-81			22
1GB-5	1107	3/10/81	2-1-81			23
1GB-13	1108	3/10/81	2-1-81			24
1GB-20	1109	3/10/81	2-1-81			25
1GB-4	1110	3/10/81	2-1-81			26
1GB-12	1111	3/10/81	2-1-81			27
1GB-11	1112	3/10/81	2-1-81			28
1GB-6	1113	3/10/81	2-1-81			29
1GB-22	1114	3/10/81	2-1-81			30
1GB-23	1115	3/10/81	2-1-81			31
1GB-21	1116	3/10/81	2-1-81			32
1GB-24	1117	3/10/81	2-1-81			33
1GB-19	1118	3/10/81	2-1-81			34

A.P. NO. 11.3 X-REF

REMARKS: 1. R - INDICATES RETEST REQUIRED (ALL NEW POINTS)

80-S45E-2 28 23
80-S45G-1 32 35
80-S45H-1 17 30 16

INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH

PREPARED BY D. Crov DATE 1-20-81
REVIEWED BY [Signature] DATE 2/26/81

ANNUNCIATOR SEQUENCE OF EVENTS RECORDED AT-TER-10

COPIES

ANN. WINDOW	ANN. POINT	11.2-3	11.3	SEQ/EVENT INPUT	11.2-4	X-REF
1GB-15	1119	NEW	NEW	NEW		35
1GB-16	1120	NEW	NEW	NEW		36
1GB-7	1121	NEW	NEW	NEW		37
1GB-8	1122	NEW	NEW	NEW		38
1GB-14	1123	NEW	NEW	NEW		39
1H-4	665	NEW	NEW	NEW		40
1H-57	666	NEW	NEW	NEW		41
				113	80H 3-24-81	42
1B-34	469	NEW	NEW	WAS 1H-4		ESK-6PV-1-2, 3
2D-49	366	NEW	NEW			ESK 10AAZ
2H-50	667	NEW	NEW	NEW		43
				081	80H 4-1-81	ESK 10DAA
				088	80H 4-1-81	
				089	80H 4-1-81	
				082	80H 4-1-81	
				090	80H 4-1-81	
				093	80H 4-1-81	
				094	80H 4-1-81	

REMARKS: 1. R - INDICATES RETEST REQUIRED.

* POINT TO BE RETESTED AS PER FIELD CHANGE TC
COME AT LATER DATE. NOT REQUIRED, 7680-S45E-3 2023 16
80-S45G-1 2235
80-S45H-1 72816 AWR

INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH

PREPARED BY D. Crov DATE 1-20-81
REVIEWED BY 16 DATE

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INSTR. NO.	AT-727					CMT. NO.	REP	FUNC.	CAL.	REMARKS (INITIALS, DATE, & COMMENTS)
	1	2	3	4	5					
										23 24 25 26 27
GB-002	1-26-81	1-26-81						2-27-81	2-27-81	24 25 26
GB-003	1-26-81	1-26-81						2-27-81	2-27-81	24 25 26
GB-004	1-26-81	1-26-81						2-27-81	2-27-81	24 25 26
GB-005	1-26-81	1-26-81						2-27-81	2-27-81	24 25 27
GB-006	1-26-81									24
GB-007	1-26-81							2-27-81	2-27-81	24 25 32 34
GB-008	1-30-81	1-26-81						2-27-81	2-27-81	24 33
GB-009	1-30-81	1-26-81						2-27-81	2-27-81	24 28
GB-010	1-30-81	1-26-81						2-27-81	2-27-81	24 29 39
GB-011	1-30-81	1-26-81						4-1-81	4-1-81	24 35 37
GB-012	1-30-81	1-26-81						4-1-81	4-1-81	24 36 38
GB-013	1-30-81	1-26-81						2-27-81	2-27-81	24 16
GB-014	1-30-81	1-26-81						2-27-81	2-27-81	24 16
GB-015	1-30-81	1-26-81						2-27-81	2-27-81	24 17
GB-016	1-30-81	1-26-81						2-27-81	2-27-81	24 22
GB-017	1-30-81	1-26-81						2-27-81	2-27-81	
GB-018	1-30-81	1-26-81						2-27-81	2-27-81	
GB-019	1-30-81	1-26-81						2-27-81	2-27-81	19 20 21
GB-020	1-30-81	1-26-81						4-1-81	4-1-81	

REMARKS: R - INDICATES RETEST REQUIRED

80-S45E-3 ~~23~~
 80-S45G-7 ~~32~~ ~~35~~
 80-S45H-7 ~~16~~

INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH

PREPARED BY D. Crov DATE 1-20-81
 REVIEWED BY [Signature] DATE

ANR

AT - TEP

EQUIP. MARK NO.	CKT. NO./ PWR. SUPPLY												
		1	2	2	3	4S	4D	5	7U	7C	3U	8C	9
		11-111-2											11U
													11C
R	SYNC. CKT	1SYGN01 8A	2/1/81	2/1/81									
R	GEN. PCB 11	1SPGA01 8AA	2/10/81	2/10/81									
R	GEN. PCB 10 1C	1SPGB01 8AA	2/20/81	2/20/81									
R	GEN. PROT. CKT.	1SPGN01 FE-21D	2/25/81	2/25/81									
R	GEN. B/U CKT.	1SPGN02 FE-21D	2/26/81	2/26/81									
R	GEN. PNL.	1SYGN01 8B	2/27/81	2/27/81									
R	GEN. PCB INTLK. REL.	1SPGN04 11B (E) (D)	2/27/81	2/27/81									
R	GEN. BKR. FAIL. CKT.	1SPGN05 #2-FE-21Y	2/25/81	2/25/81									
		1-EP-CB-12D #16											
R	GEN. ISO PHASE	1SPGN06 FE-21Y (#2)	2/25/81	2/25/81									
R	B/U GND. FAULT												
R	SWYD AUX RELAY	1YYFN01 FE-21Y (#2)	2/27/81	2/27/81									
R	EXIT. FIELD BKR. CONT	1EXPNO1 FE-21F	2/27/81	2/27/81									
R	MAIN TRANS PROTECT	1SPMN01 FE-21D	2/25/81	2/25/81									
R	SS TRANS 1A PROTECT	1SPSA01 FE-21D	2/25/81	2/25/81									
R	SS TRANS 1B PROTECT	1SPSB01 FE-21D	2/25/81	2/25/81									
R	SS TRANS 1C PROTECT	1SPSC01 FE-21D	2/25/81	2/25/81									
R	LINE DIFF. CKT	1SPLN01 FE-21D	2/25/81	2/25/81									
R	TURB. SOL. TRIP CKT.	1TMAN01 9A	2/25/81	2/25/81									
R	B/U TURB. SOL TRIP CKT	1TMAN02 9B	2/25/81	2/25/81									

REMARKS: 1. ANNUNCIATOR AND COMPUTER X-REF'S SHOWN ABOVE, AS REQUIRED.

2. R - INDICATES RETEST REQUIRED.

*3 - COMMON BREAKER (ONE TEST ONLY)

80-S45E-3 23

80-S45G-3 23

80-S45H-1 316

INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH

PREPARED BY D. Crow

DATE 1-20-81

REVIEWED BY [Signature]

DATE 3/28/81

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[illegible]

REMARKS: 1. ANNUNCIATOR AND COMPUTER X-REF'S SHOWN ABOVE, AS REQUIRED.
2. R - INDICATES RETEST REQUIRED.
3. HI-POTENTIAL TEST REQUIRED - REFERENCE SPECIAL TEST PROCEDURES.
* VEP CO A&C TO PROVIDE DATA. 80-S45E-3 2023 NG
* * Field Change X35 80-S45G-7 2235 DWR
INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH 80-S45H-7 1/16

PREPARED BY D. Crov DATE 1-20-81
REVIEWED BY W DATE

PAGE 38 OF 39

3/25/81

TEST MATRIX: MECHANICAL, AND/OR SPECIAL TEST PROCEDURES

EQUIPMENT/SYSTEM SUBSYSTEM/BOUNDARY	AT-TMP			FSOP	*	RATIO TEST ING OF CT'S			HI-PO		
	2	3	4								
CT-A											
CT-B											
CT-C											
ISOPHASE BUS DUCT											
"A" PHASE											4/1 3-9-81
"B" PHASE											4/1 3-9-81
"C" PHASE											4/1 3-9-81
GENERATOR BREAKER COOLING SKID PUMPS											
PUMP D-88A		2-9-81									
PUMP D-88B		2-9-81									
* TIMING AND SEQUENCING OF BREAKERS											
BREAKER "A"						BNP 2-9-81					
BREAKER "B"						BNP 2-9-81					
BREAKER "C"						BNP 2-9-81					

REMARKS: 1. R - INDICATES RETEST REQUIRED.

* - Testing to be done by the Vepco Electric Equipment Specialist.

80-S45E-3

80-S45G-3

80-S45H-1

3023
3235
16
AWC

INCLUDES ORIGINAL D.C.P. AND FIELD CHANGES THROUGH

PREPARED BY D. Croy DATE 1-20-81

PAGE 39 OF 39

REVIEWED BY Phyllis Thaler DATE 2/28/81

APPENDIX H

North Anna Preventive Maintenance - Mechanical		PM Code M-10-C/A-15	Page _____
System	Component Compressor	Related PM (s)	
PM Description Compressor on Generator Breaker		Reference(s) 1. Worthington Compressor Manuel	
Initial Conditions and Precautions 1. Adhere to Vepco Accident Prev. Manual 2. Initiate a Tagging Report and Radiation Work Permit when required 3. Adhere to NPSQAM, Sec. 14, as applicable 4. Maintenance Report initiated as necessary		Special Tools & Materials	

Procedure:

1. Verify that the equipment has been properly tagged.
2. Check exterior of intercoolers and aftercoolers for cleanliness. Remove dirt or dust as required.
3. Drain, flush and refill crankcase with fresh oil per instructions in Section III of Tech. Manual.
4. Change oil filter.
5. Replace suction-air filter.
6. Check belt tension and alignment of sheaves. Inspect for worn spots on the belt.
7. Check the operation of the shutters.
8. Check all nuts and bolts, tubing and fittings for tightness.
9. Check for proper operation of the automatic drain system.
10. Check the compressor-oil pressure and fourth-stage pressure.
11. Check the pressure-switch (PS) setting. See data in Section VI of Tech. Manual.

Acceptance:

1. All maintenance has been completed and the compressor operates properly.

Completed By: _____
Date: _____
Supervisor: _____

NON-SAFETY RELATED

North Anna Preventive Maintenance - Electrical		PM Code E-14-M/C-2	Page ____ of ____
System Motors 480 Volts and Below	Component Motors	Related PM (s)	Equipment Guide List on Reverse Side
PM Description Clean and Inspect Motors		Reference(s)	
Initial Conditions and Precautions 1. Adhere to Vepco Accident Prev. Manual 2. Initiate a Tagging Report and Radiation Work Permit when required 3. Adhere to NPSQAM, Sec. 14, as applicable 4. Maintenance Report initiated as necessary		Special Tools & Materials 1. Clean Dry Rags 2. Safety Approved Solvent 3. 500 Volt Megohmmeter and a Bridge certified and in current calibration	

Procedure:

1. Verify red tag procedures are carried out.
2. Make a thorough visual inspection of motor, checking for any problem areas.
3. Clean ventilation screens as necessary.
4. Wipe down motor to remove dirt and excess grease deposits.
5. Check for water and/or corrosives dripping on motor. Make request for corrective action if necessary.
6. Spin motor shaft by hand to determine if bearings are binding.
7. Verify no loose or missing screws or bolts.
8. Measure and record insulation resistance from power supply. Record the data on the back of this sheet.
9. Measure and record phase-to-phase resistance from power supply.
10. Clear red tag procedure.
11. Clear applicable Radiation Work Permits.
12. Clear initiated Maintenance Report.

Acceptance:

1. Motor surface and screens clean
2. Insulation resistance ≥ 1.5 megohm
3. Phase-to-phase resistance approximately equal in value
4. Motor shaft spins easily

Completed By: _____
Date: _____
Supervisor: _____

NON-SAFETY RELATED

APPENDIX I

EQUIPMENT LOADING IS TABULATION

<u>EQUIPMENT</u>	<u>EQUIPMENT RATING</u>	<u>MAXIMUM LOAD PRIOR TO OPERATING RESTRICTIONS*</u>	<u>PERCENTAGE OF EQUIPMENT RATING</u>	<u>MAXIMUM LOAD WITH OPERATING RESTRICTIONS*</u>	<u>PERCENTAGE OF EQUIPMENT RATING</u>
1. 500/36.5KV Transformers	112 MVA 1875 Amps at 36.5KV	81.5 MVA 1383A at 34KV	74%	1383A	74%
2. 34.4/4.16KV RSST's	37.6 MVA 4665 Amps at Neutral Position 4240 Amps at Maximum Boost	6572 Amps at 4037	155%	6240 at 4037V	147%
3. 22/4.16KV Normal SST's	22.4 MVA 3109 Amps at 4.16KV	3450A at 3.8KV	111%	3000 Amps	100%
4. 4.16/.48KV Emergency Bus Load Center Transformers	1333 KVA 1603 Amps at 480V 1000KVA 1202 Amps at 480V	1445A at 432V 1001A at 432V	90% 83%	1445A at 432V 1001A at 432V	90% 83%
5. 4KV 5" Al. Bus	6160 Amps	3078 Amps at 4.2KV	50%	3000 Amps	49%
6. 2-2000 MCM Cu. Cables/Phase RSST's to Normal Station Service Buses	3043 Amps	3078 Amps at 4.2KV	101%	3000 Amps	99%
7. 3000A Bus Duct	3000 Amps	3078 Amps at 4.2KV	103%	3000 Amps	100%
8. 4-2000 MCM Al. Cables/Phase RSST's to Transfer Buses	1660 Amps	930 Amps at 4.2KV	56%	930 Amps	56%
9. 2-1000 MCM Al. Cables/Phase Transfer Buses to Emergency Buses	994 Amps	611 Amps at 4.2KV	61%	611A	61%
10. 2-1000 MCM Al. Cables/Phase Normal Buses to Emergency Buses	1084 Amps	675 at 3.8KV	62%	675A	62%
11. 4-1500 MCM Al. Cables/Phase Normal SST's to Normal Buses	3560 Amps	3450A at 3.8KV	97%	3000A	84%

EQUIPMENT LOADING ANALYSIS TABULATION (Con't.)

<u>EQUIPMENT</u>	<u>EQUIPMENT RATING</u>	<u>MAXIMUM LOAD PRIOR TO OPERATING RESTRICTIONS*</u>	<u>PERCENTAGE OF EQUIPMENT RATING</u>	<u>MAXIMUM LOAD WITH OPERATING RESTRICTIONS*</u>	<u>PERCENTAGE OF EQUIPMENT RATING</u>
12. 4-KV Normal Bus Feeder Breakers	3000 Amps	3450A at 3.8KV	115%	3000A	100%
13. 4-KV Emergency Bus Feeder Breakers	1200 Amps	675A at 3.8KV	56%	675A	56%
14. 4-KV Transfer Bus Feeder Breakers	3000 Amps	930 Amps at 4.2KV	31%	930A	31%

*Voltages expressed are based on conservative approximations of worst case steady state voltages (i.e., the LTC is not able to fully correct to 4317V or the main generator is operating at the lower end its capability).

APPENDIX J

OPERATING RESTRICTIONS

I. Under certain worst-case conditions (i.e. low 4KV bus voltage or loading of a 4KV emergency bus to a 4KV normal bus), the 3000 amp continuously rated 4 KV normal station service switchgear may be overloaded. Operating restrictions must be followed to eliminate the possible overload and to minimize equipment loss of life. These restrictions are as follows:

1. The total load on each normal bus should be limited to 3000 amps or less.
2. For 4 KV bus alignments of 1H to 1B or 2H to 2C, loading on the respective normal buses may exceed 3000 amps. Load reduction to 3000 amps within 15 minutes is sufficient action. Emergency bus load increases due to Containment Depressurization Actuation (CDA) or Safety Injection (SI) conditions are more than offset by the load reduction due to the feedwater pump trip.
3. For 4 KV bus alignments of 1J to 2B or 2J to 1A, normal bus load reduction to 3000 amps is not a sufficient restriction. A CDA or SI on one unit will not cause a load reduction on a 4KV normal bus of the other unit. Consequently, the load increase caused by a CDA or SI could cause normal bus load to exceed 3000 amps in these cross-unit tie cases. The restrictions to be followed for these cases are as follows:

A. Within 15 minutes after a transfer of an emergency bus to a normal bus, either a condensate or a feedwater pump must be shed from the affected normal bus. If a feedwater pump is shed, this load reduction is sufficient to maintain worst case loading under 3000 amps regardless of 4KV bus voltage fluctuations.

B. If a condensate pump is initially shed, when the 4KV normal bus voltage reduces below 3800 volts, either the feedwater pump must be shed (condensate may be returned to operation) or the condensate pump must remain off and additional load must be shed as follows:

1. Bus 1A -

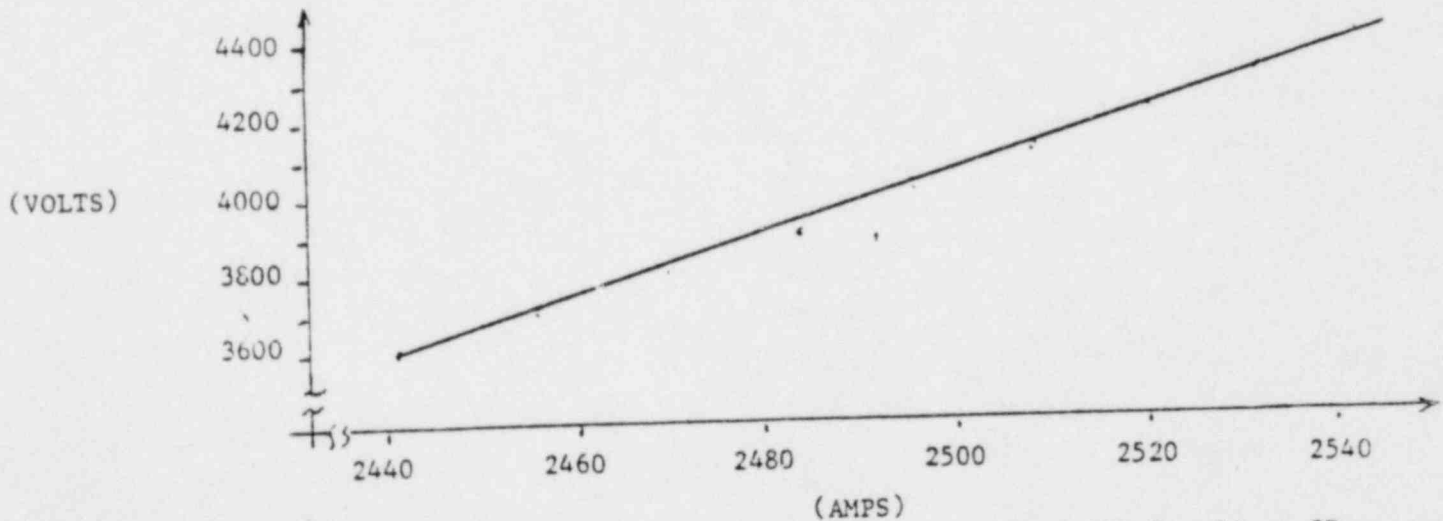
a. Voltage between 3800V and 3700V, shed high pressure heater drain pump.

b. Voltage between 3700V and 3600V, shed high pressure and low pressure heater drain pumps.

2. Bus 2B -

- a. Voltage between 3800V and 3700V, shed bearing cooling or high pressure heater drain pump.
- b. Voltage between 3700V and 3600V, shed bearing cooling and high pressure heater drain pump.
- c. Limiting worst case loading to 3000 amps or less may alternatively be assured by adherence to the following loading schedule based on bus voltages:

4KV Bus 1A or
2B Voltage While Feeding
An Emergency Bus



Maximum Non-SI and Non-CDA current for either 4KV Bus 1A or 2B while feeding an emergency bus.

II. To prevent 2 emergency buses from being fed by the same RSST at the occurrence of an SI or CDA, the following operating restriction must be followed:

1. If bus 2H is transferred to bus 2C, then bus 2J must be transferred to a power source other than bus 2C within 60 minutes of the 2H transfer.

This restriction is strictly to prevent both 2J and 2H being fed from the same source while trying to start emergency motors. If a 2H to 2C transfer is required after the initial accident occurrence and the emergency motors have accelerated, the transfer may be completed without transferring 2J to another power source.

III. Within 60 minutes after a transfer of 1J to 2B or 2J to 1A, if the unit with the affected normal bus is on-line, the generator bus of that unit must be kept at or above 21.7KV.

IV. In the event an overvoltage is indicated by alarm, operator action will be taken within 15 minutes to alleviate the condition. Initial action would be to adjust loading to reduce voltage. If an emergency bus is being fed by a normal bus, transfer of that normal bus to a RSST may be required.

V. Adherence to the transmission system voltage regulation action plan which will be implemented.

APPENDIX K

MINIMUM REQUIRED BUS VOLTAGES FOR CLASS 1E LOADS

<u>Bus</u>		<u>Minimum Voltage Required At Bus</u>			
		<u>Starting</u>		<u>Running</u>	
<u>Nominal Voltage</u>	<u>Bus #</u>	<u>Volts</u>	<u>% of Nominal</u>	<u>Volts</u>	<u>% of Nominal</u>
4160	1H	2849	68.5	3618	87.0
	1J	2847	68.4	3617	86.9
	2H	2844	68.4	3616	86.9
	2J	2846	68.4	3617	86.9
480	1H	*	*	425	88.5
(Load's fed directly from load center)	1H1	341	71.0	426	88.8**
	1J	***	***	***	***
	1J1	345	71.9	426	88.8**
	2H	*	*	440	91.7**
	2H1	340	70.8	427	89.0
	2J	***	***	***	***
	2J1	342	71.3	426	88.8**
	2J1	342	71.3	426	88.8**
480	1H	430	89.6	438	91.3**
(Loads fed from MCC's)	1H1	428	89.2	423	88.1
	1J	437	91.0	442	92.1**
	1J1	****	****	****	****
	2H	436	90.8	426	88.8
	2H1	424	88.3	429	89.4**
	2J	436	90.8	435	90.6**
	2J1	****	****	****	****
	2J1	****	****	****	****

Notes:

- Starting voltage requirements are based on those loads which start immediately with SI or CDA signals.
- MCC loads' starting requirements are based on 90% rated MOV's. To obtain the voltage requirements for 80% rated MOV's, subtract 10% from the values given.

3. * indicates no loads of the specified type (e.g., fed from MCC's) are required to start.
4. ** indicates the highest required voltage based on loads fed directly from load centers and loads fed from MCC's.
5. *** indicates load centers 1J and 2J do not feed motors directly, only through MCC's.
6. **** indicates load centers 1J1 and 2J1 do not feed MCC's.

APPENDIX L

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

JOB 3114 & 4213
CASE 1A 11/23/81

5010 65

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO. 13929.11	DIVISION & GROUP ELECT	CALCULATION NO. 13929.11-5	OPTIONAL TASK CODE N/A	PAGE 24

CASE 1A - EMERGENCY BUSES TIED TO RESERVES
UNIT 2 CDA, UNIT 1 TRIP (ANYTHING OTHER THAN CDA)

1H 1J 2H 2J

1) TIME = 0 - FIRST LOADS STARTING

4160	.857	.871	.833	.857
480	.855	.863	.746	.789
480	.854	.857	.716	.758

2) TIME = 4 SECS - FIRST LOADS ACCELERATED (TAPS ADVANCED 1 STEP)

4160	.951	.928	.918	.951
480	.954	.923	.855	.905
480	.953	.918	.877	.931

3) T = 5 SECS - MOVES STILL STARTING (TAPS ADVANCED 1 MORE STEP)

4160	.958	.933	.923	.958
480	.961	.929	.861	.912
480	.960	.923	.882	.941

4) T = 6.5 SECS - MOVES STILL STARTING (TAPS ADVANCED 1 MORE STEP)

4160	.963	.940	.930	.963
480	.967	.936	.868	.918
480	.965	.930	.889	.947

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

CASE 1A (CONT'D) 11/23/81

▲ 5010 85

CALCULATION IDENTIFICATION NUMBER				SEC - 1
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 25

5) T = 9.5 SECS - MOV LEADS STARTED (TAPS ADVANCED 2 MORE STEPS)

4160	.978	.952	.944	.978
480	.982	.949	.894	.950
480	.981	.944	.915	.963

6) T = 20 SECS - START AUX FLOW (TAPS ADVANCED 4 MORE STEPS)

4160	.998	.984	.962	.998
480	1.003	.983	.914	.971
480	1.002	.978	.934	.984

7) T = 195 SECS - PRIOR TO INSIDE RECIRC START (TAPS HAVE SETTLED)

4160	1.034	1.037	1.024	1.033
480	1.040	1.038	.984	1.010
480	1.039	1.033	1.002	1.022

8) T = 195+ SECS - START INSIDE RECIRC SPRAY (TAPS FIXED)

4160	1.021	1.028	1.007	1.021
480	1.027	1.029	.964	.996
480	1.026	1.024	.845	.865

9) T = 210 SECS - START OUTSIDE RECIRC SPRAY (TAPS FIXED)

4160	1.018	1.026	1.003	1.017
480	1.024	1.027	.960	.993
480	1.023	1.022	.961	.986

10) T = ∞ STEADY STATE (TAPS HAVE SETTLED)

4160	1.033	1.037	1.020	1.033
480	1.040	1.038	.979	1.009
480	1.039	1.033	.980	1.003

CASE 1B 11/23/81

5010 85

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 30

CASE 1B - EMERGENCY BUSES FED FROM RESERVES
 UNIT 1 CDA, UNIT 2 TRIP 60 SEC LATER

1H 1J 2H 2J

1) TIME = 0 - FIRST LOADS STARTING

4160	.899	.916	.948	.901
480	.841	.858	.951	.894
480	.779	.815	.953	.891

2) TIME = 4 SECS. - FIRST LOADS ACCELERATED (TAPS ADVANCED ONE STEP)

4160	.995	1.001	1.007	.996
480	.946	.962	1.013	.994
480	.965	.987	1.014	.992

3) T = 5 SECS - MOVES STILL STARTING (TAPS ADVANCED ONE MORE STEP)

4160	1.002	1.006	1.012	1.002
480	.953	.969	1.019	1.001
480	.972	.994	1.020	.999

4) T = 6.5 SECS - MOVES STILL STARTING (TAPS ADVANCED ONE MORE STEP)

4160	1.007	1.013	1.019	1.008
480	.960	.976	1.026	1.007
480	.978	1.001	1.027	1.005

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

11/23/81
CASE 1B (unit 1)

5010 85

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 31

2	5) TIME = 9.5 SECS. - MOVES LOADS STARTED (TAPS ADVANCED TWO MORE STEPS)				
4	4160	1.023	1.028	1.032	1.024
6	480	.988	1.007	1.040	1.024
8	450	1.004	1.016	1.041	1.022
10	6) T = 20 SECS - START AUX. FEEDWATER (TAPS ADVANCED 7 MORE STEPS)				
12	4160	1.045	1.051	1.067	1.046
14	480	1.012	1.032	1.076	1.047
16	480	1.028	1.041	1.077	1.045
18	7) T = 60 SECS - PRIOR TO UNIT 2 TRIP (TAPS HAVE SETTLED)				
20	4160	1.032	1.035	1.037	1.033
22	480	.998	1.015	1.045	1.034
24	480	1.014	1.024	1.046	1.032
26	8) T = 60 SECS - LOAD TRANSFER (TAPS FIXED)				
28	4160	.944	.916	.935	.944
30	480	.900	.885	.938	.940
32	480	.919	.896	.939	.938
34	9) T = 195 SECS - PRIOR TO START OF INSIDE RECIRC SPRAY (TAPS HAVE SETTLED)				
37	4160	1.022	1.010	1.011	1.022
39	480	.987	.988	1.018	1.023
41	480	1.003	.998	1.019	1.020

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

11/23/81

CASE 1B (cont'd)

A 5010 85

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 32

10) T = 195 SECS - START RECIRC. (TAPS FIXED)

4160	1.003	.992	1.002	1.004
480	.966	.969	1.008	1.003
480	.854	.839	1.009	1.001

11) T = 210 SECS - START OUTSIDE RECIRC SPRAY

(TAPS HAVE REACHED MAX. BOOST)

4160	.999	.989	1.000	1.000
480	.962	.965	1.006	1.000
480	.962	.955	1.008	.997

12) T = ∞ - STEADY STATE ANALYSIS

(TAPS HAVE SETTLED)

4160	1.017	1.006	1.009	1.018
480	.982	1.006	1.015	1.018
480	.981	1.005	1.017	1.016

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

JEB 3479,3834

CASE 1C 11/23/81

5010 85

CALCULATION IDENTIFICATION NUMBER			
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE

SECTION 2
PAGE 55

CASE 1C - EMERGENCY BUSES FED FROM RESERVES
UNIT 1 CDA, UNIT 2 TRIP 60 SEC PRIOR

1H 1J 2H 2J

1) TIME = 0 - FIRST LOADS STARTING

4160	.867	.882	.918	.869
480	.805	.821	.920	.860
480	.749	.782	.921	.857

2) TIME = 4 SECS - FIRST LOADS ACCELERATED (TAPS ADVANCED 1 STEP)

4160	.980	.987	.997	.981
480	.930	.949	1.000	.978
480	.949	.973	1.001	.976

3) TIME = 5 SECS - MOV'S STILL STARTING (TAPS ADVANCED 1 MORE STEP)

4160	.986	.997	1.000	.987
480	.936	.995	1.007	.985
480	.955	.980	1.008	.983

4) T = 6.5 SECS - MOV'S STILL STARTING (TAPS ADVANCED 1 MORE STEP)

4160	.992	1.000	1.006	.993
480	.943	.962	1.012	.992
480	.962	.986	1.013	.989

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

CASE 1C (cont'd) 11/23/61

5010 65

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 36

5) T=9.5 SECS - MOV LOADS STARTED (TAPS ADVANCED 2 MORE STEPS)

4160	1.007	1.013	1.013	1.007
480	.970	.992	1.020	1.007
480	.987	1.001	1.021	1.004

6) T=20 SECS - START AUX FOWTR (TAPS ADVANCED 7 MORE STEPS)

4160	.997	.987	.999	.998
480	.960	.963	1.006	.997
480	.977	.973	1.007	.995

7) T=195 SECS - PRIOR TO INSIDE RECIRC START (TAPS HAVE SETTLED)

4160	1.022	1.010	1.011	1.022
480	.987	.988	1.018	1.023
480	1.003	.998	1.019	1.020

8) T=195+ SECS - START INSIDE RECIRC SPRAY (TAPS FIXED)

4160	1.003	.992	1.002	1.004
480	.966	.969	1.008	1.003
480	.854	.839	1.009	1.001

9) T=210 SECS - START OUTSIDE RECIRC SPRAY (TAPS FIXED)

4160	.999	.989	1.000	1.000
480	.962	.965	1.006	1.000
480	.962	.955	1.008	.997

10) T=∞, STEADY STATE (TAPS HAVE SETTLED)

4160	1.017	1.006	1.009	1.018
480	.982	.984	1.015	1.018
480	.981	.974	1.017	1.016

Case IBC 2/12/82

2/12/82

Case 1BC

PAGE 2/5

U. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE
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E IBC - UNIT 1 CDA, UNIT 2 TRIP (SIMULTANEOUS)
(LOADS SHED ON BUSES 2A & 2B: { HTR DRAIN PUMPS
"B" FLOWTR
"B" CONDENSATE

(ENGINE RUNNING ON 2A & 2C)

ENERG. BUSES FED FROM RESERVES

<u>1H</u>	<u>15</u>	<u>2H</u>	<u>2J</u>
FIRST LEADS STARTING (TAPS FIXED)			
.814	.824	.871	.816
.746	.760	.871	.804
.699	.727	.872	.801

4 SECS, FIRST LOADS ACCELERATED (TAPS ADV. 1 STEP)

.908	.906	.929	.909
.851	.862	.932	.903
.872	.886	.934	.900

5 SECS, MOV LOADS	STILL ACCELERATING	(TAPS ADV 1 MORE STEP)
.915	.911	.915
.858	.867	.910
.879	.892	.907

6.5 SECS, MOVES STILL ACCELERATING (TAPS ADY 1 MORE STEP)

.920	.918	.941	.921
.864	.874	.944	.915
.884	.898	.946	.913

5) $T = 95$ SECS, HIVE ACCELERATED (TAPS ADV 6 HIVE STATE)

4160V	.955	.931	.952	.931
480V	.941	.912	.957	.931
480V	.909	.913	.959	.925

6) $T = 20$ SECS, START HIVE FEEDWATER (TAPS ADV 7 HIVE STATE)

4160V	.953	.951	.964	.954
480V	.911	.924	.990	.955
480V	.929	.934	.991	.945

7) $T = 195$ SECS, TRICK TO INSIDE RECIRC START (TAPS SETTLED)

4160V	1.022	1.031	1.037	1.022
480V	.987	1.010	1.045	1.023
480V	1.003	1.020	1.046	1.020

8) $T = 195$ SECS, START INSIDE RECIRC (TAPS FIXED)

4160V	1.003	1.013	1.028	1.004
480V	.966	.991	1.035	1.003
480V	.854	.858	1.036	1.001

9) $T = 210$ SECS, START OUTSIDE RECIRC (TAPS 6 HIVE STATE)

4160V	.999	1.009	1.026	1.000
480V	.962	.987	1.033	1.000
480V	.962	.977	1.034	.997

10) $T = \infty$, STEADY STATE (TAPS SETTLED)

4160V	1.017	1.027	1.034	1.018
480V	.982	1.006	1.042	1.018
480V	.951	.994	1.043	1.016

STONE & WEBSTER ENGINEERING CORPORATION JOB 2263, 2610
CALCULATION SHEET

CASE 1A\$ 12/16/81

5010 85

CALCULATION IDENTIFICATION NUMBER

SECTION 2

J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

PAGE 106

CASE 1A\$ - UNIT 2 CDA, UNIT 1 @ 21.5KV
EMERGENCY BUSES FED FROM RESERVES
RESTART CONDENSATE PUMPS ON BUSES 2B & 2C

1H 1J 2H 2J 2B 2C

1) VOLTAGES @ START OF PUMPS (HEAVIER LOAD ON BUS 1H)

4160	.910	.961	.890	.910	.852	.878	4160
440	.911	.959	.834	.875	.852(.850)	.878(.913)	FWP
440	.909	.953	.834	.867	.850(.884)	.874(.909)	RCP

2) VOLTAGES AFTER PUMPS ACCELERATED (HEAVIER LOAD ON BUS 1H)

4160	1.033	1.034	1.020	1.033	1.013	1.028	4160
440	1.040	1.036	.979	1.010	1.013(1.054)	1.028(1.069)	FWP
440	1.039	1.031	.980	1.003	1.011(1.051)	1.025(1.066)	RCP

EXCHANGED LOADS ON BUSES 1H AND 1J FOR JOB 2610 12/16/81
CASE 1A\$

1) VOLTAGES @ START OF PUMPS (HEAVIER LOAD ON BUS 1J)

4160	.912	.961	.887	.912	.850	.879	4160
440	.913	.959	.830	.878	.850(.884)	.879(.914)	FWP
440	.912	.953	.831	.870	.847(.881)	.876(.911)	RCP

2) VOLTAGES AFTER PUMPS ACCELERATED (HEAVIER LOAD ON BUS 1J)

4160	1.034	1.035	1.017	1.034	1.010	1.027	4160
440	1.040	1.037	.976	1.010	1.010(1.050)	1.027(1.068)	FWP
440	1.039	1.031	.977	1.003	1.008(1.048)	1.024(1.065)	RCP

NOTE: FWP & RCP VOLTAGES ARE @ METER TERMINALS ON 4160 & 440 BASE
OTHER LISTED " " @ BUS ON 4160V BASE

APPENDIX M

CALCULATION SHEET

CASE 2A 11/24/91

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 39

CASE 2A - EMERG. BUSES FED AS FOLLOWS: 1H-BUSF, 1J-2B
 2H-2C, 2J-1A
 UNIT 2 CDA, UNIT 1 ON LINE @ 20.9KV

	<u>1H</u>	<u>1J</u>	<u>2H</u>	<u>2J</u>
1) T=0 SECS - FIRST LOAD BLOCK STARTING				
4160	.866	.888	.837	.841
480	.864	.881	.750	.772
480	.863	.875	.721	.743
2) T=4 SECS - FIRST LOADS HAVE ACCELERATED (TAPS ADVANCE ONE STEP)				
4160	.944	.917	.927	.902
480	.946	.912	.866	.853
480	.945	.906	.887	.881
3) T=5 SECS - MOV LOADS STILL ACCELERATING (TAPS ADVANCE ONE MORE STEP)				
4160	.950	.923	.934	.902
480	.953	.918	.873	.853
480	.952	.913	.894	.881
4) T=6.5 SECS - MOV LOADS STILL ACCELERATING (TAPS ADVANCE ONE MORE STEP)				
4160	.957	.929	.941	.902
480	.960	.924	.880	.853
480	.959	.919	.901	.881
5) T=9.5 SECS - MOV LOADS ACCELERATED (TAPS HAVE ADVANCED 2 MORE STEPS)				
4160	.971	.942	.955	.904
480	.974	.938	.907	.868
480	.973	.932	.927	.883

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

11/24/81

CASE 2A (cont'd)

5010 85

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 40

6) T = 20 SECS - START AUX FEEDWATER (TAPS ADVANCED 7 MORE STEPS)

4160	.993	.985	.975	.886
480	1.000	.983	.929	.849
480	.999	.978	.949	.864

7) T = 195 SECS - PRIOR TO STARTING INSIDE RECIRC. (TAPS HAVE SETTLED)
SPRAY

4160	1.037	1.024	1.022	.901
480	1.043	1.024	.981	.865
480	1.042	1.019	1.000	.880

8) T = 195+ SECS. - START INSIDE RECIRC (TAPS FIXED)

4160	1.023	1.027	1.004	.890
480	1.029	1.028	.962	.853
480	1.028	1.023	.842	.742

9) T = 210 SECS - START OUTSIDE RECIRC (TAPS FIXED)

4160	1.020	1.027	1.001	.887
480	1.026	1.028	.958	.849
480	1.025	1.023	.958	.841

10) T = ∞, STEADY STATE (TAPS HAVE SETTLED)

4160	1.037	1.024	1.021	.897
480	1.043	1.024	.980	.861
480	1.042	1.019	.981	.853

CALCULATION SHEET

CASE 2A' (cont'd)

A 5010 85

CALCULATION IDENTIFICATION NUMBER					SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 43	
6) T=20 SECS - START AUX FEEDWATER (TAPS ADVANCED 7 MORE STEPS)					
4160	.995	.985	.975	.918	
480	1.000	.983	.929	.884	
480	.999	.978	.949	.899	
7) T=195 SECS - PRIOR TO INSIDE RECIRC START (TAPS HAVE SETTLED)					
4160	1.037	1.024	1.022	.934	
480	1.043	1.024	.981	.901	
480	1.042	1.019	1.000	.915	
8) T=195 ⁺ SECS - START INSIDE RECIRC (TAPS FIXED)					
4160	1.023	1.027	1.004	.922	
480	1.029	1.028	.962	.888	
480	1.028	1.023	.842	.773	
9) T=210 SECS - START OUTSIDE RECIRC (TAPS FIXED)					
4160	1.020	1.027	1.001	.919	
480	1.026	1.028	.958	.885	
480	1.025	1.023	.958	.877	
10) T=∞ - STEADY STATE (TAPS HAVE SETTLED)					
4160	1.037	1.024	1.021	.930	
480	1.043	1.024	.980	.897	
480	1.042	1.019	.981	.890	

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CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 46

CASE 2B - UNIT 1 CDA, UNIT 2 @ 20.9KV UNTIL TRIP
60 SECONDS LATER

EMERGENCY BUSES FED: 1H-BUS F, 1J-2B 2H-2C
2J-1A

	1H FIRST LOADS	1J STARTING	2H	2J
1) T=0				
415	.918	.850	.901	.963
46	.862	.788	.902	.960
48	.796	.752	.904	.957
2) T=1 SECS, FIRST LOADS HAVE ACCELERATED (TAPS ADV 1 STEP)				
415	.995	.910	.919	.983
46	.946	.866	.921	.981
48	.964	.890	.922	.977
3) T=5 SECS, MOVES STILL STARTING (TAPS ADVANCED 1 MORE STEP)				
415	1.001	.910	.919	.983
46	.953	.866	.921	.981
48	.972	.890	.922	.979
4) T=6.5 SECS, MOVES STILL STARTING (TAPS ADV. 1 MORE STEP)				
415	1.008	.910	.919	.983
46	.960	.866	.921	.981
48	.979	.890	.922	.979
5) T=9.5 SECS, MOVES ACCELERATED (TAPS ADV. 2 MORE STEPS)				
415	1.023	.911	.919	.983
46	.986	.880	.921	.981
48	1.014	.891	.922	.979

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

11/24/81 & 12/7/81

CASE 2B (cont'd)

5010 85

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 47

6) T = 20 SECS - START AUX FEEDWATER (TAPS ADVANCED 7 MORE STEPS)

4160	1.045	.874	.919	.983
480	1.013	.862	.921	.981
480	1.028	.873	.922	.979

7) T = 60 SECS - PRIOR TO UNIT 2 TRIP (TAPS HAVE SETTLED)

4160	1.034	.909	.919	.983
480	1.000	.878	.921	.981
480	1.016	.889	.922	.979

8) T = 60 SECS - LOADS TRANSFER (TAPS FIXED)

4160	.940	.871	.923	.983
480	.896	.836	.925	.981
480	.914	.847	.926	.979

9) T = 195 SECS - PRIOR TO INSIDE RECIRC START (TAPS SETTLED)

4160	1.024	.961	1.008	.983
480	.989	.935	1.015	.981
480	1.005	.945	1.016	.979

10) T = 195 SECS - START INSIDE RECIRC (TAPS FIXED)

4160	1.005	.941	.992	.983
480	.969	.913	.998	.981
480	.856	.791	.999	.979

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

11/24/81

CASE 2B (cont'd)

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CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 48

11) T = 210 SECS. - START OUTSIDE RECIRC. (TAPS AT MAX. BOOST)
SPRAY

4160	1.002	.936	.989	.983
480	.965	.908	.995	.981
480	.964	.897	.996	.979

12) T = ∞ - STEADY STATE ANALYSIS (TAPS HAVE SETTLED)

4160	1.019	.955	1.004	.983
480	.984	.928	1.011	.981
480	.984	.917	1.012	.979

CALCULATION SHEET

JOB 1347

CASE 2B' 12/7/81

A 5010 06

CALCULATION IDENTIFICATION NUMBER

SECTION 2

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J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK COD

CASE 2B' - UNIT 1 CDA, UNIT 2 @ 21.5KV
UNTIL TRIP 60 SECS LATER

1H1J2H2J

1) T=0 - FIRST LOADS STARTING

4160	.918	.880	.932	.963
480	.862	.819	.935	.960
480	.796	.780	.936	.957

2) T=4 SECS - FIRST LOADS HAVE ACCELERATED

4160	.995	.942	.950	.983
480	.946	.900	.954	.981
480	.964	.924	.956	.979

3) T=5 SECS - MOVES STILL STARTING

4160	1.001	.942	.950	.983
480	.953	.900	.954	.981
480	.972	.924	.956	.979

4) T=6.5 SECS - MOVES STILL STARTING

4160	1.008	.942	.950	.983
480	.960	.900	.954	.981
480	.977	.924	.956	.979

5) T=9.5 SECS - MOVES ACCELERATED

4160	1.023	.943	.950	.983
480	.982	.915	.954	.981
480	1.007	.926	.956	.979

CALCULATION SHEET

12/7/81

CASE 2B' 1 (cont'd)

A 5010 85

CALCULATION IDENTIFICATION NUMBER

SECTION 2

J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

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6) T=20 SECS - START AUT FDMR

4160	1.045	.926	.950	.983
480	1.013	.897	.954	.981
460	1.028	.907	.956	.979

7) T=60 SECS - PRIOR TO UNIT 2 TRIP

4160	1.034	.941	.950	.983
480	1.000	.913	.954	.981
460	1.016	.923	.956	.979

THE REMAINING TIME FRAMES (T=60+ TO T=∞) ARE THE SAME AS SHOWN ON CASE 2B DATED 11/24/81.

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

CASE 2DP 2/18/8

4 1070 54

IDENTIFICATION NUMBER		PAGE 1/5
CULATION NO.	OPTIONAL TASK CODE	

CASE 2DP - UNIT 1 CDA, UNIT 2 ON LINE @ 21.0KV
(ABBREVIATED SYSTEM STUDIED - ONLY UNIT 2 NORMALS
AND EMERG. BUSES 1J & 2H INCLUDED)
(CONDENSATE P₁ ON BUS 2B TRIPPED OFF)
EMERG. BUS 1J FED FROM NORMAL BUS 2B

TIME INTERVAL	4KV 1J	480V 1J	480V 1J1
T=0, FIRST LOADS STARTING	.904	.845	.804
T=4, FIRST LOADS ACC'D	.968	.928	.952
T=9.5, 1KV'S ACC'D	.969	.944	.954
T=20, START AUX POWER	.952	.925	.935
T=195, START INSIDE RECIR	.955	.929	.805
T=210, START OUTSIDE RECIR	.953	.926	.915
T=215, STEADY STATE	.964	.938	.928

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

JOB 1047,2552
CASE 2C 11/24/81

5010 66

CALCULATION IDENTIFICATION NUMBER

SECTION 2

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J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

CASE 2C - EMERG BUSES FED AS FOLLOWS: 1H-BUS F, 1J-2B
2H-2C, 2J-1A
UNIT 1 CDA, UNIT 2 TRIP 60 SEC PRIOR

1H

1J

2H

2J

1) TIME=0 - FIRST LOAD BLOCK STARTING

4160	.868	.853	.860	.963
480	.807	.790	.859	.960
480	.750	.754	.860	.957

2) TIME=4 SECS - FIRST LOADS HAVE ACCELERATED (TAPS ADVANCED 1 STEP)

4160	.977	.956	.960	.983
480	.926	.915	.965	.981
480	.945	.939	.966	.979

3) TIME=5 SECS - MOV LOADS STILL ACC. (TAPS ADVANCED 1 MORE STEP)

4160	.982	.962	.966	.983
480	.932	.922	.970	.981
480	.951	.946	.972	.979

4) TIME=6.5 SECS - MOV LOADS STILL ACC. (TAPS ADVANCED 1 MORE STEP)

4160	.988	.962	.972	.983
480	.939	.922	.977	.981
480	.958	.946	.978	.979

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

JOB 1538, 4616
CASE 2D 11/24/81

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 58

CASE 2D - EMERG BUSES FED AS FOLLOWS: 1H-Bus F, 1J-2B
2H-2C, 2J-1A
UNIT 1 CDA, UNIT 2 ON LINE @ 20.9KV

1H 1J 2H 2J

1) TIME = 0 - FIRST LOAD BLOCK STARTING

4160	.918	.847	.904	.963
480	.862	.785	.905	.960
480	.798	.750	.906	.957

2) TIME = 4 SECS - FIRST LOADS HAVE ACC. (TAPS ADVANCED 1 STEP)

4160	.995	.907	.921	.983
480	.946	.863	.924	.981
480	.964	.887	.925	.979

3) TIME = 5 SECS - MOV LOADS STILL ACC. (TAPS ADVANCED 1 MORE STEP)

4160	1.001	.907	.921	.983
480	.953	.863	.924	.981
480	.972	.887	.925	.979

4) TIME = 6.5 SECS - MOV LOADS STILL ACC. (TAPS ADVANCED 1 MORE STEP)

4160	1.008	.907	.921	.983
480	.960	.863	.924	.981
480	.979	.887	.925	.979

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

11/24/81

CASE 2D (cont'd)

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CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 59

5) TIME = 9.5 SECS - MOV LOADS ACC. (TAPS ADVANCED 2 MORE STEPS)

4160	1.023	.908	.921	.983
480	.988	.877	.924	.981
480	1.004	.888	.925	.979

6) TIME = 20 SECS - START AUX. FDWTR (TAPS ADVANCED 7 MORE STEPS)

4160	1.045	.892	.921	.983
480	1.013	.859	.924	.981
480	1.028	.870	.925	.979

7) TIME = 195 SECS - PRIOR TO STARTING INSIDE RECIRC SPRAY (TAPS HAVE SETTLED)

4160	1.034	.906	.921	.983
480	1.000	.875	.924	.981
480	1.016	.886	.925	.979

8) TIME = 195 SECS - SELF-STARTING INSIDE RECIRC SPRAY (TAPS FIXED)

4160	1.019	.895	.921	.983
480	.984	.862	.924	.981
480	.869	.748	.925	.979

9) TIME = 210 SECS - START OUTSIDE RECIRC SPRAY (TAPS REMAINED FIXED)

4160	1.016	.892	.921	.983
480	.981	.859	.924	.981
480	.980	.848	.925	.979

10) TIME = ∞, STEADY STATE (TAPS HAVE SETTLED)

4160	1.033	.903	.921	.983
480	.999	.871	.924	.981
480	.999	.859	.925	.979

CALCULATION SHEET

CASE 2E 12/2/81

CALCULATION IDENTIFICATION NUMBER					SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 61	
CASE 2E - UNIT 2 CDA, UNIT 1 TRIP					
EMERG BUYES: 1H-Bus F, 1T-2B, 2H-2C, 2T-1A					
	<u>1H</u>	<u>1T</u>	<u>2H</u>	<u>2T</u>	
1) T=0 - FIRST LOADS STARTED					
4160	.866	.888	.837	.873	
480	.864	.881	.750	.806	
480	.863	.875	.720	.773	
2) T=4 SECS - FIRST LOADS ACCELERATED (TAPS ADVANCED 1 STEP)					
4160	.941	.917	.927	.938	
480	.946	.912	.866	.891	
480	.945	.906	.887	.920	
3) T=5 SECS - MOVES STILL ACCELERATING (TAPS ADVANCED 1 MORE STEP)					
4160	.950	.923	.934	.938	
480	.953	.918	.873	.891	
480	.952	.913	.894	.920	
4) T=6.5 SECS - MOVES STILL ACCELERATING (TAPS ADVANCED 1 MORE STEP)					
4160	.957	.929	.941	.938	
480	.960	.924	.880	.891	
480	.959	.919	.901	.920	
5) T=9.5 SECS - MOV LOADS ACCELERATED (TAPS ADVANCED 2 MORE STEPS)					
4160	.971	.942	.955	.940	
480	.974	.938	.907	.908	
480	.973	.932	.927	.922	

CALCULATION SHEET

CASE 2E (cont'd)

CALCULATION IDENTIFICATION NUMBER				SECTION 2 PAGE 62	
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE		
6) T = 20 SECS - START AUX FEEDWATER (TAPS ADVANCED 7 MORE STEPS)					
4160	.995	.985	.975	.921	
480	1.000	.983	.929	.888	
480	.999	.978	.949	.902	
7) T = 195 SECS - PRIOR TO INSIDE RECIRC START (TAPS HAVE SETTLED)					
4160	1.037	1.024	1.022	.937	
480	1.043	1.024	.981	.905	
480	1.042	1.019	1.000	.919	
8) T = 195 ⁺ SECS - START INSIDE RECIRC (TAPS FIXED)					
4160	1.023	1.027	1.004	.925	
480	1.029	1.028	.962	.892	
480	1.028	1.023	.842	.776	
9) T = 210 SECS - START OUTSIDE RECIRC					
4160	1.020	1.027	1.001	.922	
480	1.026	1.028	.958	.889	
480	1.025	1.023	.958	.881	
10) T = ∞ - STEADY STATE (TAPS HAVE SETTLED)					
4160	1.037	1.024	1.021	.934	
480	1.043	1.024	.980	.901	
480	1.042	1.019	.981	.893	

CASE 2BC - UNIT 1 3DA, UNIT 2 TRIP (SIMULTANEOUS)
 (LOADS SHED ON BUSES 21 & 22: HTA UNIT 1)
 "B" FAULT
 "C" CURRENT
 (FAULT RUNNING ON 24 & 20)

ENERG. BUSES: 14-BUS F, 15-2B, 24-2C, 25-1A

	<u>14</u>	<u>15</u>	<u>24</u>	<u>25</u>
1) T = 0, FIRST LOAD STARTING (THIS FIXED)				
4160v	.816	.829	.805	.943
480v	.745	.766	.802	.960
480v	.701	.732	.803	.957

2) T = 4 SECS, FIRST LOADS ACCELERATING (THIS ADV 1 STEP)				
4160v	.904	.908	.887	.983
480v	.847	.864	.887	.981
480v	.868	.888	.888	.979

3) T = 5 SECS, MOV LOAD STILL ACCELERATING (THIS ADV 1 MORE STEP)				
4160v	.911	.915	.893	.983
480v	.854	.871	.894	.981
480v	.874	.895	.895	.979

4) T = 6.5 SECS, MOVs STILL ACCELERATING (THIS ADV. 1 MORE STEP)				
4160v	.917	.920	.899	.983
480v	.861	.877	.901	.981
480v	.861	.901	.902	.979

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CALCULATION IDENTIFICATION NUMBER

J.O. OR W.C. NO.

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5) $T = 1.5$ SECS, MOVs ACCELERATED (TAPS ADV 2 MORE STEPS)

4160V	.951	.934	.912	.982
480V	.986	.906	.915	.981
480V	.905	.916	.916	.979

6) $T = 20$ SECS, START A:X FDLWR (TAPS ADV 7 MORE STEPS)

4160V	.949	.952	.936	.983
480V	.907	.926	.939	.981
480V	.925	.936	.941	.979

7) $T = 195$ SECS, PRIOR TO INSIDE RECIRC START (TAPS SETTLED)

4160V	1.024	1.022	1.008	.983
480V	.989	1.001	1.015	.981
480V	1.005	1.011	1.016	.979

8) $T = 195$ SECS, START INSIDE RECIRC (TAPS FIXED)

4160V	1.005	1.003	.992	.983
480V	.969	.981	.998	.981
480V	.856	.849	.999	.979

9) $T = 210$ SECS, START OUTSIDE RECIRC (TAPS @ MAX BOOST)

4160V	1.002	1.000	.989	.983
480V	.965	.977	.995	.981
480V	.964	.967	.996	.979

10) $T = \infty$, STEADY STATE (TAPS SETTLED)

4160V	1.019	1.018	1.004	.983
480V	.984	.997	1.011	.981
480V	.984	.987	1.012	.979

APPENDIX N

CALCULATION SHEET

CASE 3A 11/24/81

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CALCULATION IDENTIFICATION NUMBER

SECTION 2
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J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

CASE 3A - EMERG BUSES FED AS FOLLOWS: 1H-1B, 1J-Bus D
2H-Bus E, 2J-1A
UNIT 2 CDA, UNIT 1 ON LINE @ 20.9kV

1H1J2H2J

1) TIME=0 - FIRST LOAD BLOCK STARTING

4160	.894	.869	.830	.841
480	.894	.861	.743	.772
480	.893	.855	.714	.743

2) TIME=4 SECS - FIRST LOADS HAVE ACC. (TAPS ADVANCED 1 STEP)

4160	.913	.926	.915	.902
480	.914	.921	.852	.853
480	.913	.916	.873	.881

3) TIME=5 SECS - MOV LOADS STILL ACC. (TAPS ADVANCED 1 MORE STEP)

4160	.913	.932	.921	.902
480	.914	.927	.858	.853
480	.913	.921	.879	.881

4) TIME=6.5 SECS - MOV LOADS STILL ACC. (TAPS ADVANCED 1 MORE STEP)

4160	.913	.938	.927	.902
480	.914	.934	.865	.853
480	.913	.928	.886	.881

CALCULATION SHEET

11/24/81

CASE 3A (cont'd)

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CALCULATION IDENTIFICATION NUMBER

SECTION 2

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J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

5) TIME = 9.5 SECS - MOV LOADS ACC. (TAPS ADVANCED 2 MORE STEPS)

4160	.913	.951	.941	.904
480	.914	.948	.891	.862
480	.913	.942	.911	.883

6) TIME = 20 SECS - START AUX. FDWTR (TAPS ADVANCED 7 MORE STEPS)

4160	.913	.982	.959	.886
480	.914	.981	.911	.849
480	.913	.975	.931	.864

7) TIME = 195 SECS - PRIOR TO STARTING INSIDE RECIRC SPRAY (TAPS HAVE SETTLED)

4160	.913	1.037	1.021	.901
480	.914	1.032	.981	.865
480	.913	1.033	.999	.880

8) TIME = 195 SECS - STARTING INSIDE RECIRC SPRAY (TAPS HAVE SETTLED)

4160	.913	1.026	1.003	.890
480	.914	1.027	.961	.853
480	.913	1.022	.842	.742

9) TIME = 210 SECS - START OUTSIDE RECIRC SPRAY (TAPS HAVE SETTLED)

4160	.913	1.024	1.000	.887
480	.914	1.025	.957	.849
480	.913	1.020	.957	.841

10) TIME = ∞, STEADY STATE (TAPS HAVE SETTLED)

4160	.913	1.037	1.016	.897
480	.914	1.032	.975	.861
480	.913	1.033	.975	.853

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CALCULATION IDENTIFICATION NUMBER

Section 2

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J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

CASE 3B - EMERG BUS FED AS FOLLOWS: 1H-1B, 1J-Bus D
2H-Bus E, 2J-1A
UNIT 1 CDA, UNIT 2 TRIP 60 SEC LATER

1H

1J

2H

2J

1) T=0, FIRST LOADS STARTING (TAPS FIXED)

4160	.904	.916	.948	.961
480	.876	.858	.951	.958
480	.784	.815	.953	.955

2) T=4 SECS - FIRST LOADS ACCELERATED (TAPS MOVED 1 STEP)

4160	.969	1.001	1.007	.983
480	.918	.962	1.013	.981
480	.937	.987	1.014	.978

3) T=5 SECS - MOVES STILL STARTING (TAPS MOVED 1 MORE STEP)

4160	.969	1.006	1.012	.983
480	.918	.969	1.019	.981
480	.937	.994	1.020	.978

4) T=6.5 SECS - MOVES STILL STARTING (TAPS MOVED 1 MORE STEP)

4160	.969	1.013	1.019	.983
480	.918	.976	1.026	.981
480	.937	1.001	1.027	.978

5) T=9.5 SECS - MOVES ACCELERATED (TAPS MOVED 2 MORE STEPS)

4160	.971	1.028	1.032	.983
480	.931	1.007	1.040	.981
480	.948	1.018	1.041	.978

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

11/24/81

CASE 3B (cont'd)

5010 95

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 74

6) T = 20 SECS - START AUX FEEDWTR

4160	.953	1.051	1.067	.982
480	.911	1.032	1.076	.980
460	.929	1.041	1.077	.978

7) T = 60 SECS - PRIOR TO UNIT 2 TRIP (TAPS HAVE SETTLED)

4160	.969	1.035	1.037	.983
460	.929	1.015	1.045	.981
480	.946	1.024	1.046	.978

8) T = 60+ SECS - LOADS TRANSFER (TAPS FIXED)

4160	.969	.882	.883	.983
480	.929	.848	.883	.981
460	.946	.860	.884	.978

9) T = 195 SECS - PRIOR TO INSIDE RECIRC START (TAPS HAVE SETTLED)

4160	.969	.975	.957	.983
480	.929	.950	.961	.981
460	.946	.960	.962	.978

10) T = 195+ SECS - START INSIDE RECIRC (TAPS FIXED)

4160	.957	.956	.946	.982
480	.915	.930	.950	.980
460	.810	.806	.951	.978

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

11/24/81

CASE 3B (cont'd)

5010 86

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 72

11) $T = 210 \text{ SECS}$ - START OUTSIDE RECIRC (TAPS @ MAX BOOST)

4160	.954	.952	.944	.982
480	.912	.925	.948	.980
480	.912	.915	.949	.978

12) $T = \infty$, STEADY STATE (TAPS HAVE SETTLED)

4160	.966	.970	.954	.983
480	.925	.944	.958	.981
480	.925	.934	.959	.978

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

JOB 1680, 2796
CASE 3C 11/24/81

CALCULATION IDENTIFICATION NUMBER					SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 75	
CASE 3C - EMERG BUSES FED AS FOLLOWS: 1H-1B, 1J-Bus D 2H-Bus E, 2J-1H UNIT 1 CDA, UNIT 2 TRIP 60 SEC PRIOR					
	<u>1H</u>	<u>1J</u>	<u>2H</u>	<u>2J</u>	
1) T=0 - FIRST LOADS STARTING (TAPS FIXED)					
4160	.904	.858	.878	.961	
480	.846	.796	.878	.958	
480	.784	.759	.879	.955	
2) T=4 SECS - FIRST LOADS HAVE ACCELERATED (THIS MOVED 1 STEP)					
4160	.969	.970	.957	.983	
480	.918	.930	.962	.981	
480	.937	.955	.983	.978	
3) T=5 SECS - MOVES STILL STARTING (TAPS @ MAX BOOST)					
4160	.969	.976	.958	.983	
480	.918	.936	.962	.981	
480	.937	.961	.963	.978	
4) T=6.5 SECS - MOVES STILL STARTING (TAPS @ MAX BOOST)					
4160	.969	.976	.958	.983	
480	.918	.936	.962	.981	
480	.937	.961	.963	.978	
5) T=8.5 SECS - MOVES ACCELERATED (TAPS @ MAX BOOST)					
4160	.971	.978	.959	.983	
480	.931	.953	.963	.981	
480	.948	.963	.964	.978	

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

11/24/81

CASE 3C (cont'd)

A 5010 65

CALCULATION IDENTIFICATION NUMBER

SECTION 2
PAGE 76

J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

6) T = 20 SECS - START ALX FEEDWATER (TAPS @ MAX Boost)

4160	.953	.951	.944	.982
480	.911	.924	.947	.980
480	.929	.934	.949	.978

7) T = 195 SECS - PRIOR TO INSIDE RECIRC START (TAPS HAVE SETTLED)

4160	.969	.975	.957	.983
480	.929	.950	.961	.981
480	.946	.960	.962	.978

8) T = 195 SECS - START INSIDE RECIRC (TAPS FIXED)

4160	.957	.956	.946	.982
480	.915	.930	.950	.980
480	.810	.806	.951	.976

9) T = 210 SECS - START OUTSIDE RECIRC (TAPS FIXED)

4160	.954	.952	.944	.982
480	.912	.925	.948	.980
480	.912	.915	.949	.978

10) T = ∞, STEADY STATE (TAPS HAVE SETTLED)

4160	.966	.970	.954	.983
480	.925	.944	.958	.981
480	.925	.934	.959	.978

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 79

CASE 3D - EMERG BUSES FED AS FOLLOWS: 1H-1B, 1J-Bus D
 2H-Bus E, 2J-1A
 UNIT 1 CDA, UNIT 2 ON LINE @ 20.9 KV

	<u>1H</u>	<u>1J</u>	<u>2H</u>	<u>2J</u>
1) T = 0 SECS - FIRST LOAD BLOCK STARTING				
4160	.904	.916	.948	.951
460	.846	.858	.951	.958
480	.784	.815	.953	.955
2) T = 4 SECS - FIRST LOADS HAVE ACCELERATED (TAPS HAVE ADVANCED 1 STEP)				
4160	.969	1.001	1.007	.983
480	.918	.962	1.013	.981
480	.937	.987	1.014	.978
3) T = 5 SECS - MOVES STILL ACCELERATING (TAPS ADVANCE ONE STEP)				
4160	.969	1.006	1.012	.983
480	.918	.969	1.019	.981
480	.937	.994	1.020	.978
4) T = 6.5 SECS - MOVES STILL ACCELERATING (TAPS ADVANCE ONE STEP)				
4160	.969	1.013	1.019	.983
480	.918	.976	1.026	.981
480	.937	1.001	1.027	.978
5) T = 9.5 SECS - MOV LOADS ACCELERATED (TAPS ADVANCE TWO STEPS)				
4160	.971	1.028	1.032	.983
480	.931	1.007	1.040	.981
480	.948	1.016	1.041	.978

CALCULATION SHEET

CASE 3D (cont'd)

5010 55

CALCULATION IDENTIFICATION NUMBER

SECTION 2

PAGE 80

J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

6) T = 20 SECS - START AUX. FEEDWATER (TAPS ADVANCE 7 STEPS)

4160	.953	1.051	1.067	.982
480	.911	1.032	1.076	.980
480	.929	1.041	1.077	.978

7) T = 195 SECS - PRIOR TO STARTING RECIRC SPRAY (TAPS SETTLED)

4160	.969	1.035	1.037	.983
480	.929	1.015	1.045	.981
480	.946	1.024	1.046	.978

8) T = 195 SECS - STARTING INSIDE RECIRC. SPRAY

4160	.957	1.019	1.032	.982
480	.915	.997	1.039	.980
480	.810	.864	1.041	.978

9) T = 210 SECS - START OUTSIDE RECIRC. SPRAY (TAPS FIXED)

4160	.954	1.016	1.031	.982
480	.912	.995	1.038	.980
480	.912	.985	1.039	.978

10) T = ∞ - STEADY STATE (TAPS SETTLED)

4160	.966	1.034	1.037	.983
480	.925	1.014	1.045	.981
480	.925	1.004	1.046	.978

CALCULATION SHEET

CASE 3AG- 2/24/82

J.O. OR W.O. NO.		DIVISION & GROUP		CALCULATION NO.		OPTIONAL TASK CODE		PAGE <u>1/2</u>
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CASE 3AG - UNIT 2 CDA, UNIT 1 ON LINE @ 21.5 KV
 BUS 2G FED FROM BUS 1G (ASST "B")
 EMERG. BUSES FED AS FOLLOWS:
 BUS 1H - BUS 1B, BUS 1J - BUS D
 BUS 2H - BUS E, BUS 2J - BUS 1A

1H 1J 2H 2J

1) T=0, FIRST LOADS STARTING

4160V	.926	.843	.787	.871
480V	.927	.833	.693 ^{40.8}	.804
480V	.926	.827	.671	.772

2) T=4 SECS, FIRST LOADS ACCELERATED

4160V	.945	.906	.882	.935
480V	.947	.900	.815	.887
480V	.946	.894	.838	.916

3) T=5 SECS, MOV'S STILL ACCELERATING

4160V	.945	.912	.887	.935
480V	.947	.906	.820	.887
480V	.946	.901	.843	.916

4) T=6.5 SECS, MOV'S STILL ACCELERATING

4160V	.945	.918	1.893	.935
480V	.947	.913	.827	.887
480V	.946	.907	.849	.916

CALCULATION SHEET

2/24/82

CASE 346 (cont'd)

A 5010 53

CALCULATION IDENTIFICATION NUMBER

J.O. OR W.O. NO. 1 DIVISION & GROUP 1 CALCULATION NO. OPTIONAL TASK CODE

PAGE 2/2

5) T = 9.5 SECS, MAIN LOADS ACCELERATED

4160V	.945	.931	.906	.936
480V	.947	.926	.852	.904
480V	.946	.920	.874	.918

6) T = 20 SECS, START AUX FLOWTR

4160V	.945	.958	.918	.918
480V	.947	.956	.865	.884
480V	.946	.950	.885	.899

7) T = 195 SECS, PRIOR TO INSIDE RECIRC START

4160V	.945	1.004	.942	.934
480V	.947	1.004	.892	.901
480V	.946	.999	.913	.915

8) T = 195 + SECS, START INSIDE RECIRC SPRAY (TAPS FIXED)

4160V	.945	.995	.923	.992
480V	.947	.994	.87	.888
480V	.946	.989	.765	.773

9) T = 210 SECS, START OUTSIDE RECIRC SPRAY

4160V	.945	.992	.918	.919
480V	.947	.991	.865	.885
480V	.946	.986	.866	.877

10) T = CO, STEADY STATE (TAPS FIXED)

4160V	.945	1.001	.936	.93
480V	.947	1.001	.885	.897
480V	.946	.995	.886	.89

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

JOB 2175

CASE 3A\$ 12/16/91

5010 66

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 108

CASE 3A\$ - UNIT 2 CDA, UNIT 1 @ 21.5KV
1H-1B, 1T-BUS D, 2H-BUS E, 2J-1A

RESTART CONDENSATE PUMP ON BUS 1A

	<u>1H</u>	<u>1T</u>	<u>2H</u>	<u>2J</u>	<u>1A</u>	
1) VOLTAGES @ PUMP START						
4160	.940	1.039	1.017	.828	.829	4160
480	.942	1.040	.976	.783	.826(.859)	FWP
480	.941	1.035	.976	.774	.826(.859)	RCP

2) VOLTAGES AFTER PUMP ACCELERATED						
4160	.940	1.039	1.017	.930	.931	4160
480	.942	1.040	.976	.897	.929(.966)	FWP
480	.941	1.035	.976	.890	.928(.966)	RCP

NOTE: FWP & RCP VOLTAGES ARE @ MITR TERMINALS
OTHER LISTED " ARE @ BUS

VOLTAGES IN () ARE ON 4KV BASE
OTHERS ARE ON 4160V BASE

CALCULATION SHEET

CASE 3D\$ 12/16/81

5010 88

CALCULATION IDENTIFICATION NUMBER

SECTION 2

J.O. OF W.D. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

PAGE 110

CASE 3D\$ - UNIT 1 CDA, UNIT 2 @ 21.5KV
 1H-1B, 1J-BUS D, 2H-BUS E, 2J-1A

RESTART CONDENSATE PUMP ON BUS 1B

1H 1J 2H 2J 1B

1) VOLTAGES @ PUMP START

411'	.860		1.037	.975	.861	4160
480	.806	1.017	1.045	.973	.861 (.895)	FWP
480	.805	1.007	1.046	.970	.859 (.893)	RCP

2) VOLTAGES AFTER PUMP ACCELERATED

4160	.966	1.036	1.037	.978	.967	4160
480	.925	1.017	1.045	.976	.967 (1.006)	FWP
480	.925	1.007	1.046	.974	.965 (1.004)	RCP

NOTE: FWP & RCP VOLTAGES ARE @ MOTOR TERMINALS
 OTHER LISTED ARE @ BUS

VOLTAGES IN () ARE ON 41KV BASE
 OTHERS ARE ON 4160V BASE

APPENDIX O

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

JOB 3081, 358- 12/3/81
CASE 4B

5010 NS

CALCULATION IDENTIFICATION NUMBER

SECTION 2

PAGE 23

J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

CASE 4B - UNIT 1 CDA, UNIT 2 @ 21.5 KV UNTIL
TRIP 60 SECONDS LATER

ENERG. BUSES: 1H-BUS F, 1J-2B, 2H-BUS E, 2J-1A

1) T=0 $\frac{1H}{-}$ FIRST LOADS STARTING $\frac{2H}{-}$ (TAPS FIXED) $\frac{2J}{-}$

416C	.918	.909	.978	.963
480	.862	.850	.985	.960
48C	.798	.808	.987	.957

2) T=4 SECS - FIRST LOADS HAVE ACCELERATED (TAPS ADV 1 STEP)

416C	.975	.971	1.006	.988
480	.946	.932	1.013	.981
48C	.944	.956	1.014	.971

3) T=5 SECS - MOVES STILL STARTING (TAPS ADV 1 MORE STEP)

416C	1.001	.971	1.013	.988
480	.953	.932	1.020	.981
48C	.972	.956	1.021	.971

4) T=6.5 SECS - MOVES STILL STARTING (TAPS ADV 1 MORE STEP)

416C	1.008	.971	1.019	.988
480	.960	.932	1.026	.981
48C	.979	.956	1.027	.979

5) T=9.5 SECS - MOVES ACCELERATED (TAPS ADV 2 MORE STEPS)

416C	1.023	.973	1.032	.988
480	.988	.948	1.040	.981
48C	1.004	.958	1.041	.971

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

12/3/81 & 12/18/81

CASE 4B (cont'd)

CALCULATION IDENTIFICATION NUMBER					SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE		PAGE 84
6) T = 20 SECS - START AUX FEEDWATER (TAPS ADJ. 7 MORE STEPS)					
4160	1.045	.956	1.077	.983	
480	1.013	.929	1.087	.981	
480	1.028	.939	1.088	.979	
7) T = 60 ⁻ SECS - PRIOR TO UNIT 2 TRIP (TAPS SETTLED)					
4160	1.034	.971	1.037	.983	
480	1.000	.946	1.045	.981	
480	1.016	.956	1.046	.979	
8) T = 60 ⁺ SECS - LOADS TRANSFER (TAPS FIXED)					
4160	.950	.907	.925	.983	
480	.907	.875	.927	.981	
480	.925	.886	.929	.979	
9) T = 175 ⁻ SECS - PRIOR TO INSIDE RECIRC START (TAPS SETTLED)					
4160	1.034	.991	1.008	.983	
480	1.000	.968	1.014	.981	
480	1.016	.977	1.015	.979	

12/3/81

CASE 48 (cont'd)

A 5010 85

CALCULATION IDENTIFICATION NUMBER

SECTION 2

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J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

10) T = 195 SECS - START INSIDE RECIRC (TAPS FIXED)

4160	1.016	.972	.992	.983
480	.980	.947	.998	.981
480	.867	.820	.999	.979

11) T = 210 SECS - START OUTSIDE RECIRC

4160	1.013	.968	.989	.983
480	.977	.942	.995	.981
480	.976	.932	.996	.979

12) T = ∞ , STEADY STATE (TAPS HAVE SETTLED)

4160	1.030	.986	1.003	.983
480	.996	.962	1.010	.981
480	.996	.952	1.011	.979

CALCULATION SHEET

CASE 4BC 12/18/81

A 5010 86

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 88

CASE 4BC - UNIT 1 LDA, UNIT 2 TRIP (SIMULTANEOUS)

EMERG. BUSES: 1H-Bus F, 1J-2B, 2H-Bus E, 2J-1A
 (LOADS SHED ON BUSES 2A & 2B INCLUDED CONDENSATE ON 2B)
 (FIBER ON 2A & 2C)

	<u>1H</u>	<u>1J</u>	<u>2H</u>	<u>2J</u>
1) T = 0 - FIRST LOADS STARTING				
4160	.840	.806	.835	.963
480	.775	.741	.833	.960
480	.724	.710	.834	.958
2) T = 4 SECS - FIRST LOADS ACCELERATED				
4160	.914	.899	.913	.983
480	.858	.854	.915	.981
480	.876	.878	.917	.979
3) T = 5 SECS - MOVIS STILL ACCELERATING				
4160	.920	.905	.920	.993
480	.865	.861	.922	.991
480	.885	.885	.923	.979
4) T = 6.5 SECS - MOVIS STILL ACCELERATING				
4160	.927	.911	.925	.983
480	.872	.867	.928	.981
480	.892	.891	.929	.979

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

12/18/81

CASE 4BC (cont'd)

45010 85

CALCULATION IDENTIFICATION NUMBER			
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE

SECTION 2
PAGE 89

5) T = 9.5 SECS - MOV LOADS ACCELERATED

4160	.941	.925	.939	.983
480	.897	.896	.942	.981
480	.915	.906	.943	.979

6) T = 20 SECS - START AUX FEEDWATER

4160	.960	.943	.961	.983
480	.918	.915	.966	.981
480	.936	.925	.967	.979

7) T = 195 SECS - PRIOR TO INSIDE RECIRC START

4160	1.037	1.013	1.026	.983
480	1.000	.991	1.033	.981
480	1.016	1.001	1.034	.979

8) T = 195+ SECS - START INSIDE RECIRC

4160	1.016	.994	1.010	.983
480	.980	.970	1.017	.981
480	.867	.840	1.018	.979

9) T = 210 SECS - START OUTSIDE RECIRC

4160	1.013	.990	1.007	.983
480	.977	.966	1.014	.981
480	.976	.956	1.015	.979

10) T = ∞ - STEADY STATE

4160	1.030	1.008	1.022	.983
480	.996	.986	1.029	.981
480	.996	.976	1.030	.979

APPENDIX P

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

12/8/81

5010 85

CALCULATION IDENTIFICATION NUMBER				SECTION 2
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 96

TRANSFER BUS-1H TO BUS 1B (cont'd)

@ TRANSFER

AFTER LOADS ALL'D

1H

1B

1H

1B

CASE 5G - UNIT 1 ON LINE @ 21.5 KV (JOB 1328 12/5/81)

4160V	.849	.652	.940	.941
480V	.738	.627	.942	.922
480V	.738	.628	.941	.924
480V	N/A	.837	N/A	.932
FWP	N/A	.849(.883)	N/A	.938(.976)
RCP	N/A	.850(.884)	N/A	.938(.976)

CASE 5G' - UNIT 1 ON LINE @ 20.9 KV (JOB 3443 12/8/81)

4160V	.820	.823	.908	.908
480V	.713	.795	.908	.888
480V	.713	.797	.907	.889
480V	N/A	.806	N/A	.897
FWP	N/A	.820(.853)	N/A	.906(.942)
RCP	N/A	.821(.854)	N/A	.906(.942)

NOTE: FWP & RCP VOLTAGES ARE @ MOTOR TERMINALS
" " " " IN () ARE ON 4KV BASE.
OTHER LISTED " ARE @ BUS ON 4.16KV BASE.

REWINNING EMERGENCY BUSES ARE FED AS FOLLOWS:
1J-BUS D, 2H-BUS E, 2J-BUS F

CALCULATION SHEET

CASE 6H 12/9/81

A 5010 85

CALCULATION IDENTIFICATION NUMBER

SECTION 2

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J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

TRANSFER CASES : BUS 1J TO BUS 2B

CASE 6H UNIT 2 TRIP (NON-CDA), SWYD @ 505KV (JOB 1786
LTC HAS REACHED STEADY STATE 12/9/81)

1J2H2BVOLTAGES @ TRANSFER

4160V	.762	.818	.765
480V	.640	.815	.742
480V	.585	.816	.742
FWP	N/A	N/A	.763 (.794)
RCP	N/A	N/A	.762 (.792)

AFTER LOADS HAVE ACCELERATED

4160V	.918	.944	.919
480V	.913	.947	.909
480V	.908	.948	.909
FWP	N/A	N/A	.918 (.955)
RCP	N/A	N/A	.917 (.954)

NOTE: FWP & RCP VOLTAGES ARE @ MOTOR TERMINALS
" " " " IN () ON 4KV BASE

OTHER LISTED VOLTAGES ARE @ BUS
" " " " ON 4160V BASE

REMAINING EMERGENCY BUSES FED AS FOLLOWS:
1H - BUS F, 2H - BUS E, 2J - BUS F

CALCULATION SHEET CASE 7A

12/9/81

5010 85

CALCULATION IDENTIFICATION NUMBER

SECTION 2

J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

PAGE 102

TRANSFER CASES: BUS 2H TO BUS 2C

CASE 7A - UNIT 2 CDA, SWYD @ 505 KV (JOB 2731 12/9/81)
LTC HAS REACHED STEADY STATE

	<u>1H</u>	<u>2H</u>	<u>2J</u>	<u>2C</u>
<u>VOLTAGES @ TRANSFER</u>				
4160V	.871	.828	.871	.831
480V	.869	.545	.832	.816
480V	.868	.547	.823	.816
FWP	N/A	N/A	N/A	CDA - N/A
RCP	N/A	N/A	N/A	.823(.861)

AFTER LOADS HAVE ACCELERATED

4160V	1.006	.975	1.006	.996
480V	1.012	.952	.981	.992
480V	1.011	.952	.974	.992
FWP	N/A	N/A	N/A	CDA - N/A
RCP	N/A	N/A	N/A	.993(1.033)

NOTE: FWP & RCP VOLTAGES ARE @ MOTOR TERMINALS
" " " " ON A 4KV BASE

OTHER LISTED VOLTAGES ARE @ BUS ON 4.16KV BASE

REMAINING EMERGENCY BUSES FED AS FOLLOWS:
1H - BUS F, 1J - BUS D, 2J - BUS F

APPENDIX Q

NORTH ANNA

CASE 1-ST-9-A

CONDITION: 0.5 seconds after load transfer; before motor start

BUS	RECORDED VALUES		COMPUTER CALC VALUES	ERROR $\frac{V_R - V_C}{V_R}$ 100%
	AMPERES	VOLTS	VOLTS	
1H	228	4060	4043	0.4%
1J	264	4095	4064	0.6%
1G	1200	4078	NC	-
2H	312	4025	4032	-0.2%
2J	132 (POWER FACTOR = .91)	4130	4043	2.1%
2G	1120	4113	NC	-
2A	1200 (POWER FACTOR = .89)	3885	4039	-4.0%
2B	1640	3850	3994	-3.7%
2C	2000	3938	3977	-1.5%

BUS	AMPERES	RECORDED VALUES	VOLTS	COMPUTER CALC VALUES	VOLTS	% ERROR (VR-VC) (VR) 100%
480 VOLT 2J	64		468		464.8	0.6%
480 VOLT 2H	122		460		467.2	-1.6%
34.5KV BUS 4	NR		36119		NC	-
500 KV	NR		522		NC	-

*Amperes at 4KV
NR = Not read

NC = Not calculated

NORTH ANNA

CASE 1-ST-9-B

CONDITION: 1.0 second after load transfer; start charging pump on bus 2J

BUS	RECORDED VALUES		COMPUTER CALC VALUES		% ERROR ($V_R - V_C$) (V_R) 100%
	AMPERES	VOLTS	VOLTS		
1H	228	3990	3899		2.3%
1J	264	4060	4064		-0.1%
1G	1200	4078	NC		-
2H	312	4025	4032		-0.2%
2J	701 (POWER FACTOR = .67)	4025	3899		3.1%
2G	1120	4060	NC		-
2A	1200 (POWER FACTOR = .89)	4025	4039		-0.35%
2B	1600	3990	3994		-0.1%
2C	1856	3955	3885		1.8%

BUS	AMPERES	RECORDED VALUES		COMPUTER CALC VALUES		% ERROR	
		VOLTS		VOLTS		$\frac{(V_R - V_C)}{V_R} \times 100\%$	
480 VOLT 2J	64		460	448.4		2.5%	
480 VOLT 2H	124		456	467.2		-2.5%	
34.5KV BUS 4	NR		36119	NC		-	
500 KV -	NR		522	NC		-	

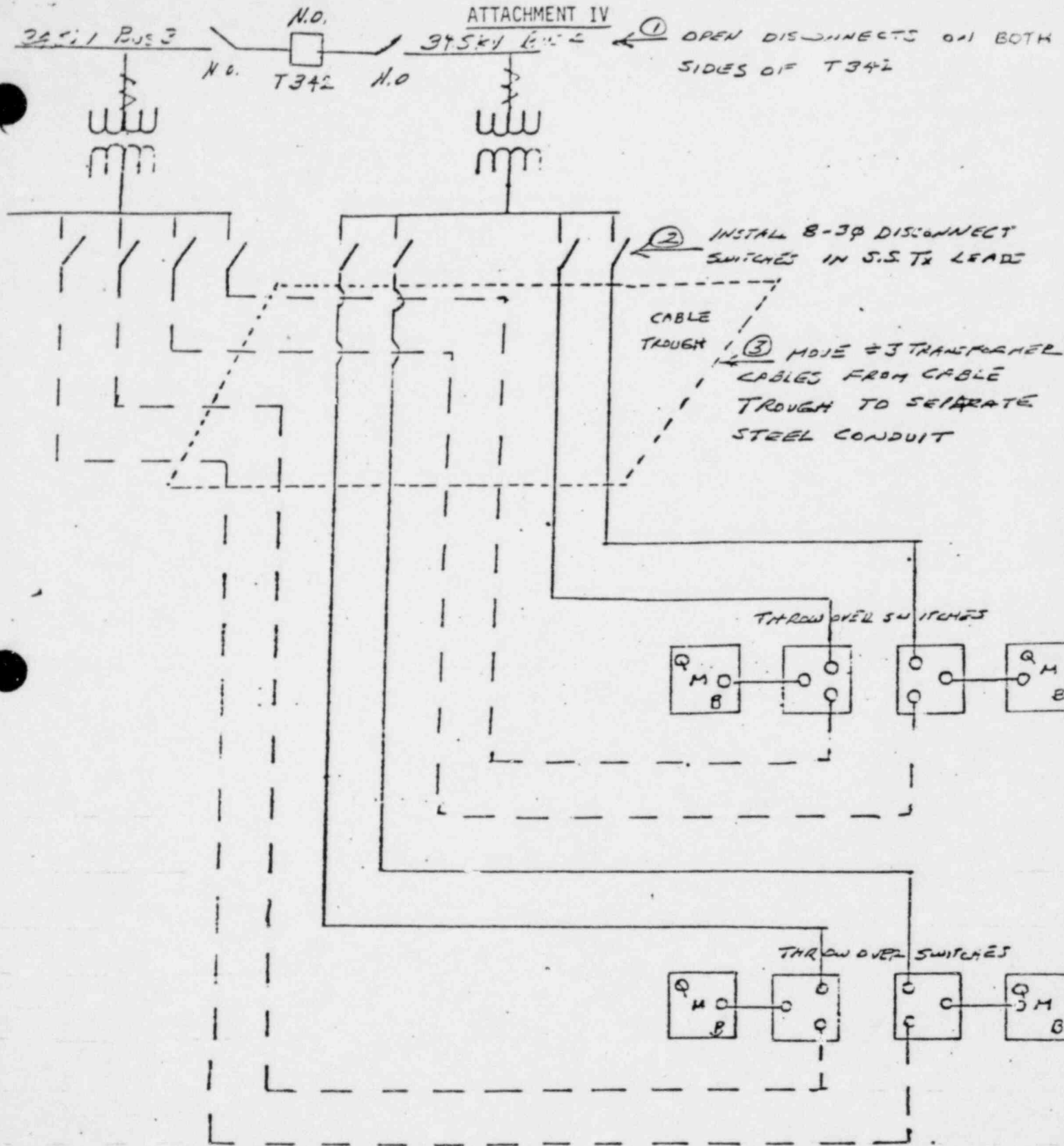
*Amperes at 4KV
NR = Not read

NC = Not calculated

APPENDIX R

CHANGES TO SWITCHYARD STATION SERVICE
NORTH ANNA SWITCHYARD

ATTACHMENT IV



NEW DISCONNECT SWITCHES & ASSOCIATED THROW OVER CONTACTS
TO BE OPERATED ALL OPEN OR ALL CLOSED AS REQUIRED.

NOTE: N.O. = NORMALLY OPEN

QMB $\Rightarrow$ 240/120 VOLT DISTRIBUTION PANEL
FOR SWITCHYARD LOADS

© 11/11

APPENDIX S

DRAFT

11-26-77

3/4.8 ELECTRICAL POWER SYSTEMS

3/4.8.1 A.C. SOURCES

OPERATING

LIMITING CONDITION FOR OPERATION

3.8.1.1 As a minimum, the following A.C. electrical power sources shall be OPERABLE:

- ~~a. Two physically independent circuits between the offsite transmission network and the onsite Class 1E distribution system, and~~
SEE ATTACHED PAGE
- b. Two separate and independent diesel generators:
 - 1. Each with a separate day tank containing a minimum of 750 gallons of fuel, and
 - 2. A fuel storage system containing a minimum of 45,000 gallons of fuel, and
 - 3. A separate fuel transfer pump.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

for each emergency bus

- a. With either an offsite circuit or diesel generator of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. sources by performing Surveillance Requirements 4.8.1.1.1.a and 4.8.1.1.2.a.4 within one hour and at least once per 8 hours thereafter; restore at least ~~two~~ offsite circuits and ~~two~~ diesel generators to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
- b. With one offsite circuit and one diesel generator of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. sources by performing Surveillance Requirements 4.8.1.1.1.a and 4.8.1.1.2.a.4 within one hour and at least once per 8 hours thereafter; restore at least one of the inoperable sources to OPERABLE status within 12 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours; restore at least ~~two~~ offsite circuits and ~~two~~ diesel generators to OPERABLE status within 72 hours from the time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

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3.8.1.1 a. At least two physically independent circuits between the offsite transmission network and the onsite Class 1E distribution system with a minimum of one circuit feeding 4kv Emergency Bus 1H and one circuit feeding 4kv Emergency Bus 1J, and

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11-26-77

ELECTRICAL POWER SYSTEMS

ACTION (Continued):

for one emergency bus

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

SURVEILLANCE REQUIREMENTS

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

- a. Determined OPERABLE at least once per 7 days by verifying correct breaker alignment indicating power availability.

4.8.1.1.2 Each diesel generator shall be demonstrated OPERABLE:

- a. At least once per 31 days on a STAGGERED TEST BASIS by:
1. Verifying the fuel level in the day tank.
 2. Verifying the fuel level in the fuel storage tank.

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11-26-77

ELECTRICAL POWER SYSTEMS

3/4.8.2 ONSITE POWER DISTRIBUTION SYSTEMS

A.C. DISTRIBUTION - OPERATING

LIMITING CONDITION FOR OPERATION

3.8.2.1 The following A.C. electrical busses shall be OPERABLE and energized with tie breakers open between redundant busses:

all existing

4160	volt Emergency Bus # 1H
4160	volt Emergency Bus # 1J
480	volt Emergency Bus # 1H, 1H1
480	volt Emergency Bus # 1J, 1J1
120	volt A.C. Vital Bus # 1-I
120	volt A.C. Vital Bus # 1-II
120	volt A.C. Vital Bus # 1-III
120	volt A.C. Vital Bus # 1-IV

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With less than the above complement of A.C. busses OPERABLE, restore the inoperable bus to OPERABLE status within 8 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.8.2.1 The specified A.C. busses shall be determined OPERABLE with tie breakers open between redundant busses at least once per 7 days by verifying correct breaker alignment and indicated power availability.

where applicable

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~~22-26-77~~

3/4.8 ELECTRICAL POWER SYSTEMS

BASES

3/4.8.1 and 3/4.8.2 A.C. and D.C. POWER SOURCES AND DISTRIBUTION

The OPERABILITY of the A.C. and D.C. power sources and associated distribution systems during operation ensures that sufficient power will be available to supply the safety related equipment required for 1) the safe shutdown of the facility and 2) the mitigation and control of accident conditions within the facility. The minimum specified independent and redundant A.C. and D.C. power sources and distribution systems satisfy the requirements of General Design Criteria 17 of Appendix "A" to 10 CFR 50. — SEE ATTACHED PAGE —

The ACTION requirements specified for the levels of degradation of the power sources provide restriction upon continued facility operation commensurate with the level of degradation. The OPERABILITY of the power sources are consistent with the initial condition assumptions of the accident analyses and are based upon maintaining at least one of each of the onsite A.C. and D.C. power sources and associated distribution systems OPERABLE during accident conditions coincident with an assumed loss of offsite power and single failure of the other onsite A.C. source.

The OPERABILITY of the minimum specified A.C. and D.C. power sources and associated distribution systems during shutdown and refueling ensures that 1) the facility can be maintained in the shutdown or refueling condition for extended time periods and 2) sufficient instrumentation and control capability is available for monitoring and maintaining the facility status.

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11-26-77

3/4.8 ELECTRICAL POWER SYSTEMS

BASES

3/4.8.1 and 3/4.8.2 A.C. and D.C. POWER SOURCES AND DISTRIBUTION

The OPERABILITY of the A.C. and D.C. power sources and associated distribution systems during operation ensures that sufficient power will be available to supply the safety related equipment required for 1) the safe shutdown of the facility and 2) the mitigation and control of accident conditions within the facility. The minimum specified independent and redundant A.C. and D.C. power sources and distribution systems satisfy the requirements of General Design Criteria 17 of Appendix "A" to 10 CFR 50.

With a generator breaker installed on Unit 1 and normally open ties between buses 1H and 1B and between buses 1J and 2B, each 4 kv emergency bus will have two physically independent feeders from the offsite transmission network. The two offsite feeders to emergency bus 1H will be physically independent from the two offsite feeders to emergency bus 1J. Each emergency-to-normal bus tie will have a normally open breaker at each bus.

The ACTION requirements specified for the levels of degradation of the power sources provided restriction upon continued facility operation commensurate with the level of degradation. The OPERABILITY of the power sources are consistent with the initial condition assumptions of the accident analyses and are based upon maintaining at least one of each of the onsite A.C. and D.C. power sources and associated distribution systems OPERABLE during accident conditions coincident with an assumed loss of offsite power and single failure of the other onsite A.C. source.

The OPERABILITY of the minimum specified A.C. and D.C. power sources and associated distribution systems during shutdown and refueling ensures that 1) the facility can be maintained in the shutdown or refueling condition for extended time periods and 2) sufficient instrumentation and control capability is available for monitoring and maintaining the facility status.

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8-21-80

3/4.8 ELECTRICAL POWER SYSTEMS

3/4.8.1 A.C. SOURCES

OPERATING

LIMITING CONDITION FOR OPERATION

3.8.1.1 As a minimum, the following A.C. electrical power sources shall be OPERABLE:

- ~~a. Two physically independent circuits between the offsite transmission network and the onsite Class IE distribution system, and~~
— SEE ATTACHED PAGE —
- b. Two separate and independent diesel generators:
 - 1. Each with a separate day tank containing a minimum of 750 gallons of fuel, and
 - 2. A fuel storage system containing a minimum of 45,000 gallons of fuel, and
 - 3. A separate fuel transfer pump.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

FOR EACH EMERGENCY BUS

- a. With either an offsite circuit or diesel generator of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. sources by performing Surveillance Requirements 4.8.1.1.1.a and 4.8.1.1.2.a.4 within one hour and at least once per 8 hours thereafter; ~~restore at least two offsite~~
ONE ~~circuit and two diesel generators to OPERABLE status within 72~~ hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
- b. With one offsite circuit and one diesel generator of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. sources by performing Surveillance Requirements 4.8.1.1.1.a and 4.8.1.1.2.a.4 within one hour and at least once per 8 hours thereafter; ~~restore at least one of the~~
~~inoperable sources to OPERABLE status within 12 hours or be in at~~
~~least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN~~
ONE ~~within the following 30 hours; restore at least two offsite cir-~~
~~cuits and two diesel generators to OPERABLE status within 72 hours~~ from the time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

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3.8.1.a. At least two physically independent circuits between the offsite transmission network and the onsite Class 1E distribution system with a minimum of one circuit feeding 4kv Emergency Bus 2H and one circuit feeding 4kv Emergency Bus 2J, and

8-21-86

DRAFT

ELECTRICAL POWER SYSTEMS

FOR ONE EMERGENCY BUS

ACTION (Continued):

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

FOR EACH EMERGENCY BUS

SURVEILLANCE REQUIREMENTS

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

- a. Determined OPERABLE at least once per 7 days by verifying correct breaker alignment indicating power availability, and
- b. Demonstrated OPERABLE at least once per 18 months during shutdown by manually transferring the onsite Class 1E power supply from the normal circuit to the alternate circuit.

4.8.1.1.2 Each diesel generator shall be demonstrated OPERABLE:

- a. In accordance with the frequency specified in Table 4.8.2 on a STAGGERED TEST BASIS by:

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ELECTRICAL POWER SYSTEMS

3/4.8.2 ONSITE POWER DISTRIBUTION SYSTEMS

A.C. DISTRIBUTION - OPERATING

LIMITING CONDITION FOR OPERATION

3.8.2.1 The following A.C. electrical busses shall be OPERABLE and energized with tie breakers open between redundant busses:

ALL EXISTING

4160	volt Emergency Bus # 2H
4160	volt Emergency Bus # 2J
480	volt Emergency Bus # 2H, 2H1
480	volt Emergency Bus # 2J, 2J1
120	volt A.C. Vital Bus # 2-I
120	volt A.C. Vital Bus # 2-II
120	volt A.C. Vital Bus # 2-III
120	volt A.C. Vital Bus # 2-IV

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With less than the above complement of A.C. busses OPERABLE, restore the inoperable bus to OPERABLE status within 8 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.8.2.1 The specified A.C. busses shall be determined OPERABLE with tie breakers open between redundant busses at least once per 7 days by verifying correct breaker alignment and indicated power availability.

WHERE APPLICABLE

With normally open ties between buses 2H and 2C and between buses 2J and 1A, each 4 kv emergency bus will have two physically independent feeders from the offsite transmission network. The two offsite feeders to emergency bus 2H will be physically independent from the two offsite feeders to emergency bus 2J. Each emergency-to-normal bus tie will have a normally open breaker at each bus.

3/4.8 ELECTRICAL POWER SYSTEMS

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BASES

3/4.8.1 and 3/4.8.2 A.C. and D.C. POWER SOURCES AND DISTRIBUTION

The OPERABILITY of the A.C. and D.C. power sources and associated distribution systems during operation ensures that sufficient power will be available to supply the safety related equipment required for 1) the safe shutdown of the facility and 2) the mitigation and control of accident conditions within the facility. The minimum specified independent and redundant A.C. and D.C. power sources and distribution systems satisfy the requirements of General Design Criteria 17 of Appendix "A" to 10 CFR 50.

The ACTION requirements specified for the levels of degradation of the power sources provide restriction upon continued facility operation commensurate with the level of degradation. The OPERABILITY of the power sources are consistent with the initial condition assumptions of the accident analyses and are based upon maintaining at least one of each of the onsite A.C. and D.C. power sources and associated distribution systems OPERABLE during accident conditions coincident with an assumed loss of offsite power and single failure of the other onsite A.C. source.

The OPERABILITY of the minimum specified A.C. and D.C. power sources and associated distribution systems during shutdown and refueling ensures that 1) the facility can be maintained in the shutdown or refueling condition for extended time periods and 2) sufficient instrumentation and control capability is available for monitoring and maintaining the facility status.

The Surveillance Requirements for demonstrating the OPERABILITY of the diesel generators are in accordance with the recommendations of Regulatory Guides 1.9 "Selection of Diesel Generator Set Capacity for Standby Power Supplies", March 10, 1971, and 1.108 "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants", Revision 1, August 1977.

Containment electrical penetrations and penetration conductors are protected by either de-energizing circuits not required during reactor operation or by demonstrating the OPERABILITY of primary and backup overcurrent protection circuit breakers during periodic surveillance.

The surveillance frequency applicable to molded case circuit breakers and/or fuses provides assurance of breaker and/or fuse reliability by testing at least one representative sample of each manufacturer's brand of circuit breaker and/or fuse. Each manufacturer's molded case circuit breakers and/or fuses are grouped into representative samples which are then tested on a rotating basis to ensure that all breakers and/or fuses are tested. If a wide

APPENDIX T



VPU(RRK)-46

J.M. Davis

Westinghouse
Electric Corporation

Water Reactor
Divisions

Nuclear Commercial
Operations Division

Box 326
Pittsburgh, Pennsylvania 15200

November 20, 1980

Mr. B. Stewart
Virginia Electric and Power Company
P. O. Box 26666
Richmond, VA 23261

Dear Mr. Stewart:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY & NORTH ANNA POWER STATION

LHSI Flow Interruption

On the Surry and North Anna plants, Westinghouse was asked by VEPCo to determine the effect on the plant safety analyses of a short duration delay (2.0 or 4.2 seconds respectively) in safety injection flow following a blackout. A related issue was evaluated extensively by the NRC during 1976 and was documented in NUREG-0138 (issue Number 4). Although the main emphasis in the NRC position stated in NUREG-0138 related to loss of power following reset of safety injection, the NRC made the following statement:

"Analyses in the Reactor Safety Study, WASH-1400, indicated the likelihood of a LOCA to be about one chance in 1000, per reactor year. The probability of the loss of offsite power in a one-hour period following a LOCA would be about one chance in 50,000. The combined probability of this sequence of events is very low.

Routine ECCS evaluations by the staff have not required consideration of interruption of flow to the core because the fundamental design basis for mitigating the consequences of a LOCA has been that a single failure or single operator error should not cause a loss of ECCS function. The staff had identified no such failure and, therefore, analyses of interruptions of core flow during a LOCA were not considered to be warranted."

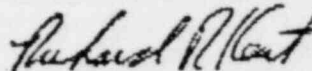
Based on the above evaluation, safety analyses have not been required to incorporate flow interruptions due to loss of power. However, Westinghouse has evaluated the effect of flow interruptions occurring during the time frame that LOCA peak clad temperatures are calculated (i.e. prior to safety injection reset). A typical flow interruption, resulting from loss of offsite power, with a time duration of approximately 15 seconds, including sequencing of safeguards loads has been investigated. The effect of this

short duration flow interruption is more than offset by performing the safety analyses with consistent assumptions, e.g. RCP running during the blowdown phase of a LOCA. A sensitivity study has been submitted to the NRC (attached letter NS-TMA-1928 from T. M. Anderson of Westinghouse to T. H. Novak of NRC dated September, 1978) which qualifies the reduction in peak clad temperature with offsite power available. This reduction more than offsets a temperature increase due to a safety injection flow interruption.

The addition of the 2.0 (or 4.2) second delay to the other delays that will occur due to sequential loading of the safeguards equipment onto the diesel generators for Surry and North Anna falls within the 15 second envelope described above. Therefore, Westinghouse concludes that the impact of the additional delay will not invalidate the results of the Surry and North Anna safety analyses. Based on the above discussion, Westinghouse does not believe that it is appropriated to perform plant specific analyses, nor would it be productive to speculate on maximum time allowable to meet safety criteria without performing significant safety analyses.

Would you please send me a copy of any correspondence you send to or receive from the NRC on this subject.

Very truly yours,



Richard R. Kent
Project Engineer
Vepco Projects

/rcc
Attachment

B. Stewart 1L, 1A

cc: G. Smith (VEPCo) 1L, 1A
R. Berryman (VEPCo) 1L, 1A
J. Davis (VEPCo) 1L, 1A
F. Walker (S&W) 1L, 1A
W. R. Cartwright (VEPCo-North Anna) 1L, 1A
J. Wilson (VEPCo-Surry) 1L, 1A

Attachment to NS-TMA-1928

PCT

Case

1

LOP

RCP-T

1950°F

2

OPA

RCP-R

1707°F

3

OPA

RCP-T

1932°F



Westinghouse Electric Corporation

Power Systems

Box 100
Pittsburgh, Pennsylvania 15200

September 6, 1978

Mr. Thomas H. Novak
U. S. Nuclear Regulatory Commission
Phillips Building
7920 Norfolk Avenue
Bethesda, Maryland

Dear Mr. Novak:

Recently a question has been raised by your staff on the assumptions made by Westinghouse with regards to offsite power and how that is interpreted with regards to containment systems actuations following a LOCA. The Westinghouse position has been that the set of assumptions yielding the highest peak clad temperature is loss of offsite power and reactor coolant pumps tripped. Inherent in this set of assumptions is the fact that there is a delay time assumed for the start-up of emergency diesels for on-site power. These are the assumptions used in a design Westinghouse ECCS analysis.

These assumptions were justified by Westinghouse sensitivity studies performed and presented to the staff in 1974. Unfortunately, these studies have never been formally documented by either Westinghouse or the staff. Also, the staff's recollection of those studies is different than that of Westinghouse. Therefore, we repeated part of that study. The details follow.

The plant analyzed was a typical 4-loop, 3411 Mwt plant with a 12' core and 17 x 17 fuel assemblies. The cases investigated were:

1. Westinghouse design case: Loss of offsite power (LOP) and reactor coolant pumps tripped (RCP-T).
2. Consistent offsite power available case: Offsite power available (OPA) and reactor coolant pumps running (RCP-R).
3. Inconsistent case: Offsite power available (OPA) and reactor coolant pumps tripped (RCP-T).

The results are summarized in the attachment. They confirm that the Westinghouse design assumptions are conservative. These results were reported to

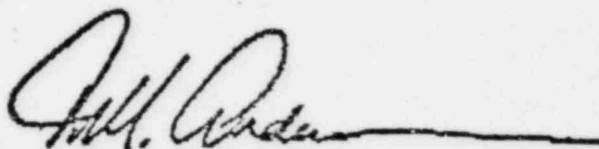
Mr. T. Kovak

-2-

x September 6, 1978

you on the telephone during the past week. It is our understanding that the Westinghouse design basis assumptions are acceptable for all Westinghouse design NSSS including the 414 design despite some misunderstanding with respect to the wording of the NRC 1974 Status Report on the Westinghouse ECCS Evaluation Model.

Very truly yours,



T. M. Anderson, Manager
Nuclear Safety Department

RAH/ljs

ATTACHMENT II

TWO UNIT SIMULTANEOUS LOADING OF THE RSST'S

A. Introduction

Our analysis to this point has consisted of identifying worst case conditions resulting from single unit (Unit 2) loading on the RSST's. As previously discussed, we believe this is a fully acceptable analysis of our offsite sources because of the Unit 1 generator breaker.

In recent telephone conferences with your Messrs. L. B. Engle and R. Trevatte and Mr. A. Udy of EGG, you have requested that we expand our analysis by analyzing the effects of Unit 1 nonsafety loads transferring to the reserve station service system during worst case conditions rather than remaining in a backfed condition on the normal station service system (a capability made possible by the generator breaker). As a result, we completed several voltage profile studies of two unit RSST loading with the emergency buses fed from the RSST's. These studies assume the presently installed load shedding for two unit loading on the RSST's has taken effect. The studies are summarized in Appendix A. The operating restriction to be used to ensure proper operation of the load shedding scheme is in Appendix B.

B. Voltage Analysis

For this analysis, the emergency buses are fed via the reserve station service system (1H on F, 1J on D, 2H on E, and 2J on F).

Cases G1E and G1E' analyze a Unit 2 CDA with Unit 1 loads transferring to the RSST's at the instant the CDA occurs. Case G1E indicates lower than required voltage at the 480V buses. Acceleration of the 4KV motors will provide sufficient voltage to the 480V motors that they will properly accelerate. It is apparent that both 2H and 2J will separate and load to the diesel generator. Case G1E' analyzes an automatic start of a feedwater pump at the occurrence of the Unit 2 CDA. Again, in this case the Unit 2 emergency buses will transfer to the diesel generator. A previously identified modification will prevent this occurrence.

Case G1E'' analyzes a Unit 2 CDA with Unit 1 loading to the RSST's 60 seconds afterwards. These results are fully acceptable.

Cases G1H and G1H' analyze transfer of both units' normal buses to the RSST's at the same instant with both units in a nonaccident condition. Results of Case G1H are acceptable. Case G1H' assumes the automatic start of a condensate pump. This starting may result in the separation of bus 2J from its offsite source.

Case G1H'' analyzes a Unit 2 trip followed by a Unit 1 loading to the RSST's 60 seconds later with both units in a nonaccident condition. The results are fully acceptable.

C. Equipment Loading

We have not completed a formalized equipment loading calculation. The RSST loading data submitted with our final 10CFR50.55E report, serial No. 403A dated August 7, 1979, concerning potential overloads of the reserve system, provides an approximation of the results we would expect from a rigorous analysis completed at this time. The maximum RSST loading indicated in that report was 138%. If limited to a one hour period, no loss of transformer life would be experienced. If continued for an 8 hour period, loss of life would be less than 2%, based on a 100% preload and average ambient temperature of 30°C.

D. Summary

The simultaneous RSST loading analysis presented in this section was completed at your request and is provided for your information. The most probable of these cases present no problems. We believe the probability of the occurrence of a condition which indicates a modification is required is sufficiently small that it may be ignored. The worst result of an occurrence of this type would be transfer of the emergency buses to their diesel generators. Combined with the occurrence probabilities, we do not believe this result is sufficiently serious to warrant additional modification.

APPENDIX A

CALCULATION SHEET

EQUIPMENT IDENTIFICATION NUMBER

J.O. OR W.O. NO.

DIVISION & GROUP

TAP CHARTER NO.

OPTIONAL TASK CODE

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CASE GIE - UNIT 1 TRIP, UNIT 2 CDA (SIMULTANEOUSLY)
 LOAD SHED → GEN BRKR FAILS - 2 UNITS' NORMAL BUSES
 LOAD GOTO RESERVES (FEEDWATER & CONDENSATE STILL RUN ON IC)
 EMERGENCY BUSES FED FROM RESERVES

	<u>1H</u>	<u>1J</u>	<u>2H</u>	<u>2J</u>
1) T=C - FIRST LOADS STARTING				
4160V	.776	.835	.795	.776
480V	.769	.825	.702	.702
480V	.768	.818	.679	.681
2) T=4 SECS - FIRST LOADS ACCELERATED (TAPS ADVANCED 1 STEP)				
4160V	.871	.893	.879	.871
480V	.869	.886	.812	.819
480V	.868	.885	.805	.815
3) T=5 SECS - MOV'S STILL STARTING (TAPS ADV 1 MORE STEP)				
4160V	.877	.895	.885	.877
480V	.876	.892	.818	.825
480V	.875	.888	.840	.854
4) T=6.5 SECS - MOV'S STILL STARTING (TAPS ADV 1 MORE STEP)				
4160V	.882	.905	.891	.882
480V	.881	.899	.825	.831
480V	.880	.893	.847	.860

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CALCULATION IDENTIFICATION NUMBER

J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

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5) $T = 9.5$ SECS - MOV LOADS STARTED (TAPS ADV 2 MORE STEPS)

4160V	.896	.917	.904	.896
480V	.896	.912	.849	.860
460V	.895	.906	.871	.874

6) $T = 20$ SECS - START AUX FDNTR (TAPS ADV 7 MORE STEPS)

4160V	.912	.947	.921	.912
480V	.913	.944	.868	.877
460V	.912	.938	.890	.892

7) $T = 195$ SECS - PRIOR TO INSIDE RECIRC START (TAPS SETTLED)

4160V	.980	1.016	.983	.979
480V	.984	1.017	.938	.951
460V	.983	1.011	.957	.964

8) $T = 195^+$ SECS - START INSIDE RECIRC SPRAY (TAPS FIXED)

4160V	.961	1.007	.964	.960
480V	.964	1.007	.917	.931
460V	.963	1.002	.804	.809

9) $T = 210$ SECS - START OUTSIDE RECIRC SPRAY (TAPS FIXED)

4160V	.957	1.005	.960	.956
480V	.960	1.005	.913	.926
460V	.959	1.000	.913	.919

10) $T = \infty$ - STEADY STATE (TAPS SETTLED)

4160V	.974	1.013	.977	.974
480V	.978	1.014	.932	.945
460V	.977	1.009	.932	.938

CALCULATION SHEET

CASE GIE' 2/1/82

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CALCULATION IDENTIFICATION NUMBER

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J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE
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CASE GIE'(REV) - UNIT 1 TRIP, UNIT 2 CDA (SIMULTANEOUS)

GEN BRKR FAILS → LOAD SHED

2 UNITS' NORMAL BUSES LOAD ONT RESERVES

(FEEDWATER ON BUS 1C STARTS WHEN 1H & 1D ARE SHED);

(CONDENSATE " " " STILL RUNNING)

EMERGENCY BUSES FED FROM RESERVES

	1H	1J	2H	2J
1) T = 0 FIRST LOADS STARTING				
1160V	.610	.535	.795	.609
480V	.590	.825	.702	.511
480V	.588	.818	.679	.518
2) T = 4 SECS - FIRST LOADS ACCELERATED (TAPS ADV 1 STEP)				
1160V	.663	.893	.879	.663
480V	.648	.886	.812	.585
480V	.646	.880	.835	.618
3) T = 5 SECS - MOV'S STILL STARTING (TAPS ADV 1 MORE STEP)				
1160V	.665	.898	.885	.665
480V	.650	.892	.818	.587
480V	.648	.886	.840	.618
4) T = 6.5 SECS - MOV'S STILL STARTING (TAPS ADV 1 MORE STEP)				
1160V	.667	.905	.891	.667
480V	.652	.899	.825	.589
480V	.650	.893	.847	.620

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

CASE GIE (Rev. 10/1/82)

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CALCULATION IDENTIFICATION NUMBER				PAGE 4/5
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	

5) T = 9.5 SECS - MCI LOADS STARTED (TAPS ADV 2 MORE STEPS)				
4100V	.896	.917	.904	.896
480V	.896	.912	.849	.860
480V	.895	.900	.871	.874
6) T = 20 SECS - START AUX FEEDTR (TAPS ADV 7 MORE STEPS)				
4100V	.912	.947	.921	.912
480V	.913	.944	.868	.877
480V	.912	.938	.890	.892
7) T = 195 SECS - PRIOR TO INSIDE RECIRC START (TAPS SET 2)				
4100V	.980	1.016	.983	.979
480V	.984	1.017	.938	.951
480V	.983	1.011	.957	.964

NOTE: FEEDWATER PUMP ON BUS 1C IS MODELED AS A STARTING LOAD FROM T=0 TO T=9.5 SECS.

IF FWP 1C HAD NOT BEEN RUNNING PRIOR TO THE LOAD SHED, IT WOULD RECEIVE AN AUTO START SIGNAL AND THIS PROFILE WOULD RESULT (GIVEN LOAD SHED IN "UNIT 2 STARTUP" POSITION WITH FWP 2A & 2B RUNNING).

IF FWP 1C HAD BEEN RUNNING, SEE CRITICAL CASE GIE FOR PROFILE (JOB 956 2/6/82). SAME CONDITIONS APPLY ON THE LOAD SHED SWITCH AND THE UNIT 2 FWP.

CALCULATION SHEET

CASE G1E'' 2/13/82

CALCULATION IDENTIFICATION NUMBER					PAGE 1/4
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION P.C.	OPTIONAL TASK CODE		
CASE G1E'' - UNIT 2 CDA, UNIT 1 TRIP 60 SECONDS LATER GENERATOR BREAKER FAILS @ T=60 → LOAD SHED ACTIVATED EMERGENCY BUSSES FED FROM RESERVES					
	<u>1H</u>	<u>1J</u>	<u>2H</u>	<u>2J</u>	
1) T=0, UNIT 2 CDA LOADS STARTING (TAPS FIXED) :					
4160V	.857	.871	.833	.857	
480V	.855	.863	.746	.789	
480V	.854	.857	.716	.758	
2) T=4 SECS, FIRST LOADS ACCELERATED (TAPS HAVE ADVANCED 1 STEP)					
4160V	.951	.928	.918	.951	
480V	.954	.923	.855	.905	
480V	.953	.918	.877	.934	
3) T=5 SECS, MOV LOADS STILL ACCELERATING (TAPS ADV. 1 MORE STEP)					
4160V	.958	.933	.923	.958	
480V	.961	.929	.861	.912	
480V	.960	.923	.882	.941	
4) T=6.5 SECS, MOV LOADS STILL ACCELERATING (TAPS ADV. 1 MORE STEP)					
4160V	.963	.940	.930	.963	
480V	.967	.936	.868	.918	
480V	.965	.930	.889	.947	

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

CASE GIE (cont'd) 2/13/64

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CALCULATION IDENTIFICATION NUMBER

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J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

	<u>1H</u>	<u>II</u>	<u>2H</u>	<u>2J</u>
5) T=9.5 SECS, MOV LOADS ACCELERATED (TAPS ADV 2 MORE STEPS)				
4160V	.978	.952	.944	.978
480V	.982	.949	.894	.950
480V	.981	.944	.915	.963
6) T=20 SECS, START AUX FEEDWATER PUMPS (TAPS ADV 7 MORE STEPS)				
4160V	.998	.984	.962	.998
480V	1.003	.983	.914	.971
480V	1.002	.978	.934	.984
7) T=60 SECS, PRIOR TO UNIT 1 TRANSFER (TAPS SETTLED)				
4160V	1.034	1.037	1.024	1.033
480V	1.040	1.038	.984	1.010
480V	1.039	1.033	1.002	1.022
8) T=60+ SECS, UNIT 1 TRIPS & TRANSFERS TO ASS, LOAD SHED (TAPS FIXED)				
4160V	.945	.999	.982	.945
480V	.947	.998	.938	.913
480V	.946	.993	.957	.927
9) T=195 SECS, PRIOR TO START OF INSIDE RECIRC SPRAY (TAPS SETTLED)				
4160V	.980	1.016	.983	.979
480V	.984	1.017	.938	.951
480V	.983	1.011	.957	.964

CALCULATION SHEET

11 2/13/52
CASE GIE (cont'd)

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CALCULATION IDENTIFICATION NUMBER

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J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

1H1I2H2I10) $T = 195^+ \text{ SECS}$, START INSIDE RECIRC SPRAY (THIS FIXED)

4160V	.961	1.007	.964	.960
480V	.964	1.007	.917	.931
480V	.963	1.002	.804	.809

11) $T = 210 \text{ SECS}$, START OUTSIDE RECIRC SPRAY

4160V	.957	1.005	.960	.956
480V	.960	1.005	.913	.926
480V	.959	1.000	.913	.919

12) $T = \infty$, STEADY STATE (THIS SETTLED)

4160V	.974	1.013	.977	.974
480V	.978	1.014	.932	.945
480V	.977	1.009	.932	.938

CALCULATION SHEET

CASE G1H 2/6/82

5010 55

CALCULATION IDENTIFICATION NUMBER

J.O. OR W.O. NO.

DIVISION & GROUP

CALCULATION NO.

OPTIONAL TASK CODE

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CASE G1H - 2 UNIT TRIP (No CDA) SIMULTANEOUSLY

GEN BRKR FAILS → LOAD SHED (ASSUMED IN "UNIT 2 STARTUP")
 2 UNITS' NORMAL BUSES LOAD ONTO RESERVES
 EMERGENCY BUSES FED FROM RESERVES

WITH FWP
 2A & 2B RUNNING

I) ASSUMING FWP IC RUNNING PRIOR TO TRIP
 (JOB 953 2/6/82)

1H1J2H2J1) $T = 0$ LOADS STARTING

4160V	.650	.884	.870	.850
480V	.643	.867	.869	.840
480V	.646	.870	.871	.838

2) $T = \infty$ STEADY STATE

4160V	.978	1.016	.991	.978
480V	.982	1.008	.997	.976
480V	.981	1.011	.998	.974

G1H

II) ASSUMING FWP IC NOT RUNNING PRIOR TO TRIP & WILL START
 ON TRIP. (JOB 945 2/6/82)

1) $T = 0$ LOADS STARTING

4160V	.650	.884	.870	.650
480V	.633	.867	.869	.623
480V	.631	.870	.871	.619

2) $T = \infty$ STEADY STATE

4160V	.978	1.016	.991	.978
480V	.982	1.008	.997	.976
480V	.981	1.011	.998	.974

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CALCULATION SHEET

CASE G1H 2/13/62

J.O. OR W.O. NO.		DIVISION & GROUP		CALCULATION IDENTIFICATION NUMBER	OPTIONAL TASK CODE	PAGE 4/4
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CASE G1H - UNIT 2 TRIP, UNIT 1 TRIP 60 SECS LATER
GENERATOR BREAKER FAILS AND LOAD SHED
ACTIVATES @ T = 60 SECONDS.
EMERGENCY BUSES FED FROM RESERVES

	<u>1H</u>	<u>1J</u>	<u>2H</u>	<u>2J</u>
1) T = 0, UNIT 2 TRIPS & TRANSFERS TO RSS (TAPS FIXED)				
4160V	.952	.859	.855	.952
480V	.955	.841	.854	.948
480V	.953	.844	.856	.946
2) T = 60 SECS., PRIOR TO UNIT 1 TRANSFER (TAPS SETTLED)				
4160V	1.034	.980	.957	1.034
480V	1.040	.971	.962	1.035
480V	1.039	.974	.963	1.032
3) T = 60+ SECS., UNIT 1 TRIPS & TRANSFERS TO RSS, LOAD SHED (TAPS FIXED)				
4160V	.921	1.004	.967	.921
480V	.923	.996	.972	.916
480V	.921	.998	.973	.913
4) T = ∞, STEADY STATE (TAPS SETTLED)				
4160V	.978	1.016	.991	.978
480V	.982	1.008	.997	.976
480V	.981	1.011	.998	.974

APPENDIX B

LOAD SHEDDING FOR
TWO UNIT SIMULTANEOUS LOADING OF THE RSST'S

The present automatic load shedding scheme, which is designed to be enabled whenever either unit is in startup, is used to reduce equipment overload and improve distribution system voltages in the cases where two units would be loaded to the RSST's simultaneously.

This existing load shedding scheme will be enabled at all times to ensure that automatic load shedding is initiated for any condition where two unit simultaneous loading to the RSST's occurs.