

15.3.7 AUXILIARY ELECTRICAL SYSTEMS

Applicability

Applies to the availability of off-site and on-site electrical power for plant power operation and for the operation of plant auxiliaries.

Objective

To define those conditions of electrical power availability necessary (1) to provide for safe reactor operation, and (2) to provide for the continuing availability of engineered safeguards.

Specification

- A.1 Under normal conditions neither one nor both reactors shall be made critical unless the following conditions are met:
- a. At least two 345 KV transmission lines are in service.
 - b. The 345/13.8 KV and the 13.8/4.16 KV station auxiliary transformers associated with the reactor(s) to be taken critical are in service; or one 345/13.8 KV station auxiliary transformer and the associated 13.8/4.16 KV station auxiliary transformer(s) are in service with the gas turbine operating.
 - c. 480 Volt buses B03 and B04 for the unit(s) to be taken critical are energized.
 - d. 4160 Volt buses A03, A04, A05, and A06 for the unit(s) to be taken critical are energized.
 - e. A fuel supply of 11,000 gallons is available; and both diesel generators are operable.
 - ~~f. All four batteries and their associated DC systems are operable.~~
 - f. Four of the five safety-related station batteries and all four of the main DC distribution systems are operable.
 - g. Four battery chargers are operable with one charger carrying the DC loads on each main DC main distribution bus: D01, D02, D03 and D04.

A.2 Under abnormal conditions ~~including Black Plant startup~~, one reactor may be made critical providing the following conditions are met:

- a. One 345 KV transmission line is in service; or the gas turbine is operating.
- b. The 345/13.8 KV and the 13.8/4.16 KV station auxiliary transformers associated with the unit to be taken critical are in service; or the associated 13.8/4.16 KV station auxiliary transformer is in service and the gas turbine is operating.
- c. Reactor power level is limited to 50% rated power until 2 or more transmission lines are restored to service.
- d. 480 Volt buses B03 and B04 for the unit to be taken critical are energized.
- e. 4160 Volt buses A03, A04, A05, and A06 for the unit to be taken critical are energized.
- f. A fuel supply of 11,000 gallons is available; and both diesel generators are operable.
- ~~g. All four batteries and their associated DC systems are operable.~~
- g. Four of the five safety-related station batteries and all four of the main DC distribution systems are operable.
- h. Four battery chargers are operable with one charger carrying the DC loads of each main DC main distribution bus; D01, D02, D03 and D04.

B.1 During power operation of one or both reactors, the requirements of 15.3.7.A.1 may be modified to allow the following arrangements of systems and components:

- a. If the 345 KV lines are reduced to only one, any operating reactor(s) must be promptly reduced to, and limited to, 50% power. If all 345 KV lines are lost, any operating reactor(s) will be reduced to supplying its auxiliary load, until one or more 345 KV transmission lines are again available.
- b. If both 345/13.8 KV auxiliary transformers are out of service and only the gas turbine is operating, only one reactor will remain operating and it will be limited to 50% power. The second reactor will be placed in the hot shutdown condition.

- c. If the 13.8/4.16 KV auxiliary transformers are reduced to only one, the reactor associated with the out of service transformer must be placed in the hot shutdown condition.
- d. Either bus A03 or A04 may be out of service for a period not exceeding 7 days provided both diesel generators are operable and the associated diesel generator is operating and providing power to the engineered safeguard bus normally supplied by the out of service bus.
- e. One diesel generator may be inoperable for a period not exceeding 7 days provided the other diesel generator is tested daily to ensure operability and the engineered safety features associated with this diesel generator shall be operable.
- ~~f. One of the batteries D05 or D06 may be inoperable for a period not exceeding 24 hours provided the other three batteries and four battery chargers remain operable with one charger carrying the DC loads of each DC main distribution bus.~~
- ~~g. One of the batteries D105 or D106 may be inoperable for a period not exceeding 72 hours provided the other three batteries and four battery chargers remain operable with one charger carrying the DC loads of each DC main distribution bus.~~
- f. One of the four connected safety-related station batteries may be inoperable for a period not exceeding 24 hours provided four battery chargers remain operable with one charger carrying the DC loads of each main DC distribution bus.

Basis

This two unit plant has four 345 KV transmission line interconnections. A 20 MW gas turbine generator and two 2850 KW diesel generators are installed at the plant. All of these energy sources will be utilized to provide depth and reliability of service to the Engineered Safeguards equipment through redundant station auxiliary power supply systems.

The electrical system equipment is arranged so that no single contingency can inactivate enough safeguards equipment to jeopardize the plant safety. The 480-volt equipment is arranged on 4 buses per unit. The 4160-volt equipment is supplied from 6 buses per unit.

Two separate outside sources can serve either unit's low voltage station

auxiliary transformer. One is a direct feed from the unit's high voltage station auxiliary transformer and the second is from the other unit's high voltage station auxiliary transformer or the gas turbine via the 13,800 volt system tie bus H01.

Separation is maintained in the 4160-volt system to allow the plant auxiliary equipment to be arranged electrically so that redundant items receive their power from the two different buses. For example, the safety injection pumps are supplied from the 4160 volt buses 1-A05 and 1-A06 for Unit No. 1 and 2-A05 and 2-A06 for Unit No. 2; the six service water pumps are arranged on 480-volt buses as follows: two on bus 1-B03, one on bus 1-B04, one on bus 2-B03 and two on bus 2-B04; the four containment fans are divided between 480-volt buses 1-B03 and 1-B04 for Unit No. 1 and 2-B03 and 2-B04 for Unit No. 2 and so forth. Redundant valves are supplied from motor control centers 1-B32 and 1-B42 for Unit No. 1 and 2-B32 and 2-B42 for Unit No. 2.

~~The Point Beach DC electrical system has been modified so that each of the four instrument bus power supplies has its own battery and battery charger. One battery charger shall be in service on each battery so that the batteries will always be at full charge in anticipation of a loss of ac power incident. This insures that adequate dc power will be available for starting the emergency generators and other emergency uses.~~

The Point Beach DC electrical system has been modified so that each of the four main DC distribution buses, which are shared between the two units, has its own power supplies consisting of a safety-related station battery (D05, D06, D0105, D0106) and a battery charger. In addition to these bus-specific power supplies, a swing safety-related battery (D0205) is installed which is capable of being connected to any one of the four main DC distribution buses. Swing battery chargers are also provided. Under normal circumstances, one battery and one battery charger are connected to each main DC distribution bus. The battery charger normally shall be in service on each battery so that the batteries will always be at full charge in anticipation of a loss-of-AC power incident. Under unusual circumstances, two of the five safety-related batteries may be out of service for a limited period of time provided one of the two out-of-service batteries is returned to service within the time periods specified in Specification 15.3.7.B.1.f. These limiting conditions for operation ensure that

adequate DC power will always be available for starting the emergency generators and other emergency uses.

The emergency generator sets are General Motors Corporation, Electro-Motive Division, Model 999-20 Units rated at 2850 KW continuous, 0.8 power factor 900 RPM, 4160 volts 3 phase, 60 cycle and consume 205 gallons of fuel per hour. Thus the 11,000 gallon supply in the Emergency Fuel Tank provides sufficient fuel to operate one diesel at design load for more than 48 hours. In addition, it will be normal for Point Beach to keep one, or the equivalent of one, bulk storage tank full at all times (55,000 gallons which is equal to about 10 days' supply). They are each capable of providing 3050 kw for a 30 minute period. The gas turbine is capable of providing 20,000 kw.

If only one 345 KV transmission line is in service to the plant switchyard, a temporary loss of this line would result in a reactor trip(s) if the reactor(s) power level were greater than 50%. Therefore, in order to maintain continuity of service and the possibility of self sustaining operations, if only one 345 KV transmission line is in service to any operating reactor(s), the power level of the affected reactor(s) will be limited to 50%.

If both 345/13.8 KV station auxiliary transformers are out of service, only one reactor will be operated. The gas turbine will be supplying power to operate the safeguards auxiliaries of the operating reactor and acts as a backup supply for the unit's normal auxiliaries. Therefore, to prevent overloading the gas turbine in the event of a reactor trip, the maximum power level for the operating reactor will be limited to 50%. These conservative limits are set to improve transmission system reliability only and are not dictated by safety system requirements.

References

FSAR Section 8.

3. Each diesel generator shall be given an inspection, at least annually, following the manufacturer's recommendations for this class of stand-by service.
4. Each fuel oil transfer pump shall be run monthly.

The above tests will be considered satisfactory if all applicable equipment operates as designed.

B. Safety-Related Station Batteries

These surveillance specifications are applicable to all four safety-related station batteries: D05, D06, D105, and D106; and the safety-related station swing battery D205.

1. Every month the voltage of each cell (to the nearest 0.05 volt), the specific gravity and temperature of a pilot cell in each battery and each battery voltage shall be measured and recorded.
2. Every 3 months the specific gravity, the height of electrolyte, and the amount of water added, for each cell, and the temperature of every fifth cell, shall be measured and recorded.
3. At each time data is recorded, new data shall be compared with old to detect signs of abuse or deterioration.
4. ~~Each battery shall be subjected to a load test at intervals recommended by the manufacturer but not exceeding five years. The battery voltage as a function of time shall be monitored to establish that the capacity is sufficient to carry the loads as delineated in FSAR Table 8.2-3 for the specified length of time. All electrical connections will be checked for tightness.~~
4. Each safety-related station battery shall be demonstrated OPERABLE:
 - a. At least once per 18 months (SERVICE TEST) by verifying that the battery capacity is adequate to supply and maintain in OPERABLE status all of the actual or simulated emergency loads for the design duty cycle.*
 - b. At least once per 60 months (PERFORMANCE TEST) by verifying that the battery capacity is at least 80% of the manufacturer's rating. This performance discharge test may be performed in lieu of the battery service test.*
 - c. Annual performance discharge tests of battery capacity shall be

given to any battery that shows signs of degradation or has reached 85% of the service life expected for the application. Degradation is indicated when the battery capacity drops more than 10% of rated capacity from its previous performance test, or is below 90% of the manufacturer's rating. When performance tests are required, they may be performed in lieu of the battery service test.*

* Service and Performance testing to begin subsequent to installation of the swing safety-related battery (D0205) which is expected by the end of 1992.

Basis

The tests specified are designed to demonstrate that the diesel generators will provide power for operation of equipment. They also assure that the emergency generator system controls and the control systems for the safeguards equipment will function automatically in the event of a loss of all normal AC station service power.

The testing frequency specified will be often enough to identify and correct any mechanical or electrical deficiency before it can result in a system failure. The fuel supply and starting circuits and controls are continuously monitored and any faults are alarm indicated. An abnormal condition in these systems would be signaled without having to place the diesel generators themselves on test.

Station batteries will deteriorate with time, but precipitous failure is extremely unlikely. The surveillance specified is that which has been demonstrated over the years to provide an indication of a cell becoming unserviceable long before it fails. If a battery cell has deteriorated or if a connection is loose, the voltage under load will drop excessively indicating replacement or maintenance.

A Service Test, performed at least every 18 months, demonstrates adequate battery capacity to supply power to loads required during the most demanding duty cycle. This design duty cycle occurs upon an actuation of safeguards loads in one unit coincident with a loss of off-site power. The design duty cycle is defined further in FSAR, Section 8.2.

A Performance Test will also be conducted at least every 60 months. The Performance Test is a constant discharge rate capacity test which allows comparison with the manufacture's rating of the battery. This test is the best indicator of the effects of aging on battery capacity. Provisions are made in these specifications to change the test periodicity to annual when the battery is degraded or when the battery reaches that point in its service life at which capacity degradation with time is accelerated. Operability is satisfactorily demonstrated by achieving a capacity of at least 80% of the manufacturer's rating. Since the Performance Test bounds the battery loads applied during a Service Test, when a Performance Test is conducted, the Service Test for that battery's current test cycle may be omitted.

These surveillance specifications are applicable to all five of the safety-related station batteries: D05, D06, D105, D106, and the swing battery D205.

Reference

FSAR, Section 8.2

BATTERY D03
EXISTING DUTY CYCLE
(SERVICE TEST)

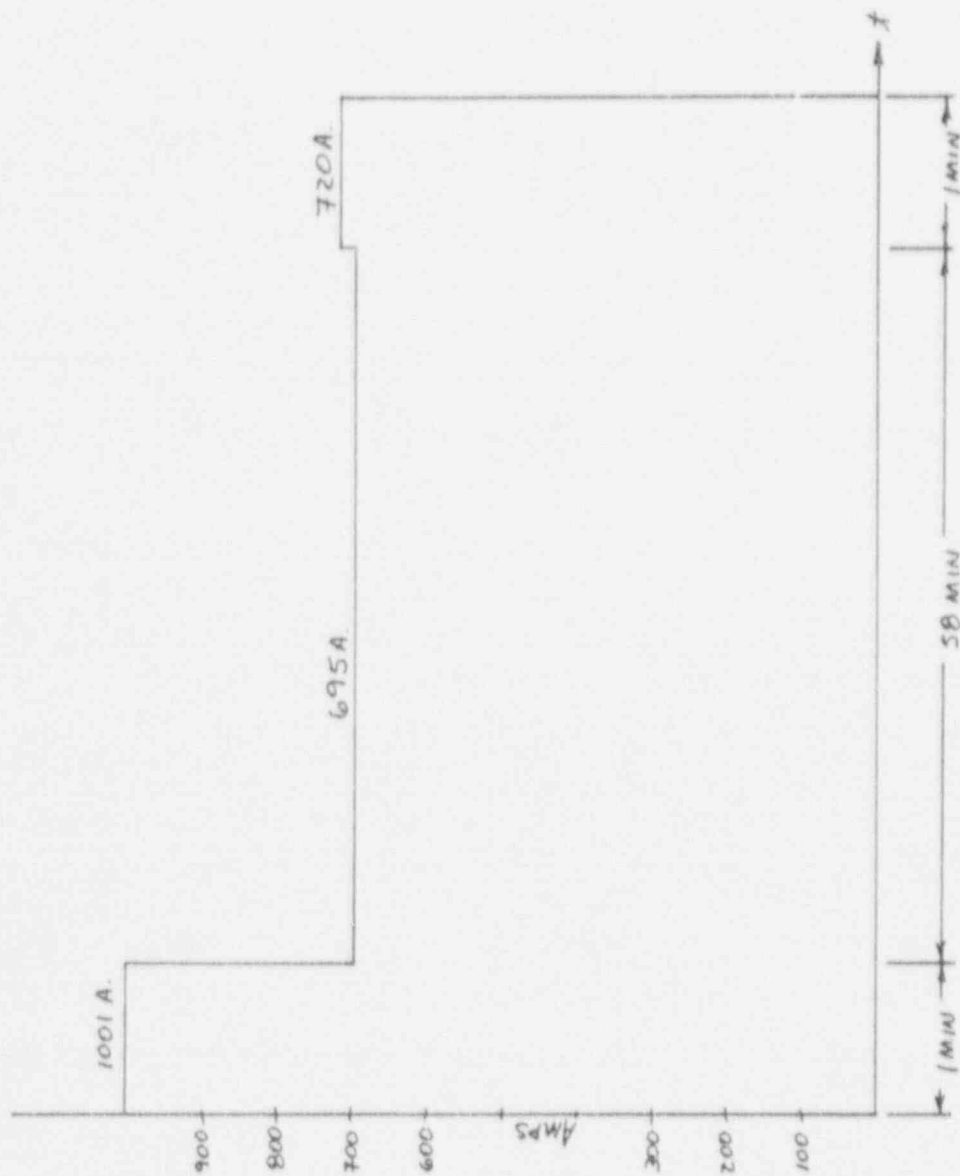


FIGURE 1

BATTERY DO16
EXISTING DUTY CYCLE
(SERVICE TEST)

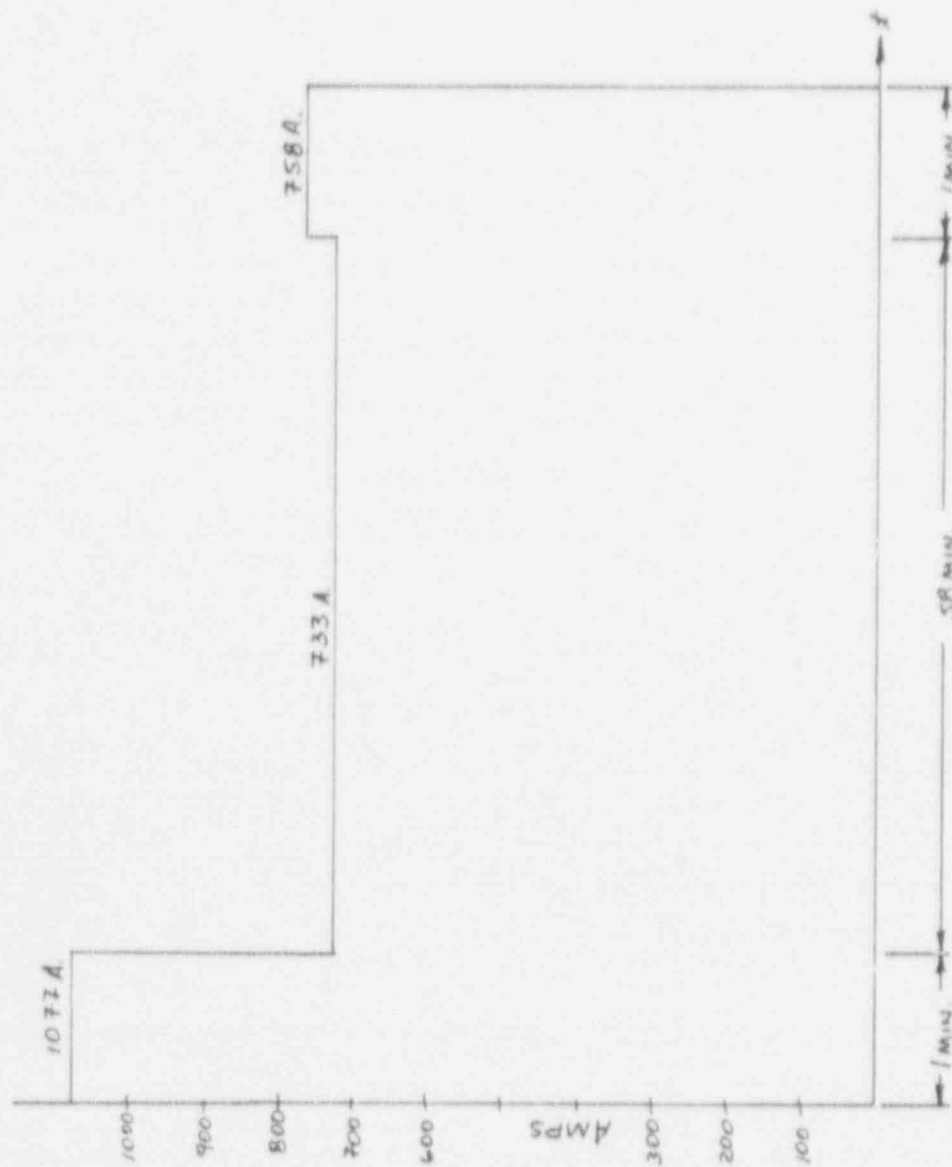


FIGURE 2

BATTERIES DIDS, D106
DUTY CYCLE
(SERVICE TEST)

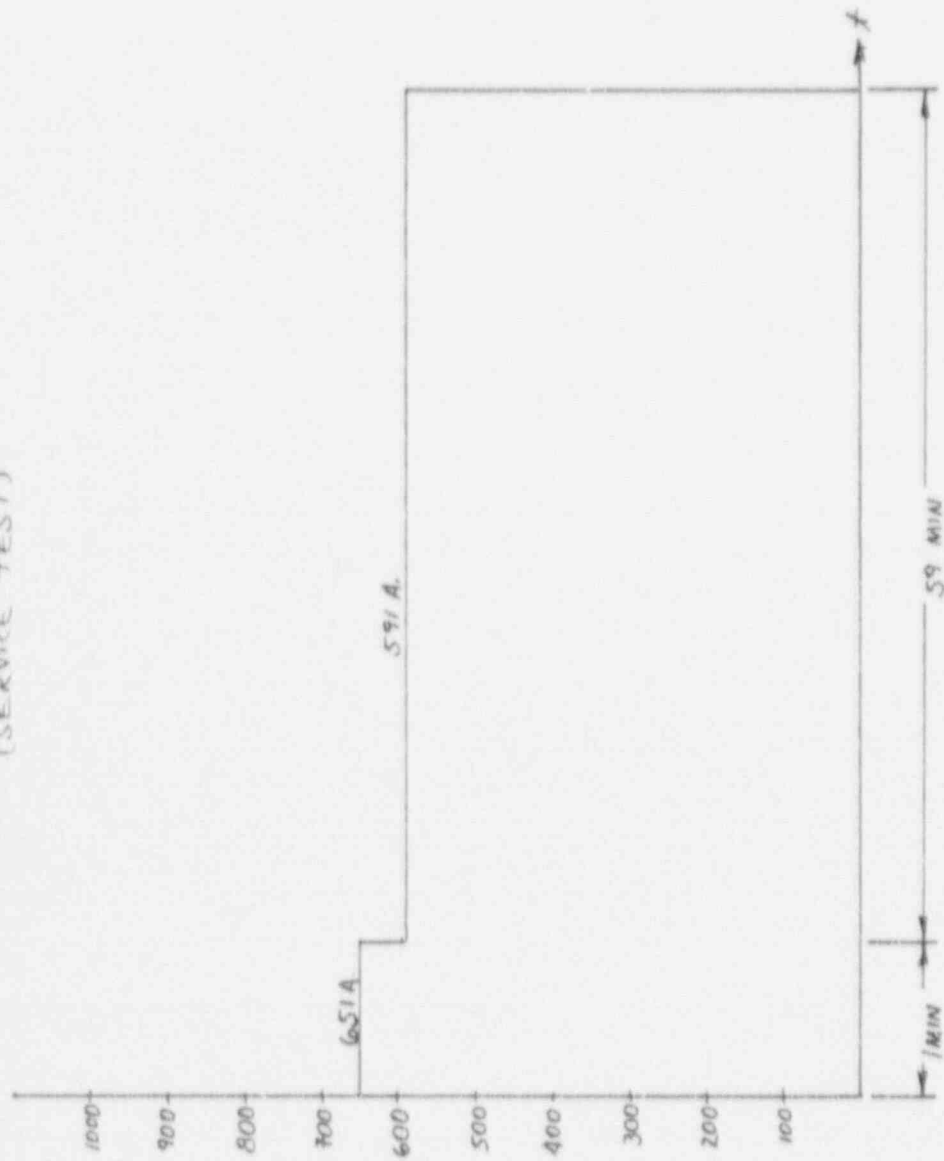


FIGURE 3

BATTERIES DOS 6 DOG
ONE HOUR RATING
(PERFORMANCE TEST)



FIGURE 4

BATTERIES DIOS $\frac{1}{2}$ DIOW
ONE HOUR RATING
(PERFORMANCE TEST)



FIGURE 5

BATTERY DOS
NEW DUTY CYCLE
AFTER REMOVING IP37D
(SERVICE TEST)

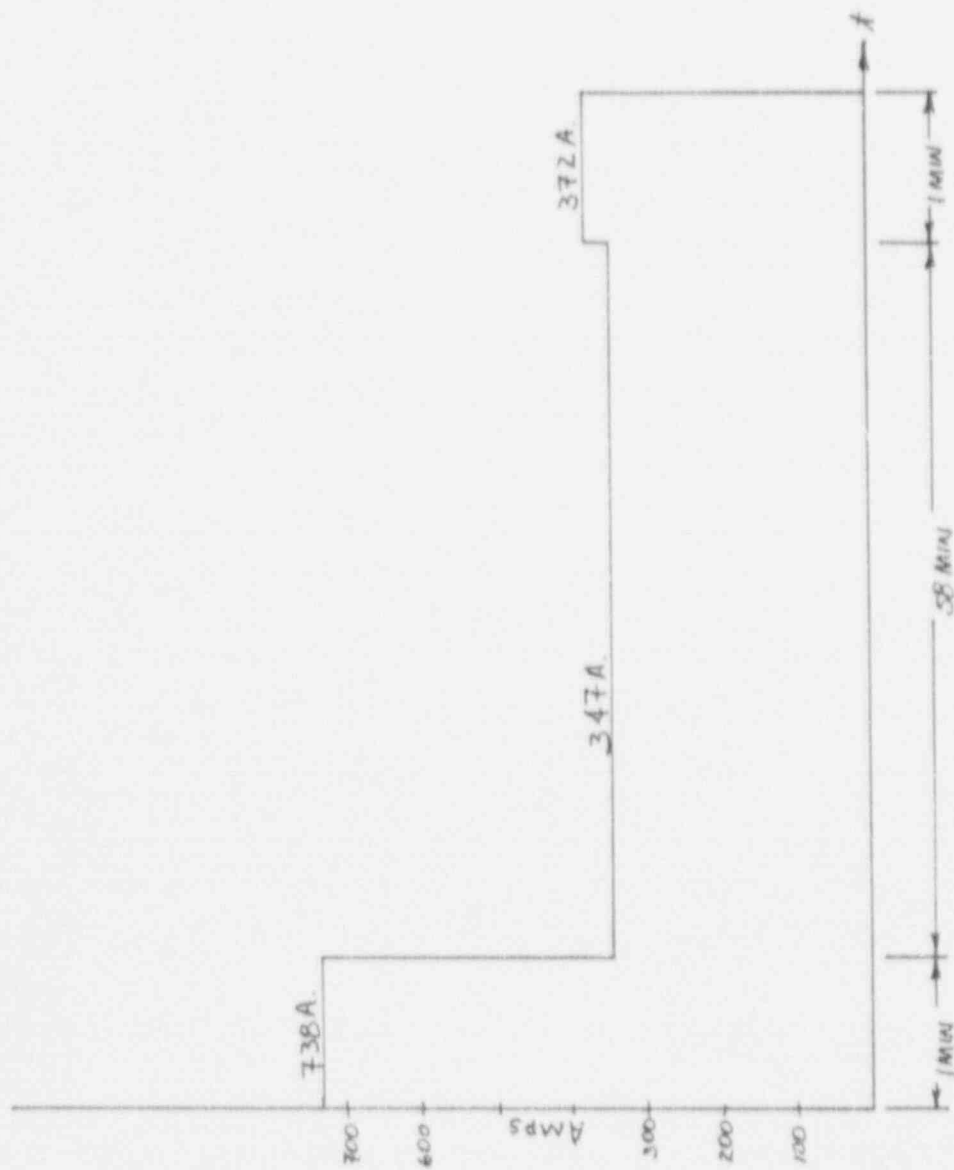


FIGURE 6

BATTERY D06
NEW DUTY CYCLE
AFTER REMOVING ZP37D
(SERVICE TEST)

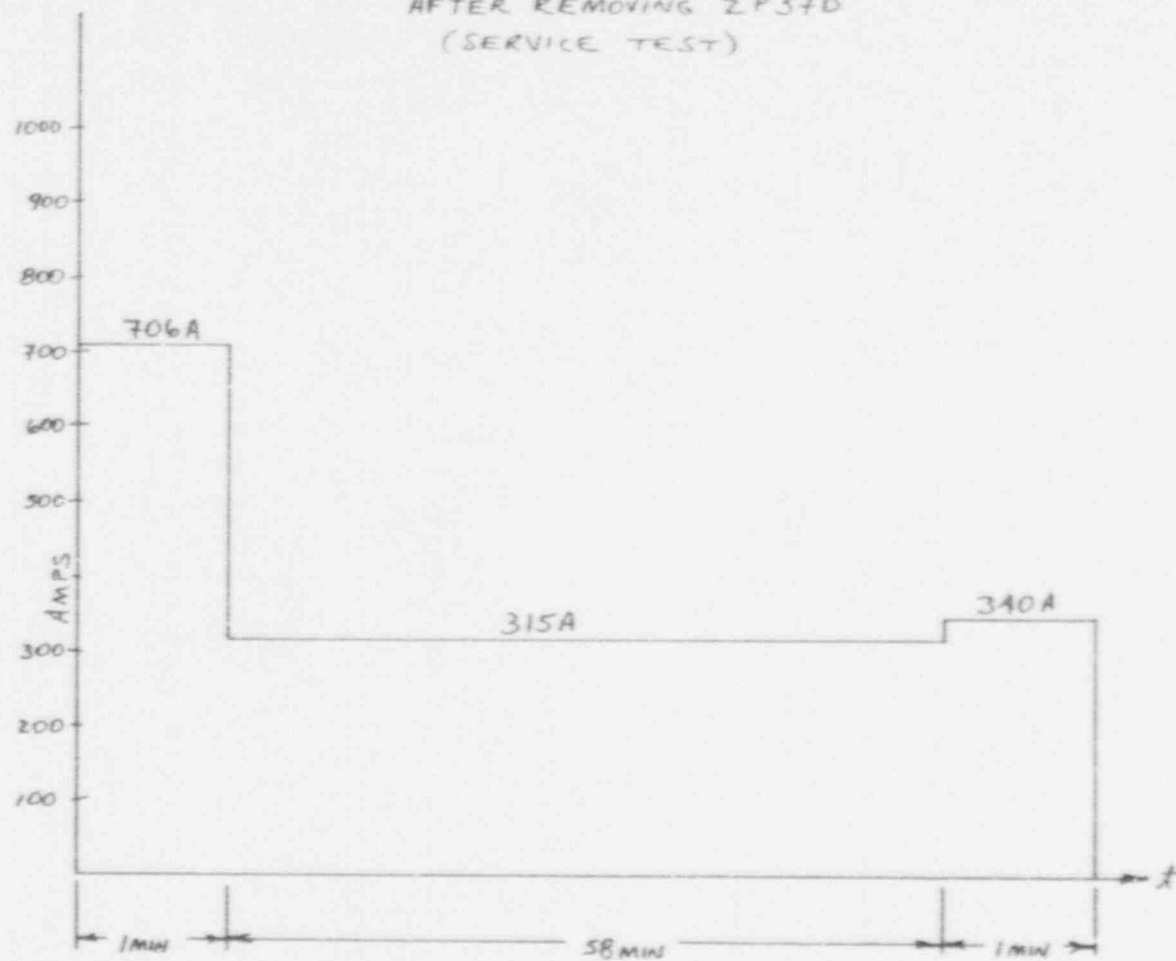


FIGURE 7