

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

02-LOT-001-262-2-02

Revision

6

07-188-91

TITLE: EMERGENCY AC POWER SYSTEMS

	<u>SIGNATURE</u>	<u>DATE</u>
PREPARER	<u>[Signature]</u>	<u>5/20/91</u>
TRAINING AREA SUPERVISOR	<u>[Signature]</u>	<u>6/3/91</u>
TRAINING SUPPORT SUPERVISOR	<u>[Signature]</u>	<u>6-4-91</u>
PLANT SUPERVISOR/ USER GROUP SUPERVISOR	<u>[Signature]</u>	<u>6/29/91</u>

Summary of Pages

(Effective Date: 6/24/91)

Number of Pages: 18

<u>Date</u>	<u>Pages</u>
May 1991	1 - 18

MASTER

TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:
CONTROLLED
VERIFICATION
DATA ENTRY:
DOCUMENT

9305030361 911031
PDR ADDCK 05000410
S PDR

5/3/91

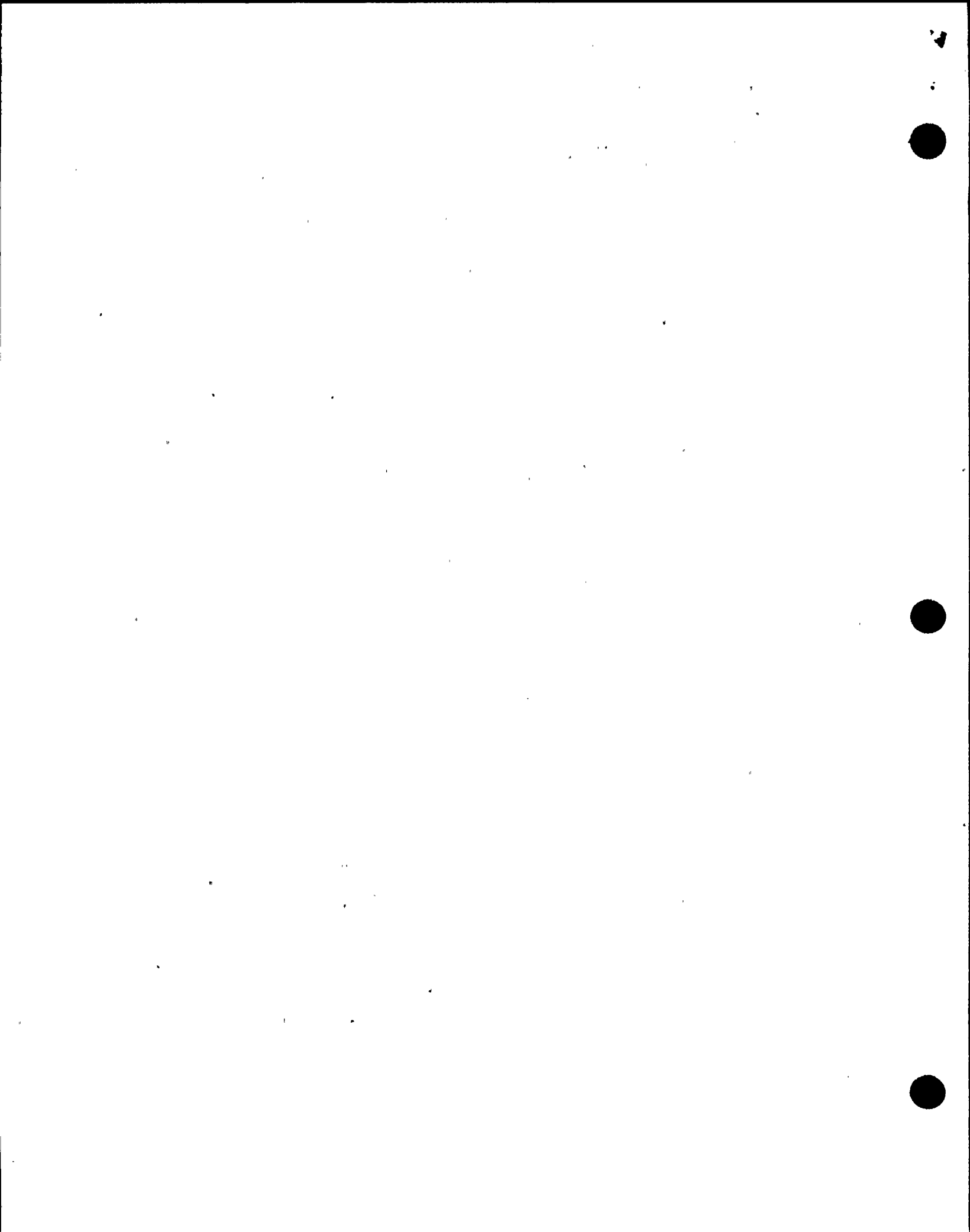
20PP

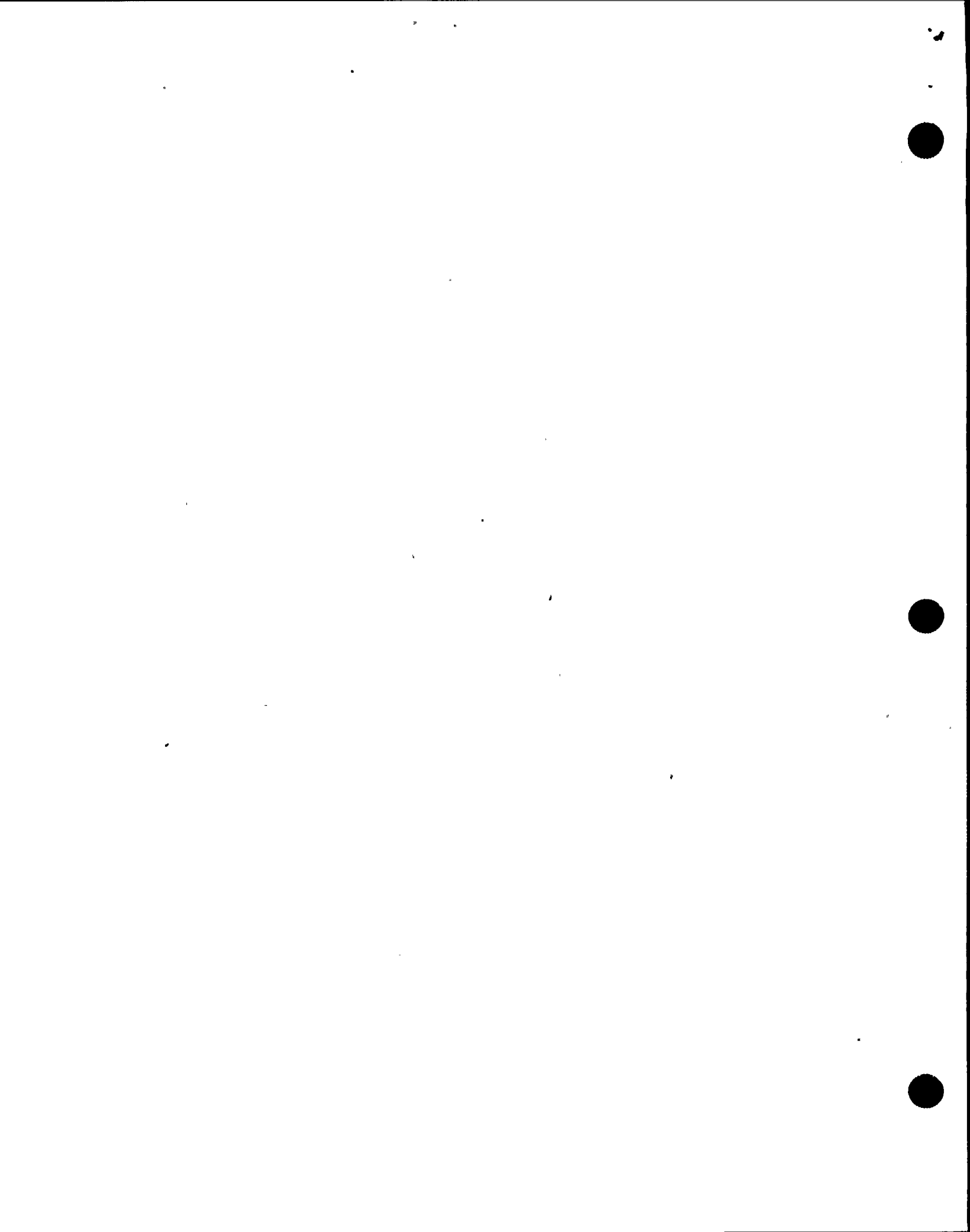
12



I. TRAINING DESCRIPTION

- A. Title of Lesson: Emergency AC Power Systems
- B. Lesson Description: This lesson contains information pertaining to the Emergency AC Power System. The scope of this training is defined by the learning objectives and in general covers the knowledge requirements of a Licensed Control Room Operator. |6
- C. Estimate of the Duration of the Lesson: 2 hours
- D. Method of Evaluation, Grade Format, and Standard of Evaluation: Written examination, passing grade of 80% or greater. |6
- E. Method and Setting of Instruction: This training should be conducted in the classroom. |
- F. Prerequisites:
 - 1. Instructor:
 - a. The instructor shall be familiar with the lesson materials and have achieved the necessary instructor certification in accordance with NTP-16. |6
 - 2. Trainee:
 - a. Initial License Candidate - In accordance with eligibility requirements of NTP-10. |6
- G. References:
 - 1. Technical Specifications
 - a. 3/4.8.1 AC Sources
 - b. 3/4.8.2 DC Sources
 - c. 3/4.8.3 On-Site Power Distribution System
 - 2. Procedures
 - a. N2-OP-72 Standby and Emergency AC Distribution System
 - 3. NMP-2 USAR
 - a. Design Basis, Vol. 16, Ch. 8.1, Pg. 8.1-6
AC Power System, Vol. 16, Ch. 8.3, Pg. 8.3-6





V. LEARNING OBJECTIVES

Upon satisfactory completion of this lesson the trainee will demonstrate the knowledge to:

A. Terminal Objectives:

- TO-1.0 Perform monthly functional test of the 4160V Emergency Bus loss and degraded voltage, N2-OSP-ENS-M001. (2620090201)
- TO-2.0 Re-energize the STUB Busses after a loss of off-site power. (2629060401)
- TO-3.0 Transfer Emergency Bus from Reserve Station Transformer and return to normal source. (2629130101)
- TO-4.0 Place a UPS in Service from a deenergized condition. (2629140101)
- TO-5.0 Energize the 600V busses. (2629220101)

B. Enabling Objectives:

Upon satisfactory completion of this lesson the trainee will demonstrate the knowledge to:

- EO-1.0 Explain the purpose of the Emergency AC Power System.
- EO-2.0 Describe the function and operation of each of the following major components and auxiliary systems to the Emergency AC Power System.
 - a. 4.16 KV Emergency Switchgear Busses
 - b. 600V Emergency Local Centers
 - c. 600V Motor Control Centers
 - d. Distribution Transformers
 - e. 600-208/120V Transformers
 - f. 120/240V and 120V Distribution Panels
 - g. 120 VAC uninterruptible power supplies.
- EO-3.0 State the setpoint and purpose for the following interlock:
 - a. Circuit breaker key interlocks.
- EO-4.0 Describe the interrelationship between the Emergency AC Power System and the following systems.
 - a. Plant D.C. Electrical Distribution System
 - b. Plant AC Electrical Distribution System
 - c. Standby Diesel Generator System
- EO-5.0 Explain the basis for each precaution and limitation listed in N2-OP-72.



- EO-6.0 Regarding the Emergency AC Power System, determine and use the correct procedure to identify the actions and/or locate information related to: | 6
- a. Startup |
 - b. Shutdown |
 - c. Normal |
 - d. Off Normal |
 - e. Annunciator Response procedures |
- EO-7.0 Given a specific set of plant conditions, determine how the Emergency AC Power System responds. |
- EO-8.0 Given a specific set of plant conditions, describe the immediate operator actions required. |
- EO-9.0 (SRO Only) Given NMP2 Technical Specifications and a set of plant conditions, determine the appropriate bases, limiting condition for operations, limiting safety system setting, and/or action statement as appropriate. |



I. INTRODUCTION

Preliminary Activities

1. Introduce self to class if unfamiliar.
2. Circulate TR for completion.
3. Discuss Method of Evaluation.
4. Handout Course Evaluation forms.
5. Handout Trainee Learning Objectives.

|6
|
|
|
|
|

Trainee Learning Objectives

Review Trainee Learning Objectives

A. Purpose

The function of the Emergency A.C. Power System (ENS) is to provide a source of AC power to all Class 1E Safety-Related station loads.

EO-1.0

|6

B. System Overview

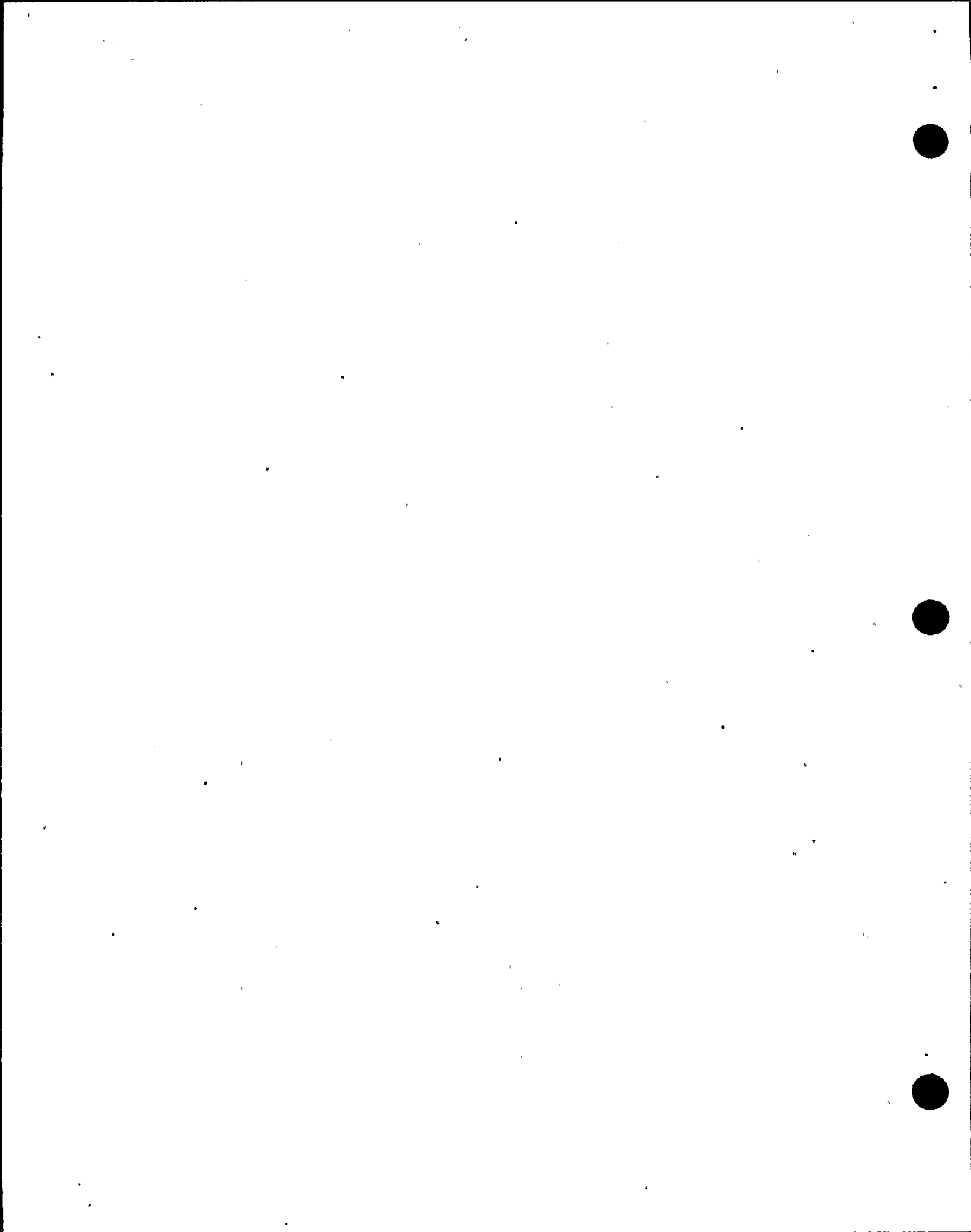
1. Emergency Distribution System consists of:
 - a. 4.16 KV Emergency switchgear buses
 - b. 600V Emergency Load Centers
 - c. 600V motor control Centers
 - d. distribution transformers
 - e. 600-208/120V transformers
 - f. 120/240V and 120V distribution panels
 - g. 120 VAC uninterruptible power supplies.

Q: What are Safety Related Loads?

|6

A: 10CFR50.49 identifies them as equipment that is relied upon to remain functional during and following design basis events to ensure (i) the integrity of the reactor coolant pressure boundary, (ii) the capability to shutdown the reactor and maintain it in a safety shutdown conditions, and (iii) the capability to mitigate the consequences of accidents that could result in off-site exposures comparable to 10CFR100 guidelines.

|
|
|
|
|
|
|
|
|
|
|



2. Safety related loads are divided between three divisions:
 - a. Division I - Green
 - b. Division II - Yellow
 - c. Division III - Purple
3. Divisions I and II major loads are the ECCS Systems with the exception of High Pressure Core Spray.
4. The High Pressure Core Spray System (CSH) and related equipment are solely supplied by Division III.

Write Division Number and respective color on board

Q: What are the ECCS Systems supplied by Divisions I and II? | 6

A: <u>Div I</u>	<u>Div II</u>
LPCS	LPCI "B"
LPCI "A"	LPCI "C"
ADS Channel "A"	ADS Channel "B"

II. DETAILED DESCRIPTION

A. 4.16KV Distribution

EO-2.0a | 6

1. There are three, 4.16KV buses in the Emergency AC Power System.
 - a. 2ENS*SWG101 (Div I)
 - b. 2ENS*SWG103 (Div II)
 - c. 2ENS*SWG102 (Div III)
(High Pressure Core Spray)

* - indicates system/component is Safety Related. | 6
 Show TP-1 (Figure 1 of N2-OLT-6T) point out each divisional bus as discussed. |
 Point out each division's major loads. |



2. Reserve Station Transformers

a. All 3 divisions of Emergency AC are normally energized from offsite power through the Reserve Station Service Transformers.

Point out transformers on TP-1.
Transformers stepdown 115 KVAC power to
4160 volts AC via tertiary windings

EO-2.0d | 6

1) 2RTX-XSR1A normally supplies Buses 101 and 102.

2) 2RTX-XSR1B normally supplies Bus 103.

3) Buses 101 and 103 have a breaker cubicle for connection to their backup source, the Auxiliary Boiler Transformer, 2ABS-X1.

Only one Emergency bus can be supplied by
2ABS-X1 at any given time.

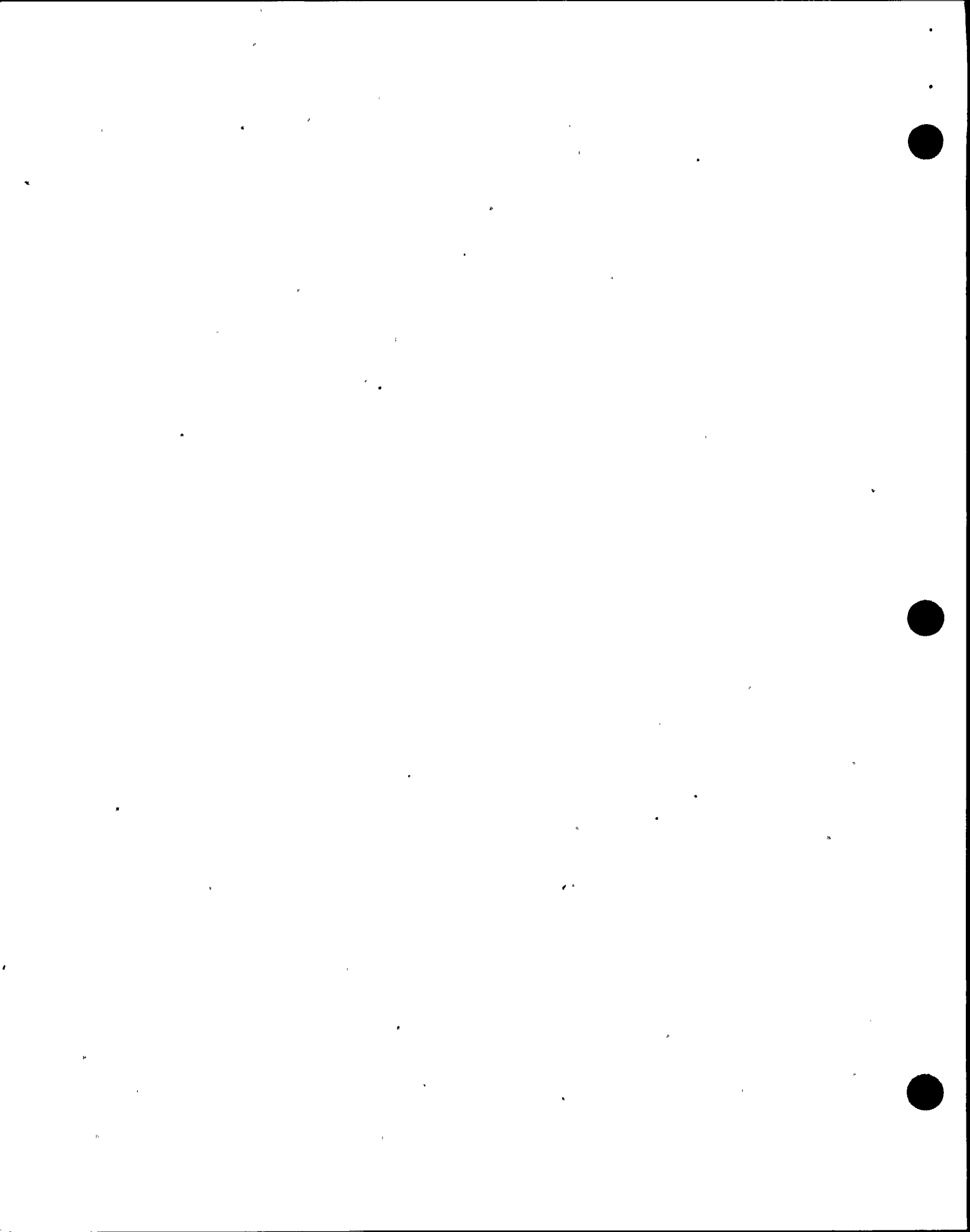
| 6

4) Bus 102 has a breaker cubicle for backup connection to 2RTX-XSR1B, if required.

5) The Reserve Station Service Transformers are designed to carry the max. load on buses 101 and 102 or 103 and 102, plus one stub bus load.

6) Aux. Boiler Transformer is sized to carry only a partial load of bus 101 or 103.

|



3. Diesel Generators (D.G.)

- a. Each division has its own D.G.
- 1) Division I Diesel (2EGS*EG1) feeds 2ENS*SWG101
 - 2) Division II Diesel (2EGS*EG3) feeds 2ENS*SWG103
 - 3) Division III Diesel (2EGS*EG2) feeds 2ENS*SWG102
- b. In case of a loss of voltage or sustained degraded voltage from Reserve Station Transformer 1A, the Emergency Diesel EG1 is automatically started.
- c. When the generator attains rated speed, voltage and frequency, (within 10 sec.). The generator output breaker (101-1) shuts.
- d. Load sequencing starts when the generator output breaker shuts at time T=0. Provided a LOCA signal exists
- 1) T=1 seconds RHS pump A starts
 - 2) T=6 seconds LPCS pump starts With a LOCA signal

Point out Diesel Generators on TP-1.

|6

Loss of voltage 3148V for 3.06 sec.

|6

Degraded voltage 3847V with time delay of:

LOCA - 8.16 sec.

Non-LOCA - 30.6 sec.

NOTE: Output breaker will not shut if the bus was manually deenergized with normal supply breakers. Circuit affected by breaker control switch position.

|6

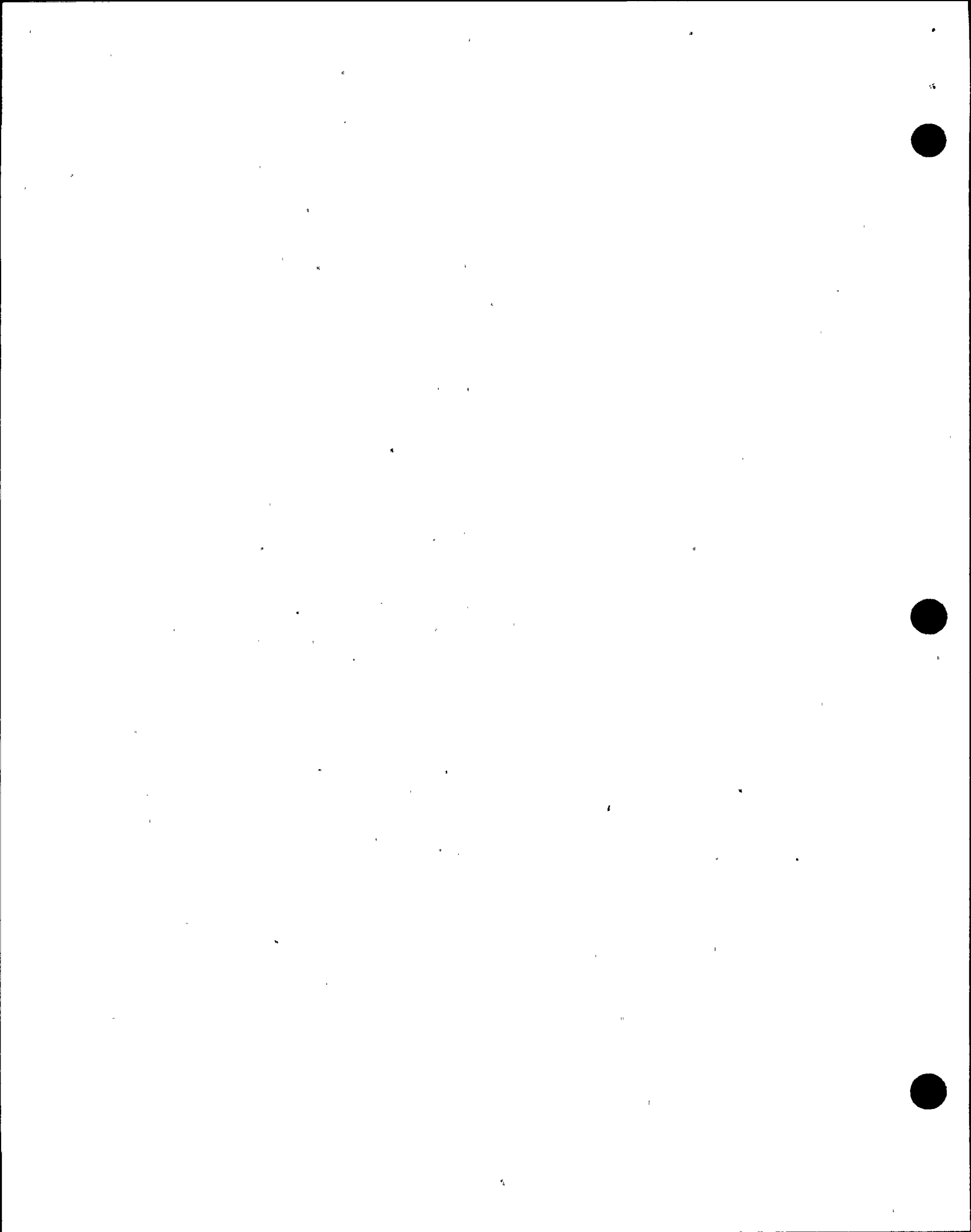


- 3) T=32 seconds one Service Water pump will attempt to start.
 - 4) If Service Water pump unsuccessful, another Service Water pump will attempt to start at T=37 seconds.
 - 5) If no Service Water pump is running by T=42 seconds, the last Service Water pump powered from that division starts.
 - 6) If at any time a Service Water pump does start, the remaining pumps in its respective loop are locked out.
- e. 2ENS*SWG103 is transferred to its Emergency Diesel Generator EG3 in a similar manner.
- 1) The load sequence is the same as EG1 except at T=1 the RHS B pump starts and T=6 the RHS C pump starts.
- f. 2ENS*SWG102 is transferred to its Emergency Diesel Generator EG2 upon loss of voltage or degraded voltage from the Reserve Station Transformer supplying it (1A or 1B).

NOTE: Load sequencing will attempt to start the red flagged pumps first. If none of the red flagged pumps start, then the sequencing will attempt to start the green flagged pumps at the following times: 48 sec., 54 sec. and 61 seconds.

NOTE: Manual start of additional Service Water pumps is prevented until T = 70 seconds. Any attempt to manually start a pump during this period will result in resetting the 70 second timer.

|6
|
|
|
|
|
|
|
|
|



- 1) Transfer is similar except no load shedding on the bus or sequencing is required.
- g. If no LOCA signal occurs the ECCS pumps will not start on any division.
- h. On LOCA, all diesels will start and run unloaded so they are ready to pick up loads in the event a LOOP should occur following a LOCA.
- 1) For Division I and II diesels, a start signal will result from:
- a) High drywell pressure (1.68 psig) or
 - b) Reactor vessel level low-low-low (17.8")
 - c) Manual ECCS System initiation switch armed and depressed.
- 2) For Division III diesel, a start signal will result from:
- a) High drywell pressure (1.68 psig) or
 - b) Reactor vessel low-low (108.8")
 - c) High Pressure Core Spray System manual initiation switch armed and depressed.

|6

|6
|
||6
|
|





- c. Div. III 2EHS*MCC201 (fed directly from 4160/600V distribution transformer 2EJS*X2. EO-2.0d
 - 5. Emergency load centers receive DC control power from respective divisional DC buses.
 - 6. MCC Loads for each respective Division I and II
 - a. Emergency motor loads (1/2-50 Hp)
 - b. Motor operated valves from 1/6 Hp up.
 - c. Heaters and miscellaneous loads.
 - 7. MCC201 feeds all Division III 600V to 120V distribution panels.
 - C. 120/208V or 120/240 Distribution EO-2.0e |6
 - 1. Provides power for Emergency Lighting, instrumentation and control loads. EO-2.0f |
 - D. Uninterruptible Power Supply (UPS) System EO-2.0g |6
 - 1. Provides Normal 120 or 208V AC, 3 phase or Normal 120V AC, 1 phase, or Emergency 120V AC, 1 phase
 - 2. Power Distribution
 - a. Each UPS system has a normal AC source and a maintenance (not-filtered) AC source, fed from 600V AC, and a 125V DC backup source. |6
|
|
 - Show TP-2 and TP-3 point out UPS's.
 - Show TP-4 (Block diagram of UPS 2A/2B).
 - b. If the normal AC supply is lost, 125V DC is used to power the UPS loads through the inverter.



- c. In case of inverter trouble, the system automatically transfers to the bypass (maintenance) source. The transfer is conducted by a make-before-break static transfer switch so no interruption of power to the UPS loads occurs.
- 3. The plant Emergency UPS system consists of two 25kVA, 120V, 1 phase buses (2VBA*UPS2A and UPS2B) and their distribution panels. They supply the Div. I and II DG control panels 2VBS*PNL101A and 2VBS*PNL301A.
 - a. Power supplies:
 - UPS2A: Norm-2EJS*PNL100A
 - Alt -2LAC*PNL100A
 - B/U -2BYS*SWG002A
 - UPS2B: Norm-2EJS*PNL300B
 - Alt -2LAC*PNL300B
 - B/U -2BYS*SWG002B

III. INSTRUMENTATION, CONTROLS AND INTERLOCKS

A. Instruments

- 1. Electrical Board 2CEC*PNL852 in Control Room has various ammeters, voltmeters, and synchrosopes for indication and control of the Emergency AC Power System.
 - Show TP-5 (Photo of PNL-852 ENS section) |6
 - |6



B. Controls

1. Individual switches are provided for the alternate and preferred bus supply breakers.
2. Synchronizing switches are provided for synchronizing the Reserve Station Transformers and Auxiliary Boiler Transformer to the buses.

Synchronizing switches engage circuits to provide voltage and frequency indications for the running and incoming sides of a given circuit breaker. A synchroscope is also engaged to provide phase relationship indication.

|6
|
|
|
|
|

C. Electrical Protection Devices

1. Overcurrent relays protect system against multiphase or phase-ground faults.
2. Lockout relays will trip and lockout on bus phase, ground or non directional overcurrent, directional overcurrent, or time overcurrent.

D. Interlocks

All backup source breakers for the Emergency AC buses are interlocked with their respective normal power source breakers so only one can be shut at a time.

EO-3.0a |6

IV. SYSTEM OPERATION

A. Normal Mode of Operation 4160V Dist.

1. Div. I and Div. III are normally energized by Reserve Station Service Transformer 2RTX-XSR1A.



2. Div. II is supplied via transformer 2RTX-XSR1B.
3. Normal breaker positions
 - a. D.G. output breakers are open.
 - b. Feeder breakers from ENS SWG*101 and 103 to stub buses 2NNS-SWG014 and SWG015 are open.
 - c. Feeder breaker to both divisional 4160/600V transformers are closed.
 - d. Motor feeder breakers from the Emergency buses 2ENS*SWG101, 102, and 103 are shut as required by normal plant operating conditions.
4. Synchronizing of two power sources on a 4160V bus is performed by the operator.
 - a. Synchronizing can be performed between the diesel generator for that bus and either the Reserve Station Service Transformer or the Auxiliary Boiler Transformer.
5. Standby Diesels are normally shutdown, but are ready to start in the event of a LOOP or LOCA.

|6
|



B. Normal Operation 600V Dist.

1. Breaker positions

Show TP-1

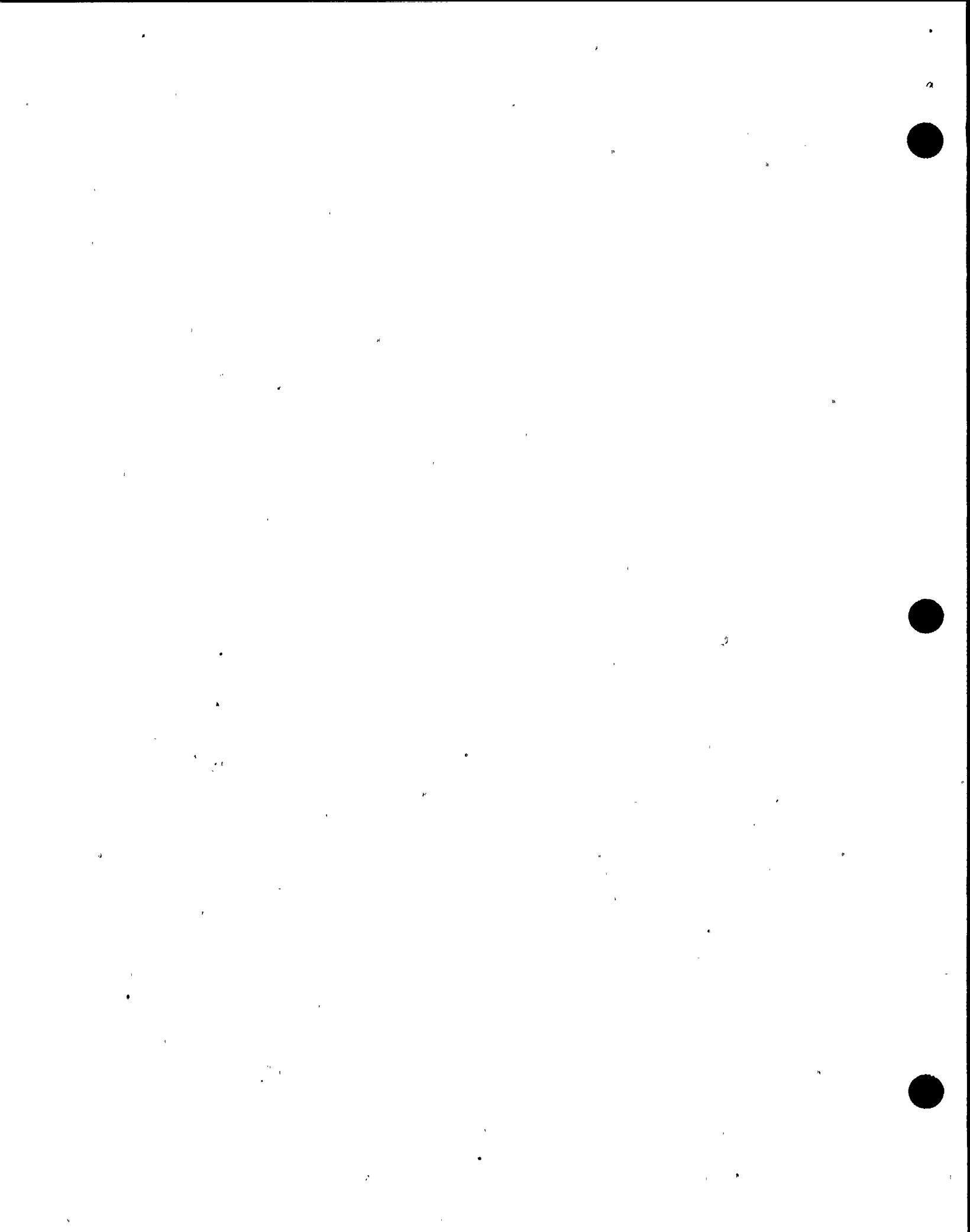
|6

- a. Normal supply breakers from load center transformers 2EJS*X1A and X3A to Emergency Load centers 2EJS*US1 and US3 are shut.

Point out breakers as discussed.

|

- b. Supply breakers from transformers 2EJS*X1B and X3B to the Emergency Load centers are open.
- c. Feeder breakers to Emergency Motor Control Centers, 600V Emergency Distribution panels and 600V Emergency Lighting panels are shut.
- d. Emergency Motor Control Centers 2EHS*MCC102, 103, 302, and 303 operate with both supply breakers shut and their tie breakers open.
- e. Emergency Motor Control Centers 2EHS*MCC101, and 301 operate with one supply breaker shut the other open.
- f. Emergency Motor Control Center 2EHS*MCC201 (for CSH system) receives power from bus 2ENS*SWG102 through breaker 102-3 and transformer 2EJS*X2.



- g. Motor feeder breakers are closed as required.
- h. UPS's are normally energized by the 600V AC Emergency Power distribution panels.
 - 1) 2EJS*PNL100A (Div. I)
 - 2) 2EJS*PNL300B (Div. II)

Show TP-2 and TP-3.
Point out supply breakers to VPS's.

|6
|

V. SYSTEM INTERRELATIONS

- A. DC Power System
Provides power to protective relaying control and breaker control.
- B. AC Electrical Distribution System
Provides power to the Emergency AC System during normal operation.
- C. Standby Diesel Generator System
Provides power to the Emergency AC System during a loss of normal AC power.

EO-4.0a |6

EO-4.0b

EO-4.0c

VI. DETAILED SYSTEM REFERENCE REVIEW

- A. Procedures
 - 1. N2-OP-72, Standby and Emergency AC Distribution System

Discuss precautions and limitations, system startup, shutdown, normal, abnormal and annunciator response procedures.

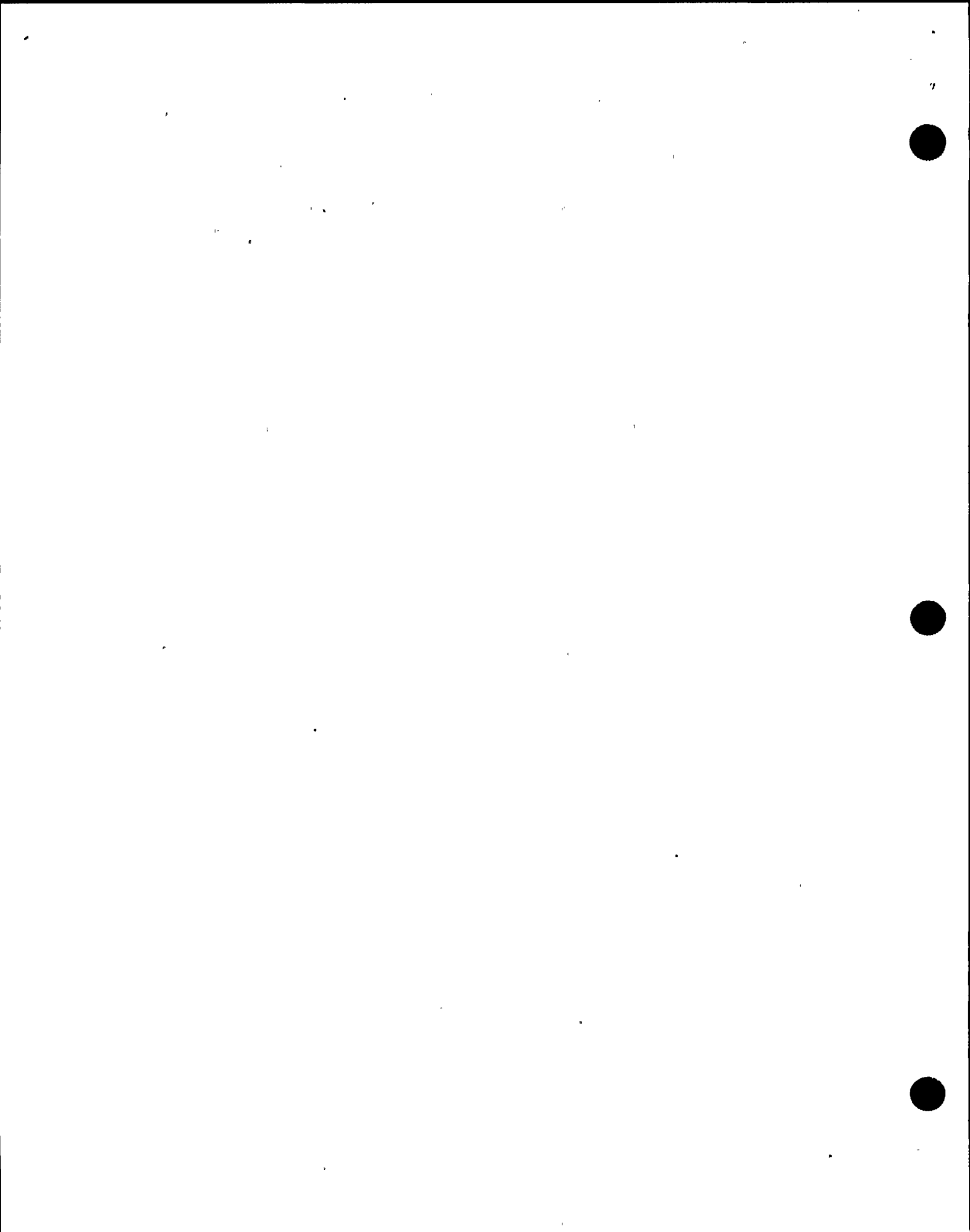
EO-5.0 |6

EO-6.0 |

a-e |

EO-7.0 |

EO-8.0 |



<p>B. Technical Specifications</p> <p>Review each of the following referenced documents with the class</p> <ol style="list-style-type: none"> 1. 3/4.8.1 AC Sources 2. 3/4.8.2 DC Sources 3. 3/4.8.3 Onsite Power Distribution System 	<p>Discuss applicable Tech. Specs. including action statements and surveillance requirements.</p>	<p>EO-9.0 6 </p>
<p>VII. RELATED PLANT EVENTS</p>		
<p>A. Review the following LER's and SOER's, with the class</p> <ol style="list-style-type: none"> 1. SOER 81-10 		
<p>VIII. SYSTEM HISTORY</p>		
<p>A. Review the following system modifications with the class.</p> <ol style="list-style-type: none"> 1. None 		
<p>IX. WRAP-UP</p>		
<p>A. Review the Trainee Learning Objectives.</p>	<p>Use TP-1 through 5 to answer any questions.</p>	<p> 6 </p>

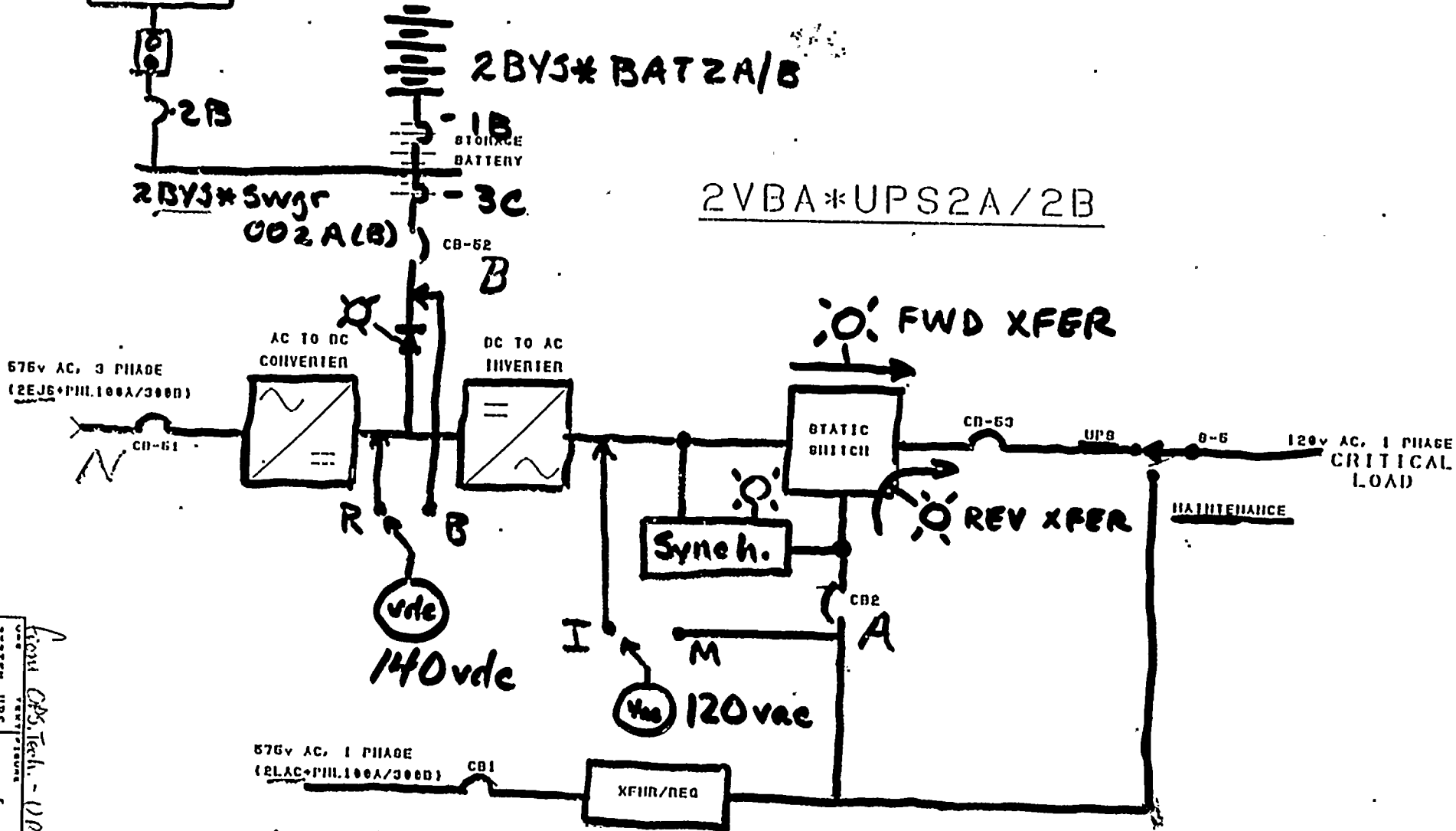


2 BYS*
CHGR 2B2 (A)

2 BYS*
CHGR 2B1 (A)

2 BYS* BAT 2A/B

2 VBA* UPS 2A/2B



N = Normal
 B = Backup (Battery)
 A = Alternate (Maintenance)

From OPS Tech. - (UPS) (ca)
 DATE 4-24-91
 UPS 2A/2B

