NORTHEAST UTILITIES
THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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January 14, 1988
MP-11374
Re: NUREG-1021/ES-201/para H.1

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Reference: Facility Operating License No. DPR-65
Docket No. 50-336
January 11, 1988 NRC License Examination Comments

Gentlemen:

Attached is the compilation of comments on the written examinations administered to Millstone Unit No. 2 license candidates on January 11, 1988.

These comments were the result of a review of the examinations conducted by members of the Millstone Unit No. 2 training staff. Included are both the comments discussed during the exam review meeting of January 11, 1988 plus additional comments resulting from reviews conducted subsequent to this meeting. Attendees at the January 11, 1988 meeting were:

M. Wilson	Northeast Utilities
R. Flanagan	Northeast Utilities
R. Cimmino	Northeast Utilities
R. Burnside	Northeast Utilities
T. Griiley	Northeast Utilities
D. Pantalone	Northeast Utilities
M. Ehredt	Combustion Engineering (NU Training Staff)
D. Silk	NRC
P. Isaksen	EG&G

The exam reviews were conducted considering the following:

1. Does the question elicit the correct response?
2. Is the key answer correct?
3. Is there potential for additional correct responses?
4. Is the question appropriate?

References are provided, where necessary, to substantiate the comments.

IE42
1/1

Please contact Mr. Michael Wilson, Supervisor, Operator Training, Millstone Unit No. 2, with any questions concerning our comments.

Yours truly,

NORTHEAST NUCLEAR ENERGY COMPANY

Stephen E. Scace
Station Superintendent
Millstone Nuclear Power Station

SES/MJW/pab

Attachment: Reactor Operator and Senior Reactor Operator Exam comments and applicable references

c: R. Gallo, Branch Chief, Region I
B. W. Ruth, Manager, Operator Training

SECTION 1

QUESTION 1.05

1. We cannot currently read 10,000 cps on our Excore NIs. The circuitry is designed to shift power indication to % power whenever countrate goes above 1000 cps. References are provided.

2. There are no PORVs on the S/G. There are Secondary Safety Valves, Atmospheric Dump Valves and Steam Dump and Bypass Valves.

3. If the student assumes a +MTC at BOC conditions, then the cooldown will add negative reactivity. The resulting condition when equilibrium is reached would be: Final Tavg less than Initial Tavg, Final Power below POAH. This means that no correct choice was given in the question.

Based on this above, credit should be given for any written answers which assume a +MTC, as well as for key answer "d" which presupposes a negative MTC.

QUESTION 1.09 b.

The candidates may assume based on part a, that 70% power is to be maintained or that power is being increased to 70%. As such, reducing power to control ASI within limits may not be recognized as an option by the candidates.

The answer key should accept for full credit two of the following three steps/methods for ASI control:

1. Rod Insertion
2. Rod Withdrawal
3. Power reduction

Reference: OP 2393, Xenon Oscillation Band Control

QUESTION 1.11

1. The students are only required to discuss the effect of source-detector geometry on the 1/m plot. They are not required to know how fuel loading, fuel enrichment or poison loading affects the 1/m plot. (Theory objectives related to 1/m plots are attached).

2. There are two correct answers to this question. Both a. and c. can be correct.

3. The key answer, "c", is technically a correct response. However this choice describes an evolution which is not done at MP2.

Based on these comments it is recommended that full credit be given for either "a" or "c".

QUESTION 1.14 (3.)

There are no S/G PORV's on Millstone Unit 2.

QUESTION 1.15 c.

The answer states that the core delta T during Natural Circulation approaches full load delta T. This is incorrect. The Natural Circulation delta T will be approximately one-half of full power delta T (this assumes maximum possible decay heat). (Reference attached).

Based on this, the phrase "Core delta T during natural circulation cooldown will approach full load delta T." should be removed from the answer key.

5.2 Withdraw the Shutdown groups as per OP 2302A (Control Element Drive System).

CAUTION: A stable reactor coolant temperature must be maintained during the critical approach.

Q- 1.05

NOTE: At approximately 1000 CPS increasing, the wide range log channels extended range detectors high voltage will be de-energized and the "Extended" range light will be extinguished on the Reactor Protection Panel. The meter indication will go from approximately 1000 CPS to approximately 10^{-7}% power and the counts per second light will transfer to the % light on C04.

5.3 Prior to withdrawal of the Regulating CEA's, record the position of all CEA's on OPS Form 2619D-1, or demand a computer printout of all CEA positions and affix the printout to OPS Form 2619D-1.

5.4 Withdraw the Regulating CEA's as per OP 2302A (Control Element Drive System).

5.5 Check the following during approach to criticality:

5.5.1 Power level on the operable wide range nuclear instruments indicates no significant deviation in readings.

5.5.2 Startup rate not to exceed one DPM.

5.5.3 40% group overlap (maximum).

5.5.4 Individual CEA alignment.

5.5.5 The boron concentration and CEA position for criticality are consistent with the ECP.

5.6 Within 15 minutes prior to making the reactor critical, complete OPS Form 2619D-2.

5.7 When the indicated reactor power is increasing (slightly positive SUR) without CEA withdrawal, the reactor is critical.

5.8 Turn off audible count rate.

7.2.8 Logic Test Modules

7.2.8.1 Channel A - Module AB

7.2.8.2 Channel B - Moduel BC, Module BD

7.2.8.3 Channel C - Module AC, Module CD

7.2.8.4 Channel D - Module AD

All module switches:

a. Matrix Relay Trip Select in OFF position.

b. Channel Trip Select in OFF pos:tion.

7.3 Indication Prior to Startup

7.3.1 Wide Range Channels

a. Before a startup commences check each channel wide range drawer and verify the extended range off pushbutton not lit.

b. Also verify the CPS lamp is lighted on C04.

c. Wide Range Channel Counts Per Second (CPS) range meter should indicate on 0.1 to 10^4 CPS.

d. Chamber Voltage lamp (amber) lighted.

e. Chamber Voltage indicator (0-1000 volts) at 600-900 volts.

7.3.2 Power Range Safety Channel drawer

a. Power On lamp (red) lighted

b. Chamber Voltage indicators (0-1000 volts) at 750 $\pm$ 50 VDC.

c. High Channel Deviation lamp (red) off.

7.3.3 RPSCIP drawer

a. Delta T Power Blocked lamp (red) off (block removed automatically above 10^{-4}% power or when the Zero Power Mode key is in the OFF position).

b. Delta T Test lamp (red) off.

c. Delta T Power Not Selected lamp (red) off.

_____ OFF if Delta T Power is selected.

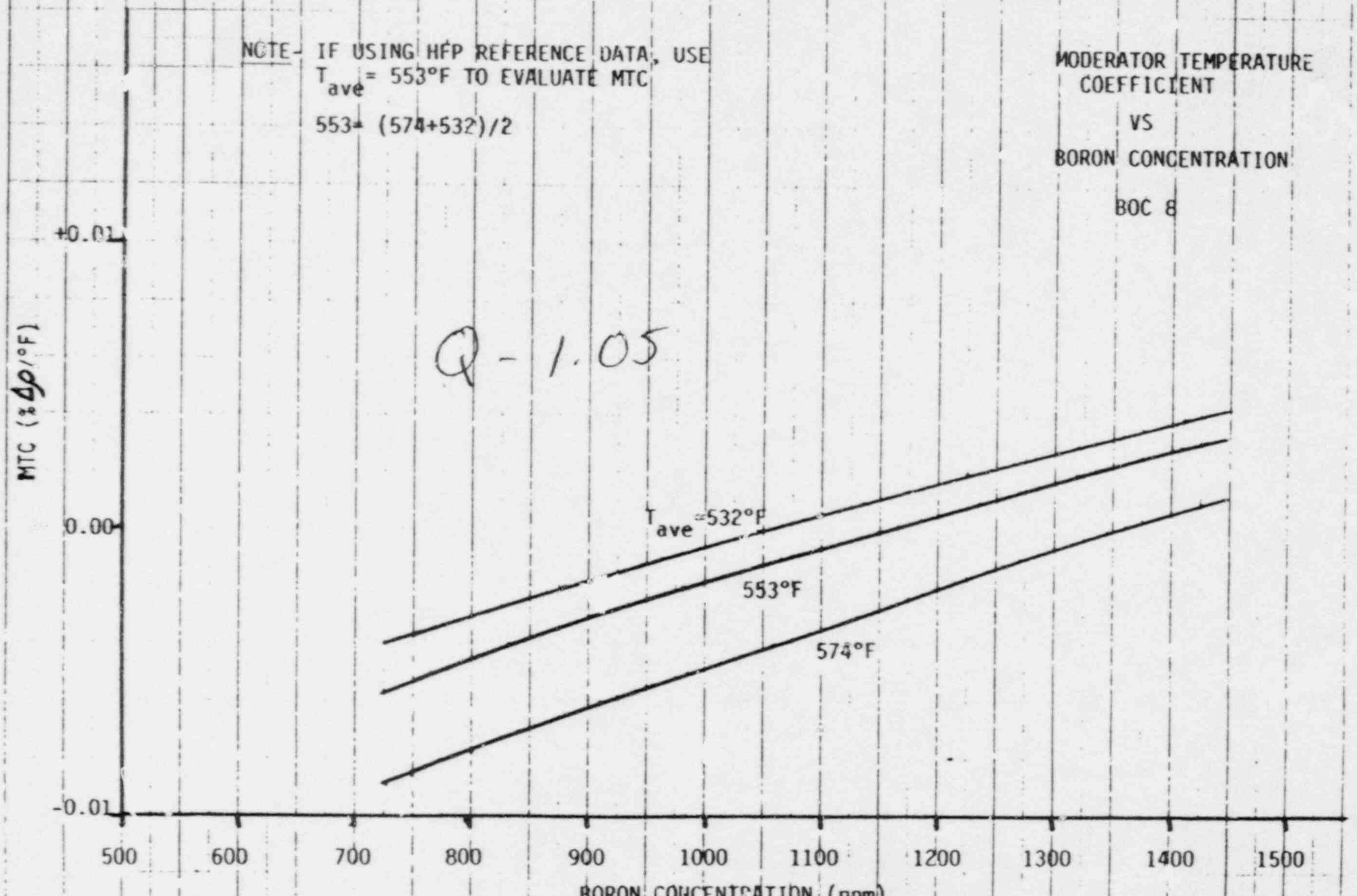
7.4 Operation During Powe, Increase

1.05 7.4.1 Subpower Range

7.4.1.1 Observe the shift from CPS to Percent Power at 1000 CPS.

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY
	c) The count rate circuit supplies a signal to: o Meter display (C04 and RPS) o Audible count rate o Count rate/Campbelling summer o Extended range bistable	
Q-105	5) As counts increase (due to startup) the Extended Range bistable will be at 1000 cps:	RO-1.1, purpose RO-7b.2, conditions actuating interlock
	a) Turn off the Extended Range light above the drawer power meter.	
	b) Shift the C04 meter CPS/% light to "%"	RO-7a.2, components affected
	c) Deenergize the K2 relay in the pre amp assembly which removes the discriminators and one fission chamber from the circuit.	

John S Kleine APPROVED | 11/12/80 DATE | 2-80-180 PORC



TP-4

OP Form 2208-3
Rev. 16

REACTOR OPERATION
LESSON OBJECTIVES

ID# M2-OP-RO-FUND-2116G Rev 0 Date 9-23-86

Enabling Objectives: At the completion of this lesson, the RO will be able to:

1. Define the following terms:
   a. Point of Adding Heat (POAH)
   b. Shutdown Margin

2. Explain the purpose of a 1/M plot.

Q-1.11

3. Describe the relationship between source - detector geometry and 1/M plot results.

4. State the purpose of performing an ECP.

5. Sketch a typical reactor trip power level trace and explain its shape.

6. Explain the neutron flux traces made during a reactor startup.

7. State the source and magnitude of decay heat.

8. Describe reactor plant coastdown.

9. Draw and explain the axial power distribution which occurs during each of the following core conditions:
   a. BOL, HZP
   b. EOL, HZP
   c. BOL, HFP
   d. EOL, HFP

10. Use OP-2208 to:
    a. Calculate the amount of PMW or boric acid necessary to change RCS boron concentration by a given amount.
    b. Calculate an ECP.

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY
	When we reach the POAH, we will see the negative feedback. (~10^{-2}% power).	Point out we will see: 1. decreasing SUR 2. increasing moderator temperator (steam dumps will compensate for this)
	2) On the control room indication we will not see any effects of moderator and fuel reactivity feedback until power is between .1% and 1%.	
Q-1.11	3. 1/M Plots	
	a. We can see by our formula for M that as K approaches one, M approaches infinity, we use 1/M so that as we approach criticality, 1/M approaches zero.	
	1) M = 1/1-k 1/M = 1-K	

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY
	2) $M = CR_F/CR_0$ or CR_2/CR_1	
	then	
	$1/M = CR_1/CR_2$	
	b. Uses of 1/M Plots	Obj-2
	1) Reactor Startup	
	The 1/M plot can be used to predict criticality as positive reactivity is added to the core.	Point out that we do not use 1/M plots during normal startups.
	2) Fuel loading	One of the reasons that 1/M plots are not done during normal reactor startups is the constantly changing effective core geometry that occurs while control rods are being withdrawn.
	a) As fuel is being loaded into the core, K_{eff} (and therefore countrate) is increasing. Even though the boron concentration is more than adequate to keep the reactor shut down during fuel load, 1/M plots are done. Data is taken after each bundle is loaded.	

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY
	b) Countrate response, and therefore the value of 1/M is strongly influenced by source-detector-fuel geometry.	Obj-3
	c) Source-detector geometry is important based on which neutrons (source or fission) make up the majority of the neutrons that the detector is seeing.	
	o In the area very close to the source, there are a large number of source neutrons present.	
	o These source neutrons are producing an equilibrium population of MxS neutrons in any fissionable material exposed to the flux from the source.	
	o Recall that for a k of .9, for example, m = 10, which means that for every 10 neutrons present in the core, 9 are fission neutrons and 1 is a source neutron.	

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY
	o Another factor to consider is the distance that the source neutrons travel before undergoing an interaction.	
	o A source neutron is not likely to travel much further than about 30 cm (one foot).	
	o This means that any neutrons present more than a few feet from the source are likely to be fission neutrons rather than source neutrons.	
P-14	o If the detector is placed too near the source, the detector will see a large percentage of source neutrons and a small percentage of fission neutrons.	
	o As Keff is increased, the number of fission neutrons will increase and the number of source neutrons will remain constant.	

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY

- o If the detector is seeing primarily source neutrons, the increase in fission neutrons will only have a small affect on its response.

- o This detector response is non-conservative since it predicts core criticality at a much higher reactivity addition than it will actually occur at.

- o If the detector is placed too far from the source, it will see a large percentage of fission neutrons and a small percentage of source neutrons.

- o If the detector is seeing primarily fission neutrons, an increase in fission neutrons will have a large affect on detector response.

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY

- o This detector response is conservative since it predicts core criticality at a lower reactivity addition than it will actually occur at.

- o The ideal detector location would be far enough from the source so that the source neutrons would have a minor effect on response yet close enough so that the increase in fission neutron population is accurately seen during reactivity changes.

TP-15

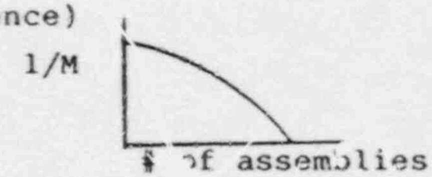
Q-1.11

d) In addition to source detector geometry, the fuel loading pattern can play a role in detector response during fuel load.

- o S 4 3 2 1 d

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY

(Loading sequence)

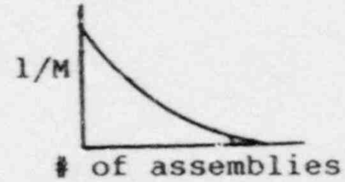


Q - 1.11

Very little multiplication occurs initially due to the distance between the source and fuel bundle. If extrapolation is performed after a few bundles are added, criticality will be over estimated. This is not conservative.

o S 1 2 3 4 D

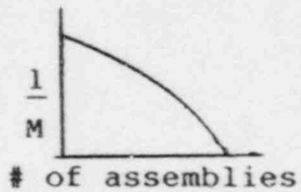
(Loading sequence)



INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY

This loading sequence results in an immediate increase in countrate due to the proximity between source and fuel. This sequence underestimates criticality and therefore is more conservative.

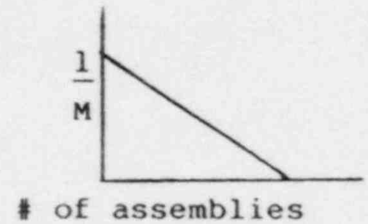
o S 1 2 3 4
D



The source and detector are so close together that multiplication is masked by the strength of the source. This geometry results in a non-conservative 1/M plot. Notice also that the fuel is not loaded between the detector and the source.

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY

o 6 7 8
5 S 1 D
4 3 2



The fuel is loaded uniformly around the source giving the best detector response.

B. Reactor Shutdown

1. Reactor Trip

TP-16 a. The response of reactor power to a large negative insertion of reactivity (trip) can be divided into five regions. Obj-5

- prompt drop
- short lived precurser decay
- long lived precurser decay

Q-1.15a

CEN-128 OPERATOR TRAINING PACKAGE
FOR
NATURAL CIRCULATION

PREPARED FOR

THE C-E OWNERS GROUP

May, 1980

Combustion Engineering, Inc.
1000 Prospect Hill Road
Windsor, Connecticut 06095

NATURAL CIRCULATION

1.0 INTRODUCTION

1.1 Objective

Slide 1

This training package provides the operator of a C-E designed Nuclear Power plant with an indepth knowledge of extended plant operations in a subcooled natural circulation mode. Specifically plant characteristics and their operational implications are presented in detail. At the conclusion of the lecture, the operator will have a thorough understanding of:

1. the plant design features that impact natural circulation heat removal,
2. the expected values of plant parameters during operation in a natural circulation mode,
3. the results of testing that has been conducted for natural circulation heat removal,
4. the operational implications of operation in a natural circulation mode.

The main intent of this package is to supplement the event specific training packages with detailed information regarding natural circulation. Natural circulation provides the means of removing core heat and monitoring RCS heat removal when RCPs or Shutdown Cooling are unavailable. Some of the emergency procedures that may involve natural circulation include:

1. Loss of RCS Flow.
2. Loss of AC Power.
3. LOCA.
4. Steam Generator Tube Rupture
5. Steam Line Break

The Emergency Procedure Guidelines, transient analysis, and Sequence of Events Analysis in CEN-128, Response of Combustion Engineering Nuclear Steam Supply System to Transients and Accidents were used to prepare this package. The best-estimate plant response in CEN-128 is used throughout. Nominal values and system response are assumed. This response is based on a C-E reference design, used to represent the currently operating reactors designed by C-E. Reference plant material should be supplemented by plant specific information, where appropriate. Such information should be supplied by the user in the right hand margins.

1.2 Overview

Slide 2

The objective of this training package will be accomplished in three sections as outlined below:

The DESIGN FEATURES AND CHARACTERISTICS section which describes the natural circulation mode of operation has three subsections:

- 2.1 Typical Plant Parameters
- 2.2 Important Potential Impact
- 2.3 Determining Factors for Natural Circulation.

The PLANT PERFORMANCE section which describes expected plant performance based on test results, analyses, and actual operating incidents has three subsections:

- 3.1 Test Results
- 3.2 Analyses Results
- 3.3 Operating Experience

The MITIGATION PROCESS, which provides the operator with the necessary information on how potentially adverse effects of operating in natural circulation are mitigated, has four subsections:

- 4.1 Operator Actions
- 4.2 Safety Function Orientation
- 4.3 Alternative Systems to Accomplish Safety Functions
- 4.4 Precautions

1.3 List of References

1. Response of Combustion Engineering Nuclear Steam Supply System to Transients and Accidents, CEN-128, April 1980.

2. Input for Response to NRC Lessons Learned Requirements for Combustion Engineering Nuclear Steam Supply Systems, CEN-125, December 1979.

3. Review of Small Break Transients in Combustion Engineering Nuclear Steam Supply Systems, CEN-114P July 1979.

2.0 DESIGN FEATURES AND CHARACTERISTICS

2.1 Typical Plant Parameters

Slide 3

Central to the accomplishment of the basic safety function of Core Heat Removal is the ability to transport Reactor Coolant to a region where Reactor Coolant System Heat Removal can be accomplished. Three basic heat removal schemes or modes are available for post reactor trip residual heat removal:

Forced Circulation

a. Reactor Coolant Pumps

b. Safety Injection Pumps (HPSI or LPSI)

Natural Circulation

a. Subcooled

b. Two-phase

Pool Boiling or Reflux Boiling

Reactor coolant pump forced circulation and heat transfer to the steam generators is the preferred mode of operation for residual heat removal whenever plant temperatures and pressures are above the Shutdown Cooling System entry conditions. The subcooled natural circulation capability of all C-E plants provides an emergency means for controlled core cooling using the steam generators for extended periods of time if the reactor coolant pumps (RCPs) are unavailable. Two-phase natural circulation and pool boiling are schemes that will occur to provide adequate core cooling during certain transients but are essentially beyond operator control and are not desirable as long term methods.

Slide 4

It is the accomplishment of subcooled natural circulation resulting from the density gradient over the elevation difference between heat sink and heat source that will be addressed in the remainder of this lecture.

The natural circulation flow rate is determined by point where the thermal driving head just offsets the system head loss (i.e. friction losses).

NATURAL CIRCULATION

Since the natural circulation flow rate will vary with decay heat level it becomes convenient to use the reactor core ΔT (i.e. $T_h - T_c$) as the primary measure of natural circulation. The ΔT essentially provides a measure of flow relative to power.

$$Q = \dot{m}\, c_p \Delta T$$

$$\Delta T = c_p \frac{Q}{\dot{m}}$$

where

Q = decay heat

$\dot{m}$ = natural circulation mass flow rate

c_p = specific heat capacity of Reactor Coolant

The ΔT can be further referenced to the normal flow power ΔT (i.e. the ΔT for 100% power and 100% flow) to yield the power to flow ratio (i.e. percent power-to-percent flow).

Slide 5

$$\frac{Q/Q_{NFP}}{\dot{m}/\dot{m}_{NFP}} = \frac{\Delta T}{\Delta T_{NFP}}$$

Hence in order to have heat transfer conditions at least as acceptable as those that exist at full power, it is desirable to have a power to flow ratio less than 1 or in other words a ΔT less than the normal full power ΔT.

A typical CE plant is designed with an effective natural circulation thermal driving head of 25 ft.

Based on test results from the power ascension test program, which will be examined in more detail later, this results in typical actual power to flow ratios of 0.25 to 0.5 and hence natural circulation ΔT's of anywhere from 15 °F to 30°F.

Decay heat levels of interest range from approximately 3% at 200 sec. following trip (effect loss of forced circulation due to RCP coastdown) to approximately 0.8% 10 hours after trip.

Therefore actual core flow rates are on the order of 10,000 gpm to 46,000 gpm for a typical C-E operating plant.

Since flow is dependent on the decay heat level the power-to-flow ratio (and hence ΔT) will also vary with power.

Slide 6

As a gross approximation ΔT varies as $[Q]^{2/3}$ where Q is the decay heat power level.

The following simple derivation of the relation between ΔT and decay heat, Q, may be presented or used as a student exercise:

For NATURAL CIRCULATION:

Thermal driving head (H) + head loss (h_1) = 0

where $H = Z(\rho_c - \rho_h)$

Z = elevation

ρ_c = cold density

ρ_h = hot density

and, $h_1 = K\dot{V}^2$

K = loop resistance

$\dot{V}$ = volumetric flowrate

$$Z(\rho_c - \rho_h) = -KV^2$$

$$Z(\rho_h - \rho_c) = KV^2$$

assuming density linear with temperature and a small range of density, then

$$(\rho_h - \rho_c) \propto (T_h - T_c) = \Delta T$$

and $$\dot{V} \propto \dot{m}^2$$

now $$Z\,\Delta T \propto K\dot{m}^2$$

or simply $\Delta T \propto \dot{m}^2$

substituting in primary calormetric

$$Q = \dot{m}c_p\Delta T$$

$$Q \propto \sqrt{\Delta T}\cdot\Delta T$$

$$Q \propto \Delta T^{3/2}$$

$$\Delta T \propto Q^{2/3}$$

2.2 Important Potential Impact

Slide 7 With the loss of RCS forced circulation four of the basic safety functions are impacted.

Core heat removal is now relying on cooling flowing at much lower rates resulting in correspondingly higher temperatures. Additionally, the accomplishment of this safety function is much more susceptible to the effects of voiding resulting from loss of inventory or pressure control.

Reactivity control by boron is affected by slower loop transit time.

RCS heat removal is affected in that with slower loop transit times, monitoring of RCS heat removal is much less effective and manual control is necessary.

Finally, RCS pressure control is affected in that the main pressurizer sprays are now unavailable requiring reliance on auxiliary spray.

2.3 Determining Factors for Natural Circulation

Slide 8 Natural Circulation flow rate is governed by:

Slide 9
Slide 10

1. Decay heat - typical values of decay heat may be as high as 3.0% of full power 200 seconds after shutdown to 1.2% one hour after shutdown.

Slide 11

2. Component elevations - satisfactory natural circulation decay heat removal is obtained by elevation difference between bottom of core and top of the S.G. tube sheet. Typical elevation differences are on the order of 25-35 feet. Additionally, a small contribution to natural circulation is achieved as coolant density changes while passing through the S.G. tubes.

Slide 12

3. Primary to Secondary heat transfer - water in S.G. provides a heat sink and returns primary coolant at a greater density. No degradation of heat transfer occurs as long as secondary level covers at least 1/3 of the tube height.

Slide 13
Slide 14
Slide 15
Slide 16

4. Loop flow resistance - the major resistive element is the locked rotor RCP therefore relative loop pressure drops will not be analogous to forced flow situations. Flow resistance will also be affected by any gas or vapor voiding.

3.0 PLANT PERFORMANCE

3.1 Test Results
3.2 Analyses Results
3.3 Operating Experience

3.1 Test Results

Slide 17
Slide 18
Slide 19
Slide 20

All plants as part of the power assention test program conduct a reactor trip from power by stopping all reactor coolant pumps and monitor pump coastdown and natural circulation. The basic elements of this test are as follows:

Initial Conditions

40% power
NSSS controls in automatic mode

Sequence of Events

Trip RCPs manually
RPS trips reactor and turbine
Operator slowly restores SG water levels using auxiliary feedwater
Operator terminates auxiliary feedwater and SGs "steam down" for 1-2 hours.

Evaluation

Core decay heat is derived from measured steam generator water level changes and corresponding inventory depletion.

RCS flow is derived from measured T_H, T_C and derived core decay heat.

Evaluation of these tests shows the following results:

Slide 21

1. That values of power to flow ratios and ΔTs are as predicted.

2. The transition from forced to natural circulation presents readily discernable characteristics that are of use to the operator in establishing natural circulation, specifically:

'ide 22

Th increases and then peaks or stabilizes within 5 to 10 minutes.

Core exit thermocouples tract T_H.

ΔT (i.e. $T_H - T_C$) is less than the normal full power ΔT.

T_C is controllable by the secondary heat sink.

3.2 Analyses Results

Slide 23
Slide 24
Slide 25
Slide 26

Within CEN-128 analyses natural circulation performance can be examined from the Loss of AC event. It should be noted that:

1. Characteristics are the same as test results.
2. ΔT power provides measure of natural circulation performance.
3. Effects of pressurizer are small.

3.3 Operating Experience

Several instances of natural circulation at hot standby and at least one occurrence of natural circulation cooldown.

Slide 27
Slide 28
Slide 29

On April 15, 1977, St. Lucie Unit 1 was manually tripped due to the loss of Component Cooling Water (CCW) to the Reactor Coolant Pumps (RCP) which was initially caused by loss of instrument air compressors in the containment (CCS valves are solenoid actuated, air operated). The plant tripped at 3:39 p.m. and the reactor coolant pumps tripped at 3:40 p.m. and remained secured for the subsequent cooldown.

Based on apparent damage to seals in both "B" reactor coolant pumps and concern of same for "B" reactor coolant pumps, a natural circulation cooldown was established via the Turbine Bypass System to condenser with vacuum being maintained with steam from NSSS. The 5% valve (60-50% open) established a 75°F cooldown rate. At 410°F, the steam generator pressure was decreasing and vacuum was dropping so atmospheric dumps were used for additional steam load and both auxiliary sprays were initiated to decrease pressurizer temperature and pressure. Once on atmospheric dumps, a 60°/hr cooldown rate was establisned until the reactor coolant system reached 320°F. At this point the system started to level off. Two charging pumps were sufficient to keep up with shrink except when increasing one steam generator to a high level, when three were required. During reactor cooldown, the system was being purged of H_2 by feeding and bleeding the Volume Control Tank.

The cooldown rate at 320°F slowed down to 25°F/hr. At 11:20 p.m., the system was at 300°F with pressurizer pressure of 350 psia and water phase at 440°F. Line up for Shutdown Cooling (SDC) was in progress. Shutdown cooling was placed into service at 1:42 a.m., April 16, 1977 and the plant was cooled significantly at 9:15 a.m., April 16, 1977, thus concluding the incident.

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY
Q-1.15c	8) Expected response to NC	RO-4
	a) Established in 5 - 15 min.	
	b) 20 - 25°F ΔT	For maximum decay heat
	c) 3 - 3.5% Flow	
	d) Stable/decreasing T_H	
	e) Stable T_c	
	f) Subcooled RCS (no voiding)	No voiding has been observed during the MP2 NC events.
	g) Adequate SG Heat Removal	
	h) 5 min. Loop Transit Time	
	c. Verification Criteria	RO-5
	1) T_H constant or decreasing	

SECTION 2

QUESTION 2.04 part c.

The reference given (M2-OP-ELECT-2342, p. 3 & 4) does not state a specific reason for the 460 amp limit on bus 24E when it is being supplied from 24F. Procedure OP 2343 (reference book 4, section 14), step 7.22, caution #1 states, "Do not exceed load limits on RSST 15G-21S or its busing 3.0 MVA 460 amps." The identifier "15G-21S" is the designation for the Unit 1 RSST, not a breaker or disconnect. As the Unit 1 RSST is not limited to 460 amps and the Unit 2 operators have no real indication or control of the total load on the Unit 1 RSST, the 460 amp limit is understood to be based on the bus connecting the Unit 1 RSST to 24E. (Reference excerpts are attached).

QUESTION 2.08 part b

The question asks for three (3) sources of SFP makeup water but does not solicit a system flowpath.

Therefore an answer stating the RWST as a possible source should be fully accepted as one of the three required answers.

QUESTION 2.09 part d.

The AFW Flow Control Valves have three modes of operation as stated in both OP 2322 (ref. book 4) and AOP 2579B (ref. book 7). These modes are Auto, Manual and Manual (Local). If an Automatic Feedwater Actuation Signal (AFAS) is present then the "Reset-Normal-Override Switch" has three modes of selection which allow the operator additional modes of operation (AFW SD & OP 2322). As the question did not mention the switch by any name, nor indicate that an AFAS had occurred, it is impossible for an examinee to determine which "modes of operation" the question is attempting to solicit. Therefore, discussion in either area of AFW Valve control should be accepted for full credit.

QUESTION 2.10 part a.

The CEA, upon loss of the lift coil, will be held in place by the Upper gripper and/or the Lower gripper coils.

The key answer should be changed to allow full credit for mentioning either the upper gripper or the lower gripper.

QUESTION 2.11

The following CVCS components also receive a signal on SIAS according to reference M2-OP-PRI-2304 Fig. 2a. (CVCS SD): (# 1-7 given in answer key).

8. PMW to charging pump suction (2-CH-196)

9. Precise reactivity control isolates (2-CH-909, CH-910)

10. Boric acid pump recirc. isolations close (2-CH-510, CH-511)

III. DESCRIPTION

A. 6900 Volt

Load center 25A and load center 25B are both normally supplied by the NSST. On a loss of normal power to these load centers, power will automatically transfer to the RSST. This transfer will cause the buses to be deenergized for a very short period of time (less than 1 second). For the loads supplied from load centers 25A and 25B turn to Appendix A.

B. 4160 Volt

Load centers 24A and 24B normally receive power from the NSST through feeder breakers. They, in turn, provide power to load centers 24C and 24D. On a turbine trip, these feeder breakers from the NSST open and the feeder breakers from 24G to load centers 24C and 24D will close. Load center 24G is powered from the RSST. Load center 24E is designated as the swing bus and can receive power from either 24C or 24D. There is a backup power supply to 24E from 24F which is powered from the Unit 1 RSST. This power supply is restricted to 460 amps and is sized to be capable of supplying one Emergency Core Cooling System train following an accident.

Q 2.04 c

The 4.16 KV subsystem is divided into two specific "Facilities." Facility 1 begins with load center 24C which powers one train of Emergency Safeguards Equipment and is provided with an emergency power supply by the "A" Emergency Diesel Generator. Facility 2 begins with load center 24D and powers a redundant second train of Emergency Safeguards Equipment and is provided with an emergency power supply by the "B" Emergency Diesel Generator. These Emergency Diesel Generators are designed to automatically start and load when a Loss of Normal Power (LNP) signal is received. For further information refer to the Emergency Diesel Generator System Description.

Load center 24E provides power to a third Service Water Pump, High Pressure Safety Injection Pump and Reactor Building Closed Cooling Water Pump. These pumps are installed spares and can provide support to either Facility 1 or Facility 2. When they are servicing a facility, load center 24E is provided power from that facility.

C. 480 Volt

The 480 volt subsystem is supplied with power from the 4.16 KV System through a 4.16 KV to 480 volt step down transformer. The transformers are located directly adjacent to the 480 volt load centers that they service.

7.21.2 Verify tie breakers 24C-2T-2 and 24D-2T-2 are open.

7.21.3 Obtain permission from Unit #1 control room.

7.21.4 Verify all feeder breakers on 24E are open.

7.21.5 Put synchronizing switch for 21S3-24E-2 on. Check incoming voltage.

7.21.6 Synchroscope will not move due to dead bus.

7.21.7 Close 21S3-24E-2.

7.21.8 Observe running voltage.

7.21.9 Turn synchroscope off.

7.21.10 Bus 24E is now energized.

7.21.11 Close feeder breakers as required.

7.22 Energizing Bus 24C from Bus 24E.

Q-2.04 C

<u>CAUTION:</u> 1. **Do not exceed load limits on RSST 15G-21S or its busing 3.0 MVA 460 amps.**

2. Diesel Generator 12U must be shutdown and disabled.

7.22.1 Verify 15G-12U-2 is open.

7.22.2 Verify 22S3-24C-2 is open.

7.22.3 Verify 24C-1T-2 is open.

7.22.4 Verify 24C-2T-2 is open.

7.22.5 Verify 24D-2T-2 is open.

7.22.6 Verify all individual load breakers on Bus 24C are open.

Q 2.04 C

7.22.7 Verify Bus 24E is energized and **notify Unit 1 Control Room** Operator that they will be supplying Unit 2 Bus 24C.

7.22.8 Bypass ESAS undervoltage channels for 24C (A3) using the bypass keys from the Control Room Key Locker at ESAS Cabinets.

7.22.9 Reset Facility 1 Sequence using sequencer reset key from the Control Room Key Locker at ESAS Cabinet.

to the first room which houses the two electric motor-driven auxiliary feedwater pumps is by stairs leading down from the ground floor at elevation 14'6". The enclosure over the pump room stairwell serves as a protective barrier against direct water streams into the pump room due to a possible overhead pipe failure. The second room which houses the turbine-driven auxiliary feedwater pump is a water-tight vault physically separated from the motor-driven auxiliary feedwater pump room by a reinforced concrete wall. The only access means to this room is through a water-tight fire door.

D. Controls and Instrumentation

The electric-driven auxiliary feed pumps are individually controlled from control room panel C05, or from the hot shutdown panel C21 in the Turbine Building. The electric-driven pumps may be either automatically actuated or manually actuated.

Q2.09d

For automatic actuation, each pump and its associated control flow valve have two switches on each panel. The first switch, sometimes called the automatic permissive or the permissive block switch, either allows or blocks the automatic start of the respective pump. This auto permissive switch has three positions:

- Pull to lock, which blocks the automatic signal.
- Reset, which resets the automatic function.
- Start, which will start the electric auxiliary feed pumps and open the flow control valves.

Q 2.09d

The second switch selects the mode of operation of the flow control valve associated with the pump. The three modes of selection are: 1) "NORMAL", which allows the valve to open fully for an automatic actuation; 2) "OVERRIDE", which allows manual control of the valve position following an automatic actuation; and 3) "RESET," which resets the electrical logic for returning the mode of operation back to normal.

For manual actuation of the electric pumps, there are switches on both control panels which allow use of the pumps on an "as needed" basis. One way to do this is to manually initiate the automatic actuation sequence; this is done by using the start position of the permissive-block switch, which starts the automatic initiation regardless of S/G levels. A second way to manually initiate AFW is to use other switches which manually start the pump(s) and to manually control the feedwater regulating valve position(s) to provide the desired flow rate.

The Terry Turbine, which is not automatically actuated, can also be manually actuated from panels C05 or C21. The Turbine will operate reliably at steam supply pressures of 50 psig or higher - normal operation is at normal steam generator pressures. The turbine can be supplied from either steam generator. Turbine speed is governor controlled between 1400 and 4200 rpm, which is controlled by a handswitch on C05.

Q 2.09d

7.7.5 To override the Auto-AFW Initiation Signal to an individual FRV at C05 or C-21:

7.7.5.1 Momentarily place the Reset-Normal-Override Switch HS 5276A(B) or HS5279A(B) to override.

7.7.5.2 Observe C04 Alarms-"AFW HV5276A (HV5279A) Auto-Open-Override.

7.7.5.3 Shift FRV controller to Manual-HIC 5276A(B) or HIC 5279A(B) and adjust flow rate a desired.

7.7.6 To bypass a S/G level input, obtain the bypass key from the S.S. and bypass the desired channel at C100. Annunciation of the bypassed channel is on C04.

7.8 Transfer of AFW FRV control from C05 to C-21.

Q 2.09d

NOTE: AFW FRV maybe in either Manual or Auto prior to transfer to C-21.

7.8.1 At C-21, place the Normal/Remote Handswitches (HS 5276C and HS 5279C) to Remote.

7.8.2 Place C-21 controller to Manual and adjust flow as required.

7.9 Transfer of AFW-FRV control from C-21 to C05.

7.9.1 If both C-21 & C05 FRV controller, are in Auto, Place HS 5279C and 5276C to Normal, and on C05 place FRV controller to Manual and adjust flow as necessary.

7.9.2 If the transfer is to be made with the FRV controllers in Manual, the C-21 controller output must be matched to the C05 controller output prior to shifting HS 5276C and 5279C to Normal position.

7.10 See change 1

ch 1

4.8 De-energize B61 by tripping breaker B0610 at 22F to stop Charging Pumps B and C to prevent RCS overfill, and to allow manual valve operation.

4.9 Open or verify open Auxiliary Feed Header Cross-tie valve, 2-FW-44.

4.10 Use "A" Aux. Feedpump, P-9A, to provide Aux. feedwater due to the fact that the control for the remaining pumps may have been affected by the fire.

Q 2.09d

4.11 Maintain S/G level 70-80% (C05) with Aux. Feedwater Reg. valves FW-43A, and FW-43B in manual (Local).

4.12 When accessible, verify or open 2-CH-429 with handwheel. Rev. 1

4.13 Verify and, if necessary, manually open valve 2-CH-131.

4.14 Maintain PZR level 40-60% (Local) by opening 2-CH-192 and borate (in gravity feed mode) to the required shutdown margin using Charging Pump A or B (C02).

4.15 When level is less than 16% initiate procedure OP-2322 to provide Fire Water to Aux. Feedwater Suction.

4.16 Ensure makeup to Fire Water Supply Tanks from the City Water Main.

4.17 Perform applicable steps of Reactor Trip Recovery (EOP 2526).

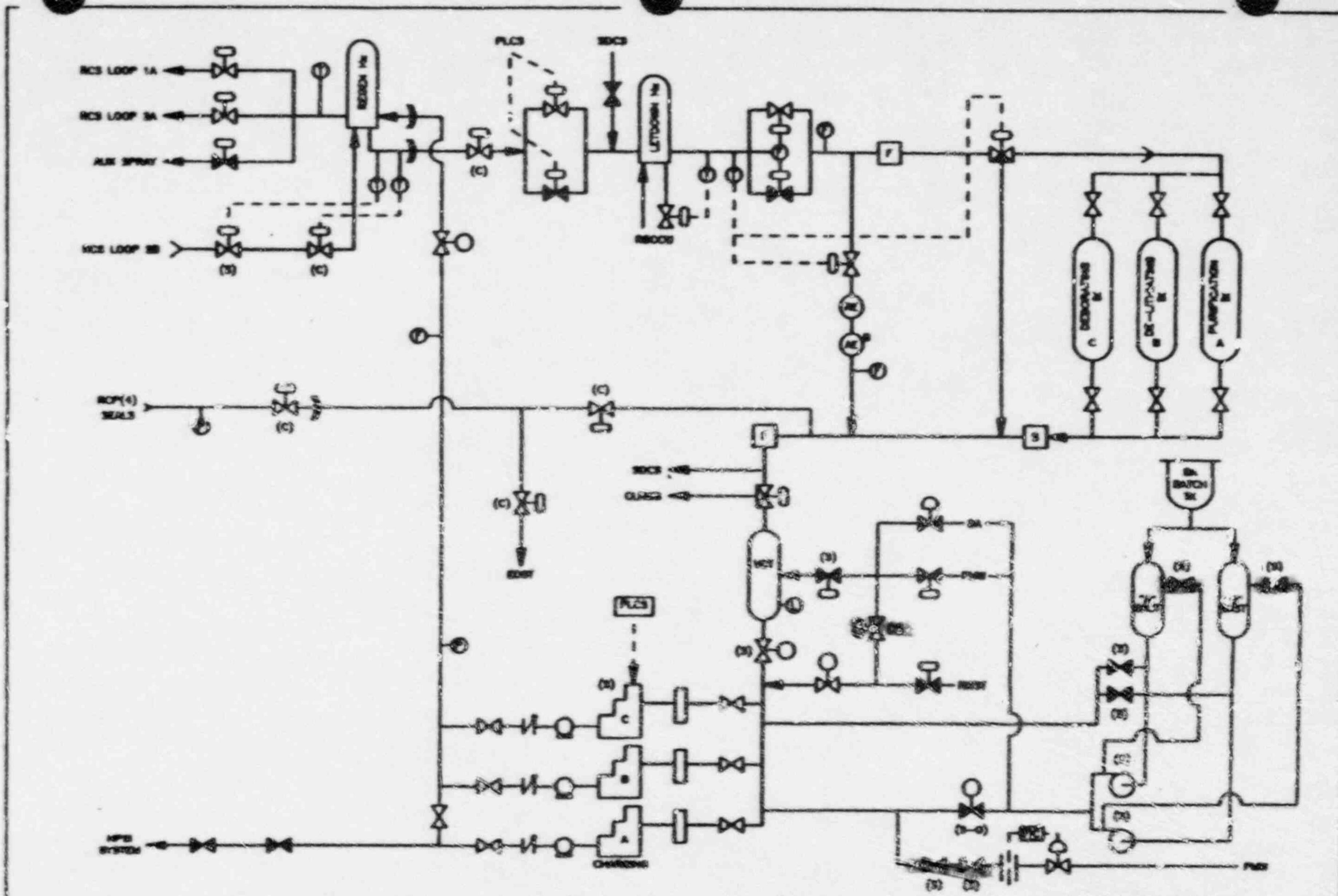
NOTE: This plant is in Hot Standby > 300°F. Maintaining RCS inventory via Charging and secondary heat removal via Aux. Feed.

4.18 Direct Chemistry to obtain a CTMT air sample for CTMT entry.

4.19 Proceed to procedure 2579BB for Cold Shutdown.

5. DISCUSSION

5.1 This procedure was developed in accordance with the Millstone Point Unit #2 Appendix "R" Compliance Review as issued March 1987. This report takes into account compliance with the rules of Appendix R 10CFR50 as updated per NRC staff positions, letters, seminars, and regional workshops.



CHEMICAL AND VOLUME CONTROL SYSTEMS CVCS

FIGURE 2a

M2107-29--87 86002304

Q 2.11

SECTION 3

QUESTION 3.02 part a.

Examinees may assume a cause for the given plant conditions (i.e. Excess Steam Demand Event in containment), in which case a SIAS, CIAS, and EBFAS could also occur on a high containment pressure.

As an EBFAS would override the AEAS signal, credit should be given if these actuations are assumed to occur.

QUESTION 3.07

The question did not clearly solicit a reason for each of the automatic actions, but the answer key requires a reason for full credit. Therefore, the reason part of the key answer should not be required for full credit.

QUESTION 3.08 part b.

The phrase "increasing S/G pressure" in the key answer should not be required for full credit. Steam Generator pressure is not an input used for TM/LP calculations.

QUESTION 3.10 part b.

An explanation that deals with the actual system response that will close the other five steam dump valves, should also be accepted for full credit. This includes Tavg less than the setpoint for the B, C, and D steam dumps or steam pressure less than the atmospheric dump setpoint.

QUESTION 3.11 a. and e.

3.11 a.

The D/G 12 U Trouble Annunciator will result from any one of 30 different conditions (reference attached). Depending on which condition caused the Annunciator to alarm, any one of the answers given in Column B could be correct.

Example:

1. If the annunciator alarms due to a "Lube Oil Level Low" condition, the D/G will not trip and answer number 1. is correct.

2. If the annunciator alarms due to an "Engine Overspeed" condition, the D/G will trip under any condition and answer number 2. is correct.

3. If the annunciator alarms due to a "Lube Oil Temp. High" condition, the D/G will trip, unless it had received an Emergency Start signal, and answer number 3. is correct.

Based on this, it is recommended that part a. be deleted.

3.11 e.

A DC Control Power Failure will either 1) Not Trip the D/G, 2) Trip the D/G unless an Emergency Start Signal is present or 3) Cause the D/G to come up to speed on the mechanical governor with no trip protection (except overspeed). What will happen depends upon what portion or portions of DC Control Power is lost.

To determine what will happen to the D/G, refer to the circuit diagrams supplied.

1. Figure 8.3-2 Sheet 12 shows that the "Loss of Control DC," Annunciator is caused by one of four relays: CR1, CR2, CR3, and CF4.

2. Identifying each one of these relays we find that:

   a. CR1 is the relay that indicates a loss of power to the starting portion of the D/G Control Circuitry. Refer to Figure 8.3-2 Sheet 3.

b. CR2 is the relay that indicates a loss of power to the shutdown and local starting portion of the D/G Control Circuitry. Refer to Figure 8.3-2 Sheet 4.

c. CR3 is the relay that indicates a loss of power to the automatic tripping and emergency shutdown portion of the D/G Control Circuitry. Refer to Figure 8.3-2 Sheet 5.

d. CF4 is the relay that indicates a loss of power to the Exciter Control Circuitry. Refer to Figure 8.3-2 Sheet 10.

3. A loss of power to CR1, CR2 or CF4 will produce a D/G Trip signal. Refer to Figure 8.3-2 Sheet 6. Note that a loss of power to CR3 will not produce a DG trip signal since the trip circuitry must be de-energized for this relay to lose power. A loss of CR3 will produce a "Loss of DC Control Power" annunciator, however, as shown on Figure 8.3-2 Sheet 12.

4. A Loss of power to CR1, CR2 or CF4 will not produce a D/G trip if an Emergency Start Signal is present. This is shown on Figure 8.3-2 Sheet 7. On an Emergency Start, the indicated ESS contact opens which prevents the Loss of DC Power Trip Signal from energizing the Shutdown Relay (SDR).

5. In addition to the above, a loss of power to the circuitry monitored by either CR1 or CR2 will fail open the Air Start Valves and roll the D/G with air. If the Trip Circuitry (CR3) also loses power, the D/G will come up to speed and run with no trip protection available (except the overspeed trip) and the "Loss of DC Control Power" Annunciator in alarm.

6. The difference in response of the D/G to partial loss of control power vice total loss of control power is covered on pages 106 and 107 of the D/G Instructor Guide (lesson plan excerpts attached).

Based on the above information it is recommended that part e. be deleted.

Initial

Monitor C08 E.D.G. voltmeter and frequency meters for proper indication.

Take corrective action as necessary to maintain 4.16kV and 60 hz. If D/G output voltage decreases to 4025 volts the undervoltage contact in the D/G output breaker opens, not allowing the breaker to automatically close on an LNP signal.

Subsequent

Determine cause of alarm, i.e., low frequency, overload, voltage regulator maladjustment or failure.

Notify Electrical Maintenance Department.

8.4 D/G 12U Trouble C08 A-36
D/G 13U Trouble C08 B-36

NOTE: Alarms on local Panel C38/C39.

8.4.1 Lube Oil Level Low C38/C39 1-1

Initiating Device	Setpoint
LS-8795	Dip stick "add oil" mark.
LS-8796	Dip stick "add oil" mark.

Action:

Auto

None

Initial

Determine cause of low oil level.

Subsequent

1. Submit trouble report/notify maintenance to add oil.
2. Reset alarm by depressing reset on engine std control panel and then reset panel C38(39)
3. If unit is removed from service refer to Section 2, License Requirements.

Rev. 9 Ch. 5

8.4.2 Lube Oil Pressure Low C38/C39 1-1

Initiating Device	Setpoint
PS-8785	16 PSI Decreasing
PS-8784	18 PSI Decreasing
PS-8783	20 PSI Decreasing
PS-8788	20 PSI Decreasing
PS-8787	18 PSI Decreasing
PS-8786	16 PSI Decreasing

Action:

Auto

If no emergency start signal (ESS) is present, engine will trip when alarm comes in. If an ESS is present, 2/3 pressure switches must actuate to trip unit.

Initial

1. Check oil sump level.
2. Check for oil leak or broken oil lines.

Subsequent

1. Notify Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.3 Lube Oil Temp. Low C38/C39 3-1

Initiating Device	Setpoint
OTLA	105°F Decreasing

Action:

Auto

None

Initial

Determine cause of alarm:

1. Check standby heater in service and standby L.O. pump operating if engine is shutdown.
2. Check temperature control valve operation if engine is running.
3. Verify proper valve alignment.

Subsequent

1. Notify Maintenance Department of malfunction.
2. If unit is removed from service for maintenance, refer to Section 2, License Requirements.

8.4.4 Lube Oil Temp. High C38/C39 4-1

Initiating Device	Setpoint
TS-8799	230°F Increasing
TS-8800	230°F Increasing

Action:

Auto

If no emergency start signal present, unit will trip.

Initial

Determine cause of high temperature alarm:

1. Engine overload - reduce load.
2. Check cooling water supply pressure.
3. Check temperature control valve operating.
4. Check oil sump level normal.
5. Check pump discharge pressure.
6. Check D/G service water flow and strainer ΔP for indication of plugging.
7. Verify vent fan operating with D/G running.

Subsequent

1. Notify Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.5 Crank Case Pressure High C38/C39 5-1

Initiating Device	Setpoint
PS-8791	+0.5" H_2O
PS-8792	+0.5" H_2O

Action:

Auto

If no ESS is present, unit will trip.

Initial

Determine cause of alarm.

CAUTION: If cause of alarm is high crankcase pressure, do not remove crankcase inspection plates for one hour.

Subsequent

1. Notify Maintenance Department of malfunction.
2. If engine is removed from service, refer to Section 2, License Requirements.

8.4.6 Jacket Coolant Temp. Low C38/C39 3-2

Initiating Device	Setpoint
TS-8775	90°F Decreasing
TS-8776	90°F Decreasing

Action:

Auto

None

Initial

Determine cause of alarm:

1. Check standby heater in service and pump operating.
2. Check temperature control valve operating if engine is running.
3. Check D/G service water flow secured if D/G not running.
4. Verify vent fan not operating with D/G secured.

Subsequent

1. Notify Maintenance Department of malfunction.
2. If engine is removed from service, refer to Section 2, License Requirements.

8.4.7 Jacket Coolant Pressure Low C38/C39 2-2

Initiating Device	Setpoint
PS-8771	15 PSI Decreasing
PS-8772	15 PSI Decreasing

Auto

If no emergency start signal present, unit will trip.

Initial

Determine cause of alarm:

1. Check water level normal.
2. Check for obvious leaks.
3. Check proper alignment of valves.

Subsequent

1. Notify Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.8 Jacket Coolant Level Low C38/C39 1-2

Initiating Device	Setpoint
LS-8769	Expansion Tank 15" from bottom
LS-8770	Expansion Tank 15" from bottom

Action:

Auto

None

Initial

Determine cause of alarm:

1. Check level in expansion tank.
2. Check for obvious leaks.

Subsequent

1. If no leaks are found, fill to normal level (23"). Notify Chemistry for chemical sample/addition.
2. Notify Maintenance Department of malfunction.
3. If unit is removed from service, refer to Section 2, License Requirements.

8.4.9 Jacket Coolant Temp. High C38/C39 4-2

Initiating Device	Setpoint
TS-8773	200°F Increasing
TS-8774	200°F Increasing

Action:

Auto

If no emergency start signal present, unit will trip.

Initial

Determine cause of alarm:

1. Engine overload - reduce load and determine cause of overload.
2. Check water level normal.
3. Check temperature control valve for proper operation.
4. Check operation of standby heating system.
5. Check system for obvious leaks.
6. Check D/G service water flow and strainer ΔP indication for plugging.
7. Verify proper operation of D/G vent fan.

Subsequent

1. Notify Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.10 Fuel Oil Pressure Low C38/C39 2-7

Initiating Device	Setpoint
PS-7026	10 PSI Decreasing
PS-7020	10 PSI Decreasing

Action:

Auto

If no emergency start signal is present, unit will trip when fuel pressure reaches 10 psi.

Initial

Determine cause of alarm:

1. Check oil supply tank level normal.
2. Check for obvious leaks.
3. Verify fuel oil supply open/latched.

Subsequent

1. Notify Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.11 Engine Overspeed C38/C39 5-4

Initiating Device	Setpoint
Over Speed Governor	1050 RPM

Action:

Auto

Engine trip.

Initial

Determine cause of overspeed:

1. Governor malfunction.
2. Loss of electrical load.
3. Emergency stop pushbutton at control end of engine.

Subsequent

1. Attempt to reset the overspeed alarm from the engine skid mounted panel.

   NOTE: If alarm resets, then a faulty speed switch is indicated.

2. If action in Step 1 is not successful, then operate the overspeed trip reset lever at the control end of engine and then reset the alarm.
3. If engine and alarm reset, attempt to restart the engine.
4. Notify Maintenance Department of malfunction.
5. If unit is removed from service, refer to Section 2, License Requirements.

8.4.12 Fuel Oil Supply Tank Level Lo T-48A C38 1-7
Fuel Oil Supply Tank Level Lo T-48B C39 1-7

Initiating Device		Setpoint
LS7002	Hi/Lo	138"/132" (97%/92%)
LS7011	Hi/Lo	138"/132" (97%/92%)

Action:

Auto

None

Initial

Determine if alarm is Hi or Low:

1. Check diesel oil transfer pump P47A/P47B breaker not tripped.
2. Visually check level glass on supply tank.
3. Check for leaks.
4. Check valve line up normal.

Subsequent

1. Notify Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.
3. If low level is due to malfunction of transfer pump, the tank may be filled using other transfer pump and normally locked closed crosstie valve as per Operating Procedure No 2346B.

8.4.13 Engine Start Failure C38/C39 5-3

Initiating Device	Setpoint
TD1	12 Sec. Engine Crank Time

Action:

Auto

Blocks engine start thru shutdown relay.

Initial

Determine cause of alarm:

1. Check other alarm drops and verify support components operable.
2. Check starting air pressure normal and no air leaks.

Subsequent

1. If any of the above were corrected, reset shutdown relay and attempt another start.

2. If none of the above:
   a. Notify Maintenance Department of malfunction.
   b. If unit is removed from service, refer to Section 2, License Requirements.

8.4.14 Starting Air Pressure Low C38/C39 3-7

<u>Initiating Device</u>	<u>Setpoint</u>
PS-8314 A (B)	150 PSI Decreasing
PS-8818 A (B)	150 PSI Decreasing

<u>Action</u>:

<u>Auto</u>

None

<u>Initial</u>

Determine cause of alarm:

1. Check A.C. and D.C. air compressor operation and circuit breaker closed.
2. Check air dryer valve lineup.
3. Check for air leaks or lifting relief valve.
4. Check air receiver air pressure local indication to verify possible faulty pressure switch.
5. Ensure air compressor returns pressure to normal.

<u>Subsequent</u>

1. If any of above conditions were found and/or corrected, verify pressure returned to normal.
2. If condition not corrected, notify Maintenance Department.
3. If unit is removed from service, refer to Section 2, License Requirements.

8.4.15 D.C. Control Power Failure C38/C39 3-4

<u>Initiating Device</u>	<u>Setpoint</u>
CR1, CR2 or CR3 Relay	Loss of 125 V.D.C.

Action:

Auto

Engine Air start valves fail open an loss of 125 VDC. Engine will come up to speed on mechanical (governor with no protection).

Initial

1. Determine if alarm is valid.
2. Trip D/G locally using mechanical overspeed trip and shut starting air isolation valves.
3. Determine cause of loss of 125 dc check circuit breaker No. 20 in 125 vdc distribution panel 201A-1V (15G-120) 201B-1V (15G-13V) closed.

Subsequent

1. Notify Electrical Maintenance of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.16 480V Auxiliary Power Loss C38/C39 2-4

Initiating Device	Setpoint
74 Relay	N/A

Action:

Auto

None

Initial

Determine cause of alarm:

1. Check breaker on MCC 22-1E (15G-12U) or MCC 22-1F (15G-13U) closed.

Subsequent

1. Notify Electrical Maintenance Department.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.17 Generator Bearing Temp. High C38/C39 1-5

Initiating Device	Setpoint	
TE 9370B, TE 9371B, TE 9371D, TE9370D	85°C	185°F

Action:

Auto

None

Initial

Determine cause of alarm:

1. Check bearing oil level.
2. Check temperature with hand held pyrometer or similar device.

Subsequent

1. Notify Maintenance Department and Instrument Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.18 Generator Undervoltage C38/C39 1-6

Initiating Device	Setpoint
27/59-1 27/59-2	N/A

Action:

Auto

None

Initial

Determine cause of alarm:

1. Take manual voltage control and return voltage to normal.

Subsequent

1. Notify Electrical Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.19 Generator Underfrequency C38/C39 3-6

Initiating Device	Setpoint
81/X	N/A

Action:

Auto

Generator breaker "15G-12U-2" or "15G-13U-2" trip.

Initial

Determine cause of trip by relay operation, record and reset the relay.

Subsequent

1. Notify Electrical Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.20 Generator Lockout Trip C38/C39 5-5

Initiating Device	Setpoint
86 Relay	N/A

Action:

Auto

Generator breaker "15G-12U-2" or "15G-13U-2" trip.

Initial

Determine cause of trip by relay operation, record and reset the relay(s).

Subsequent

1. Notify Electrical Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.21 Generator Non-Lockout Trip C38/C39 5-6

Initiating Device	Setpoint
Reverse Power Relay - 32 Relay	N/A
Voltage Restraint Overcurrent - 51V Relay	
Core Balance Ground Fault - 50 GS Relay	
Overcurrent (Instantaneous) - 50 Relay	

Action:

Auto

Generator breaker "15G-12U-2" or "15G-13U-2" trip.

Initial

Determine cause of trip by relay operation, record and reset the relay(s).

Subsequent

1. Notify Electrical Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.22 Generator Neutral Ground Fault C38/C39 4-5

Initiating Device	Setpoint
59/SI Relay	N/A

Action:

Auto

None

Initial

Determine cause of alarm by relay operation, record and reset the relay(s).

Subsequent

1. Notify Electrical Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.23 Generator Excitation Loss C38/C39 3-5

Initiating Device	Setpoint
40/76 Relay	N/A

Action:

Auto

None

Initial

Determine cause of alarm:

1. Reset exciter and verify alarm clears.
2. Check D.C. control power available.

Subsequent

1. Notify Electrical Maintenance Department.
2. If unit removed from service, refer to Section 2, License Requirements.

8.4.24 Service Water Flow Low C38/C39 5-7

Initiating Device	Setpoint
FS 6389	500 GPM
FS 6397	500 GPM

Action:

Auto

None

Initial

Determine cause of low flow condition:

1. Check service water pump in operation and system pressure normal.
2. Check differential pressure (local gages) on service water strainer to determine if strainer is plugging.
3. D/G heat exchanger(s) inlet flow control valve open and operating properly.
4. Check for obvious leaks.
5. Check possible faulty flow switch.
6. Check engine lube oil and jacket cooling water temperature normal.
7. If service water flow cannot be established, shutdown the diesel within 3 minutes.

Subsequent

1. Notify Maintenance Department and/or Instrument Department of malfunction.
2. If engine is removed from service, refer to Section 2, License Requirements.

8.4.25 Generator Stator Temp. High C38/C39 2-5

Initiating Device	Setpoint
Thermal Relay 49	110°C

Action:

Auto

None

Initial

Reduce load on generator:

1. Verify D/G room ventilation fans operating.
2. Verify power factor (reactive load) normal.
3. Verify no obstruction in vent. intake or that ventilation system has malfunctioned.

Subsequent

1. Continue to minimize diesel load if possible. If diesel is not vital to safe plant operation, unload diesel and run at "0" load to promote cooling of stator.
2. If diesel is vital to safe plant operation, attempt to promote a second source of cooling air:
   a. Open doors of affected room.
   b. Set up portable booster fans.
   c. Verify outside air damper is fully open and recirculating air supply damper fully closed.

8.4.26 4160V Auxiliary Power Loss C38/C39 1-4

Initiating Device	Setpoint
27-X1/15G-22S3	N/A
27-X2/15G-22S3	N/A

Action:

NOTE: This alarm indicates an under voltage condition between bus 24G and buses 24C/24D.

Auto:

1. Actuation of either D/G 4160V auxiliary power loss alarm relay initiates interlocking which prevents closing the RSST feeder breakers 22S3-24C-2 and 22S3-24D-2.

NOTE: The above automatic action will inhibit any attempt to parallel the D/G's with the 345 KV System in the event of an undervoltage condition on the 345 KV System RSST or the feeder breaker from 24G to 24C/24D is not closed.

Initial:

1. Verify RSST is energized and 345 KV System voltage normal (GETAC and C08 indication).
2. Verify RSST feeder breaker 24C/24D is closed.

Subsequent

1. If above conditions are satisfied reset the alarm at the D/G skid mounted panel (s).
2. If alarm resets and LNP recovery operation is in progress proceed with recovery operation.
3. If alarm cannot be reset notify maintenance to investigate and initiate repairs.
4. If alarm was actuated due to maintenance on bus 24G ensure alarm is reset following restoration of bus 24G to normal.

8.4.27 D.C. Air Compressor Started C38/C39 4-7

Initiating Device	Setpoint
PS7985D/B 42/a Relay	190 PSI Decreasing

Action:

Auto

D.C. compressor starts.

Initial

Determine cause of alarm:

1. Check A.C. compressor hand switch in auto.
2. Check A.C. compressor circuit breaker closed.
3. Check air dryer valve lineup.
4. Check for air leaks or relief valve lifting.
5. Check air pressure recovery.

Subsequent

Determine cause of low pressure condition:

1. Notify Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.28 Generator Overvoltage C38/C37 2-6

Initiating Device		Setpoint
27/59.2	27/59.2	N/A

Action:

Auto

None.

Initial

Determine cause of alarm:

1. Take manual voltage control and return voltage to normal.

Subsequent

1. Notify Electrical Maintenance Department of malfunction.
2. If unit is removed from service, refer to Section 2, License Requirements.

8.4.29 Aux. Control Sw. Not in Auto Position C38/C39 4-4

Initiating Device				Setpoint
RS1	RS2	RS3	RS4	N/A
A	A	A	A	

Action

Auto

None.

Initial

Determine cause of alarm:

1. Check auxiliary control switches in auto position.
   a. Coolant Pump
   b. Coolant Heater
   c. Lube Oil Pump
   d. Lube Oil Heater

Subsequent

1. If alarm is due to switch malfunction, notify Electrical Maintenance Dept.

8.4.30 Fuel Oil Supply Valve Shut C38 A-10
C39 A-10

Initiating Device	Setpoint
PS 7026A	3 PSIG
PS 7020A	3 PSIG

Action

Note: This is an operator alert alarm to provide indication to the operator that the fuel oil supply valve to the diesel engine(s) is closed.

Auto

Unit will not start or will trip if running. (See Section 8.4.10)

Initial

1. Dispatch operator to determine cause of alarm (i.e: valve tripped due to fire, PM's, or break in fuel oil line.

CAUTION: VALVES 2-FO-79 (80)ARE THERMALLY TRIPPED AS WELL AS MANUALLY TRIPPED. CHECK CAREFULLY TO ENSURE VALVE STEM IS ACTUALLY OPEN (UP) FOLLOWING RESET ACTION OR WHEN CHECKING VALVE OPEN.

Subsequent:

1. If valve is tripped due to fire, initiate AOP 2559.
2. If valve is tripped due to performance of preventative maintenance, ensure valve is properly reset following the completion of maintenance.
3. If low pressure is due to line break, isolate the fuel oil at the supply tank.
4. Refer to License Requirements, Section 2.

8.5 D/G 12U (13U) Breaker Closing Ckt. Blocked C08 C-36
C08 D-36

Initiating Device	Setpoint
3 Relay/Operate	N/A

Action:

Auto

None.

Initial

1. Determine cause of alarm:
   1.1 If breaker trips when removing D/G from service on reverse power or maintenance has been performed on breaker, reset alarm by leaving Syn. Switch in off and using breaker control switch on C08, go to close and then back to trip.

2. If alarm does not reset verify operability of the other D/G and associated equipment.

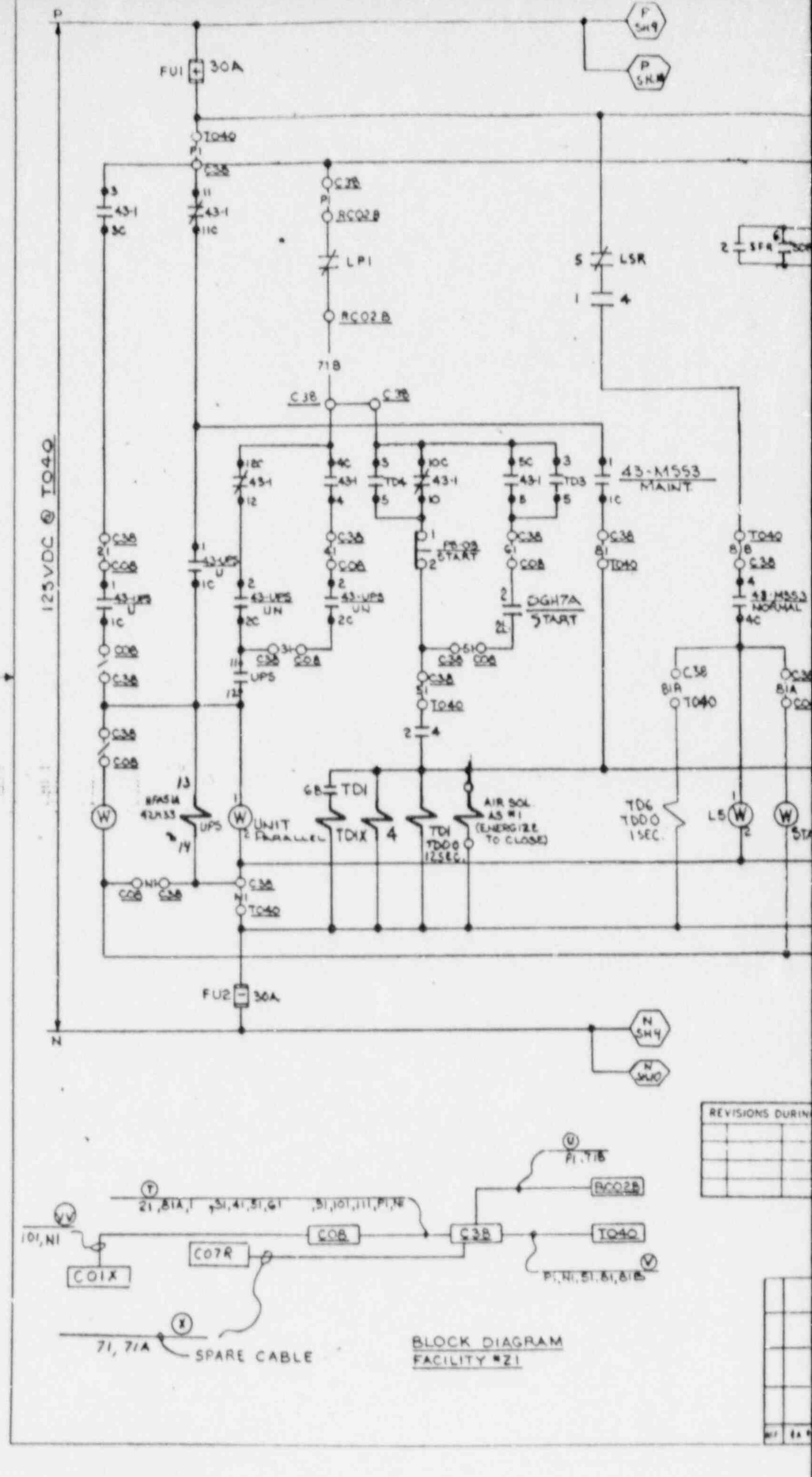
Subsequent

1. Determine cause of trip by relay operation, record and reset the relay(s).
2. Notify Electrical Maintenance Department of malfunction.
3. If unit is in-operable, refer to Section 2, License Requirements.

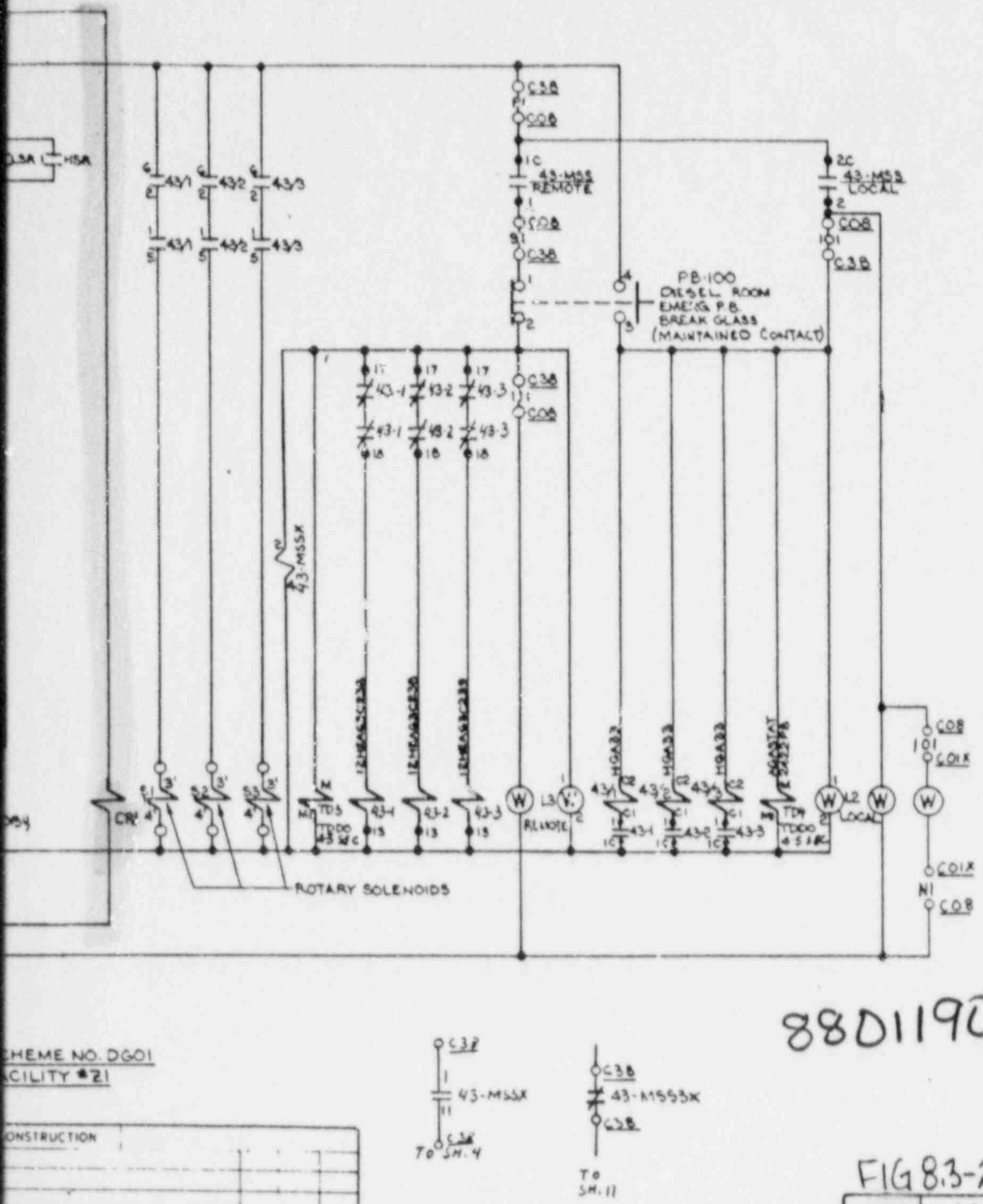
INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY
	1) Electrical - energizes SDR.	
	2) Setpoint is 225°F.	
	h. Engine Start Failure	
	1) Electrical - energizes SDR.	
	2) If the engine cranks for 12 seconds and does not reach a speed of 250 RPM or establish adequate lube oil pressure, the diesel will trip.	Adequate lube oil pressure is 13 psig.
Q 3.11e	i. DC Control Power Failure	This trip actuates on partial loss of DC control power to the Diesel.

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY
Q 3.11e		On a total loss of DC the Diesel will start and come up to speed but the breaker will not close because of the loss of control power.
	1) Electrical - energizes SDR.	
	2) Loss of 125V DC control power.	
	3. Diesel Generator Breaker Trips	
	a. Generator Underfrequency	
	1) 81/X relay.	
	b. Generator Non-Lockout.	
	1) Reverse Power.	

Q 5.11E



P
N
FU1 30A
FU2 30A
125VDC @ TO40
43-M553 MAINT.
43-M553 NORMAL
DGH7A START
PB-02 START
LSR
LP1
RCO2B
TO40
C38
CO8
43-1
43-UPS
UPS
UNIT PARALLEL
TD1
TD1X
TD1 TDDO 12SEC.
TD6 TDDO 1SEC.
AIR SOL. AS #1 (ENERGIZE TO CLOSE)
REVISIONS DURING
CO1X
CO7R
SPARE CABLE
71, 71A
101, N1
BLOCK DIAGRAM FACILITY #21



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8801190328-01

SCHEME NO. DG01
FACILITY #21

CONSTRUCTION

FIG 8.3-2 SH3

QA

NOTES:

1. ALL DEVICES ARE 15G-12U EXCEPT AS NOTED.
2. FOR 43-MSS, 43-MSS3 & 43-UPS SEE SH A.
3. 4 RELAY TO BE ENERGIZED INITIALLY.
4. FOR DGH7A/15G-12U, SEE SH. A
5. FOR 43 MSS3X COIL SEE SH. 4

NO	DATE	REVISION	BY	CHK	APP	APP
2	2/83	AS BUILT PER DCR-M2-P-74-84 PDCR-7-17-86	CP			

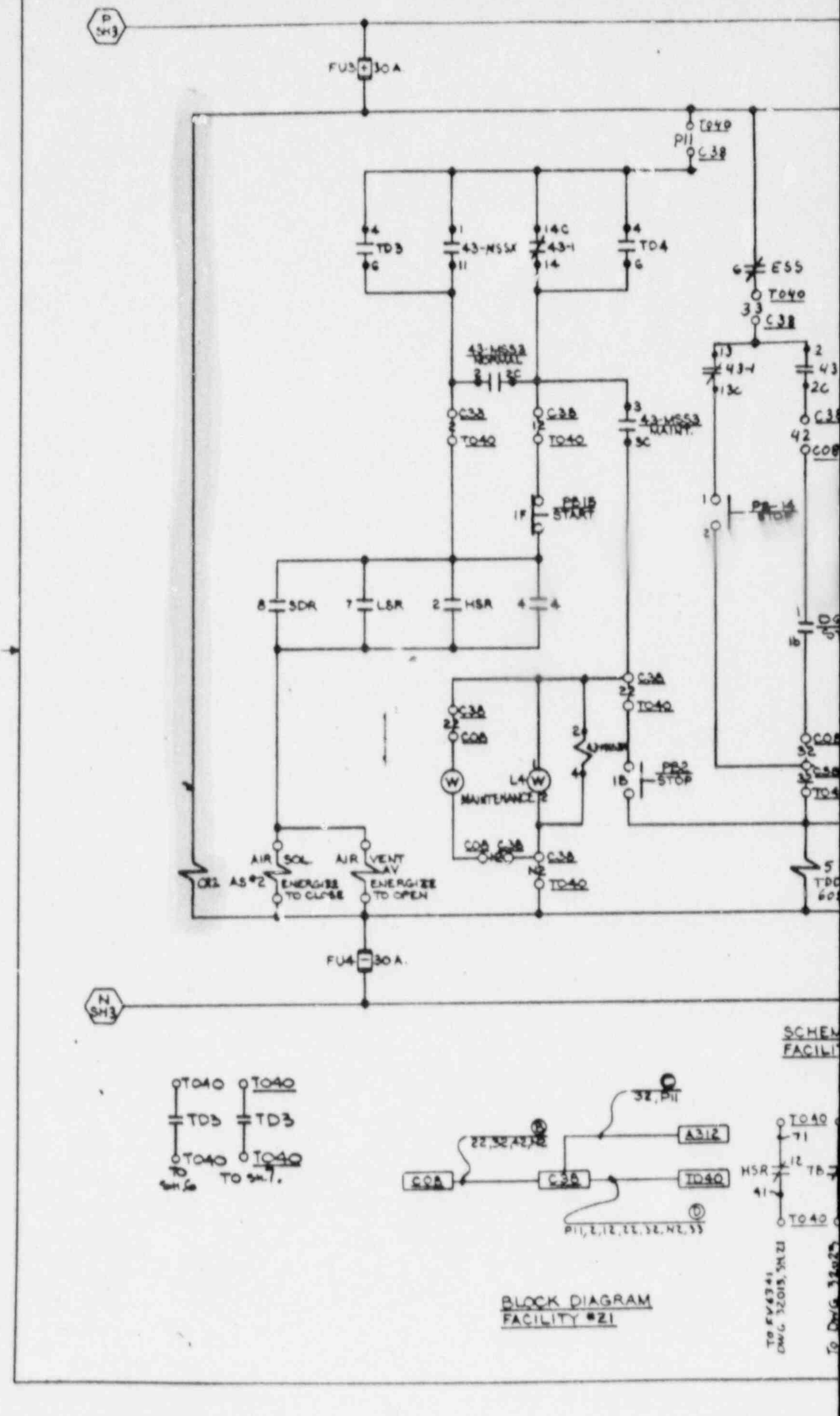
MP	P.A. NO.	NO	DATE	REVISION	BY	CHK	APP	APP
	–	2	1/30/84	AS BUILT PER PDCR-2-34-83 DCR-M2-P-002-84	VL	REM		AP
✓	78-303	1	12/21/78	DCR-2-152-76, 2-174-76 & M2-P-011-78	CD			
		0	1/14/76	ISSUED AS-BUILT	SH			

BECHTEL CORPORATION
GAITHERSBURG, MARYLAND
JOB 7604

THE MILLSTONE POINT COMPANY
SUBSIDIARY OF
NORTHEAST UTILITIES

TITLE
MILLSTONE NUCLEAR POWER STATION UNIT NO. 2
DIESEL GENERATOR 15G-12U (H7A)
ENGINE CONTROL

BY J. FUHR	CHKD	APP	APP
DATE 2-11-72	DATE 3-2-72	DATE 3-2-72	DATE
SCALE ~	MICROFILM DATE 1-14-76	DWG NO 25203-32041	SH. 3



FU3 30 A.
FU4 30 A.
TD3
43-MSSX
43-H
TD4
ESS
43-MSS3 NORMAL
43-MSS3 MAINT.
PB-1B START
PB-1A STOP
PB2 STOP
SDR
LSR
HSR
MAINTENANCE
AIR SOL.
AS #2
ENERGIZE TO CLOSE
AIR VENT AV
ENERGIZE TO OPEN
CR2
BLOCK DIAGRAM
FACILITY #21
COB
C38
TD40
A312

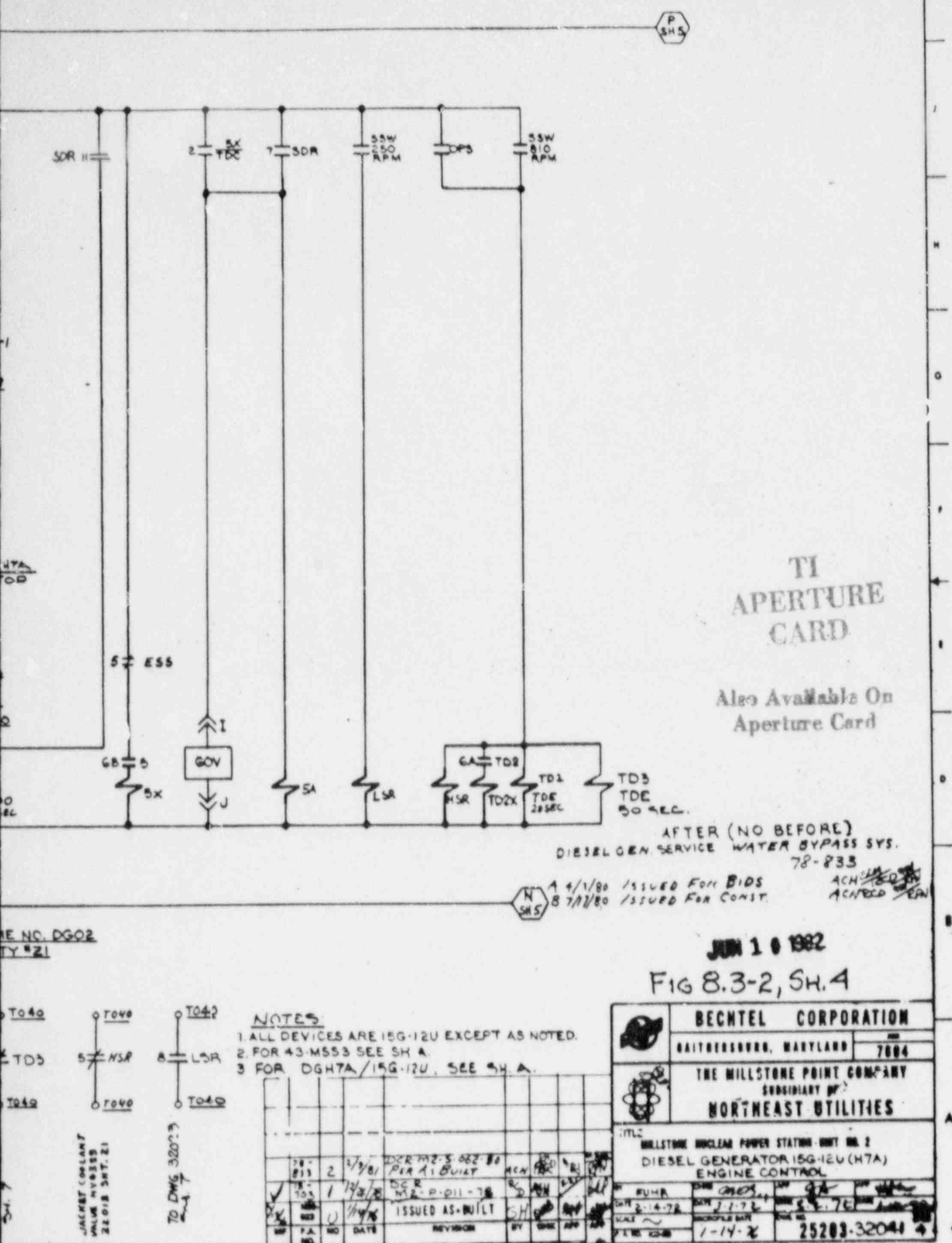
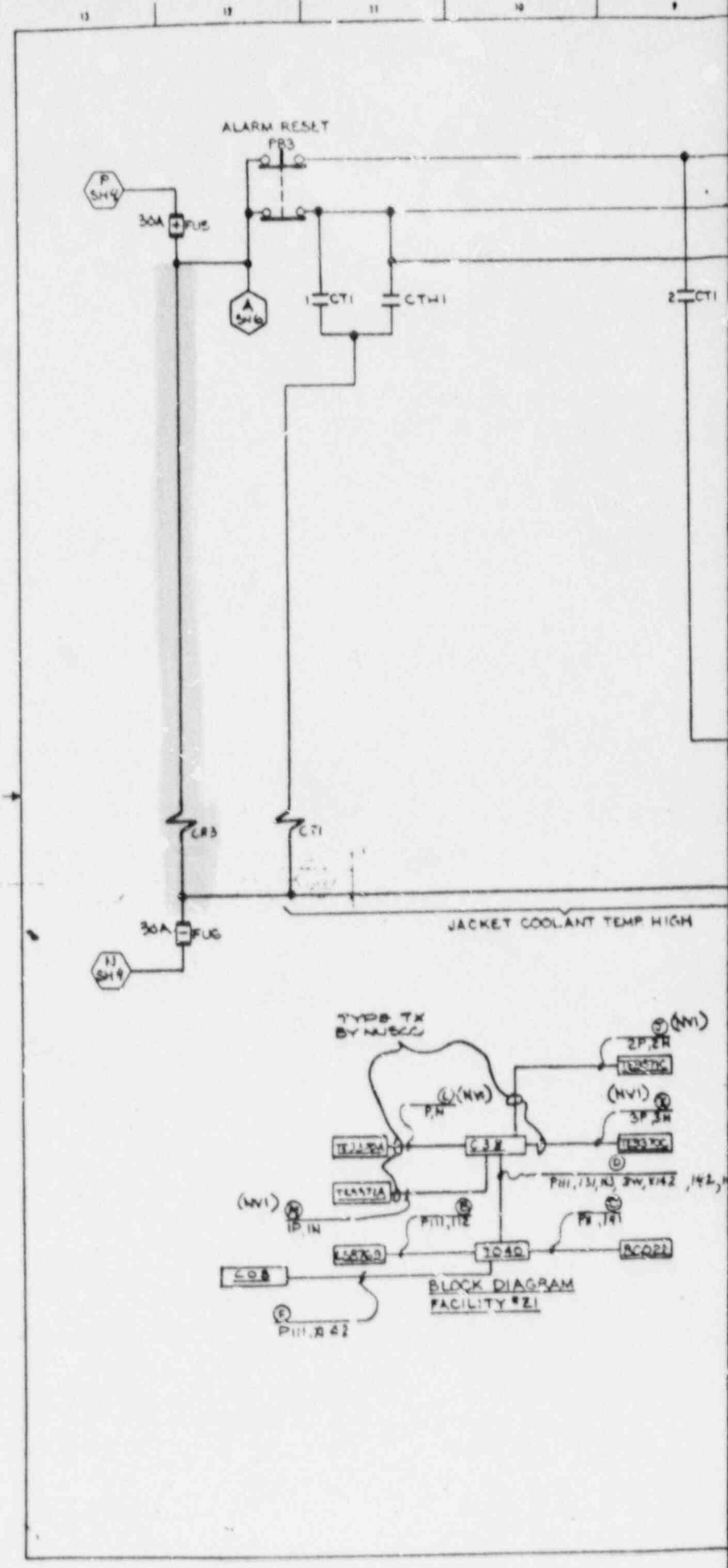
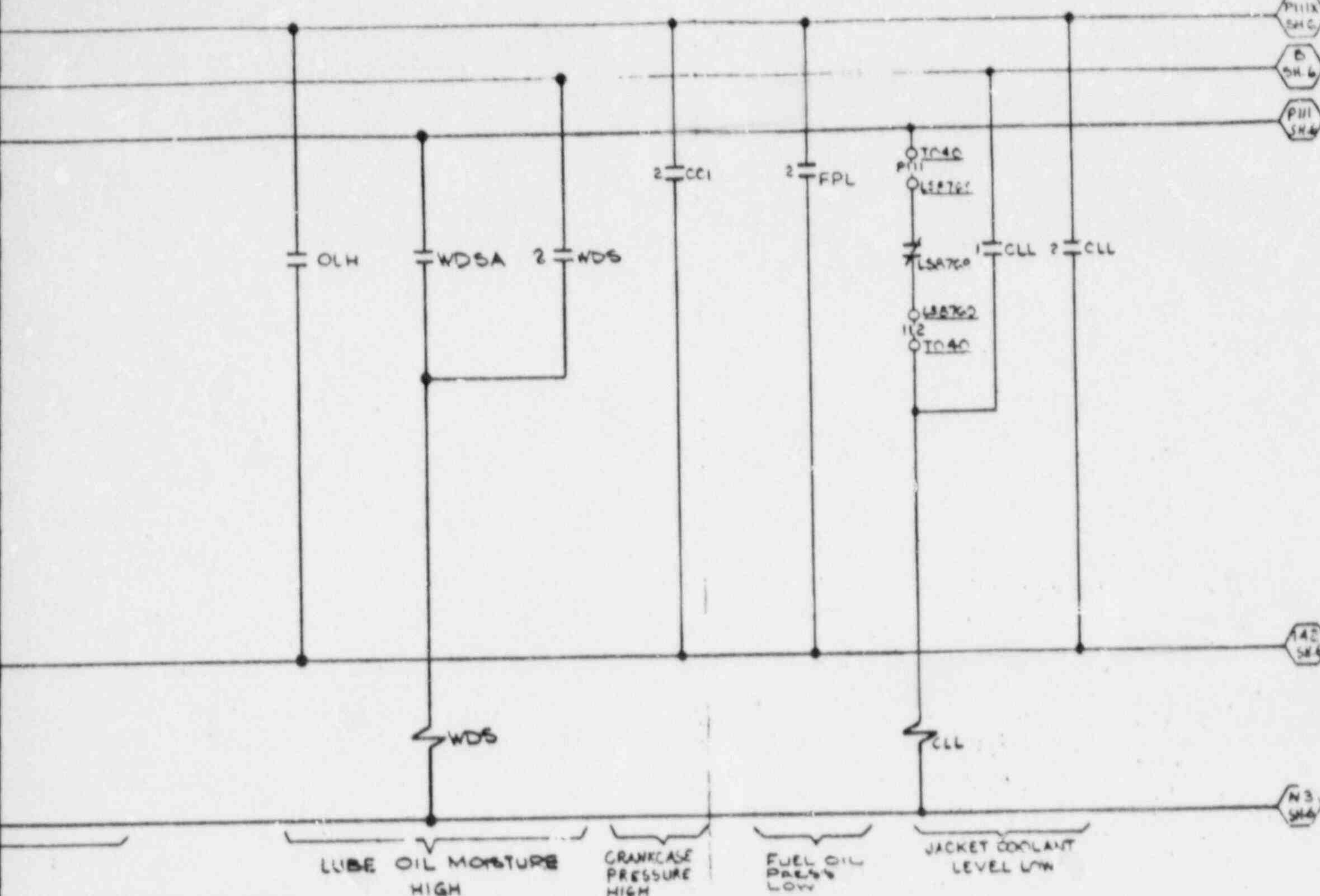


FIG 8.3-2, SH. 4

8801190328-02



ALARM RESET
PB3
30A
FUS
CT1
CTH1
2 CT1
CR3
JACKET COOLANT TEMP HIGH
(NV1)
BLOCK DIAGRAM
FACILITY #21



SCHEME NO. DG02
FACILITY #21

JUN 1 0 1982

FIG. 8.3-2 SH.5

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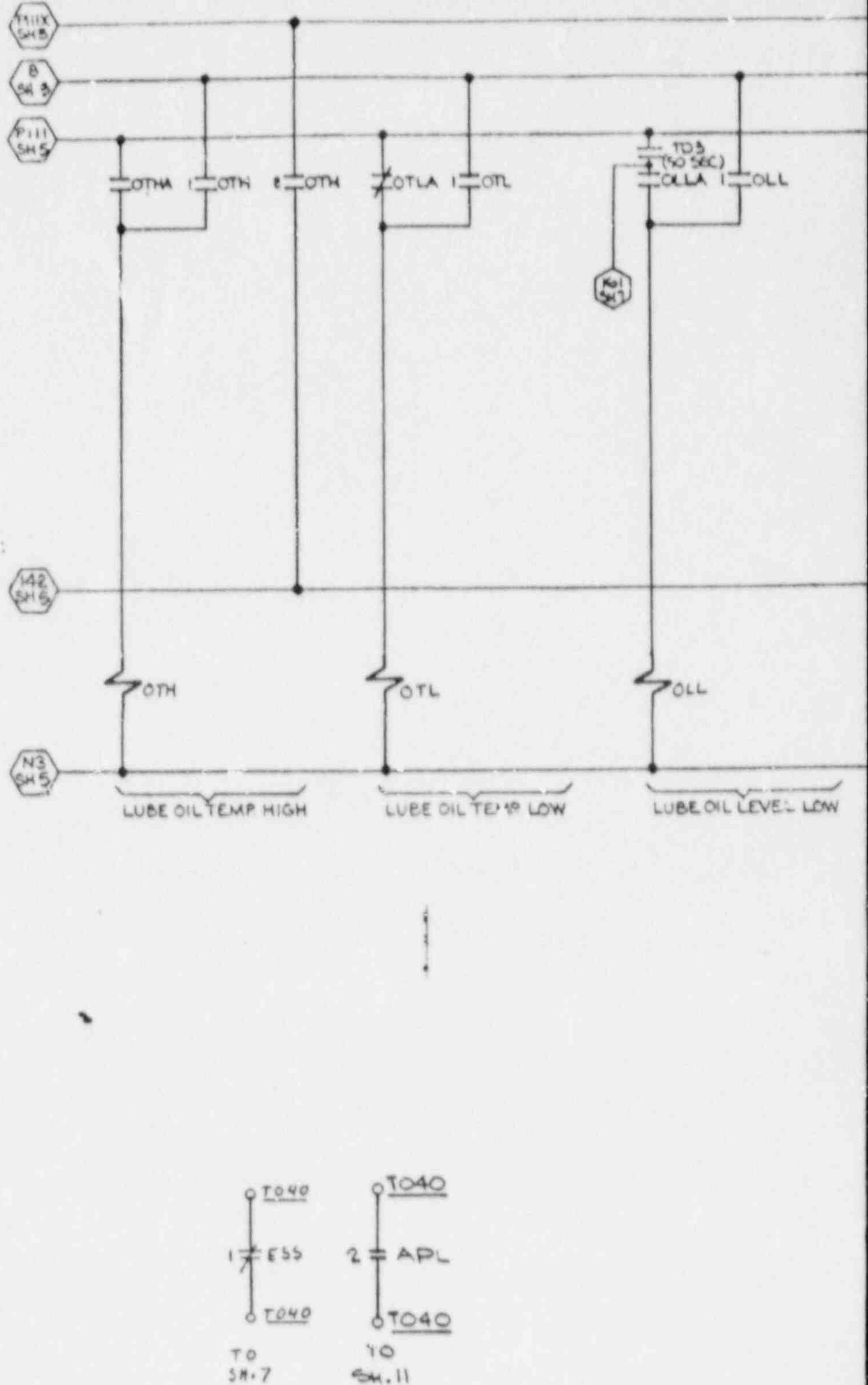
TITLE
MILLSTONE NUCLEAR POWER STATION - UNIT NO. 2
DIESEL GENERATOR 1EG-12U (H7A)
ENGINE CONTROL

DR JFUHA	CHKD	APP	APP
DATE 1-14-72	DATE 2	DATE 2-2-72	DATE
SCALE ~	MICROFILM DATE	DWG NO. 25203-32041	SH 5

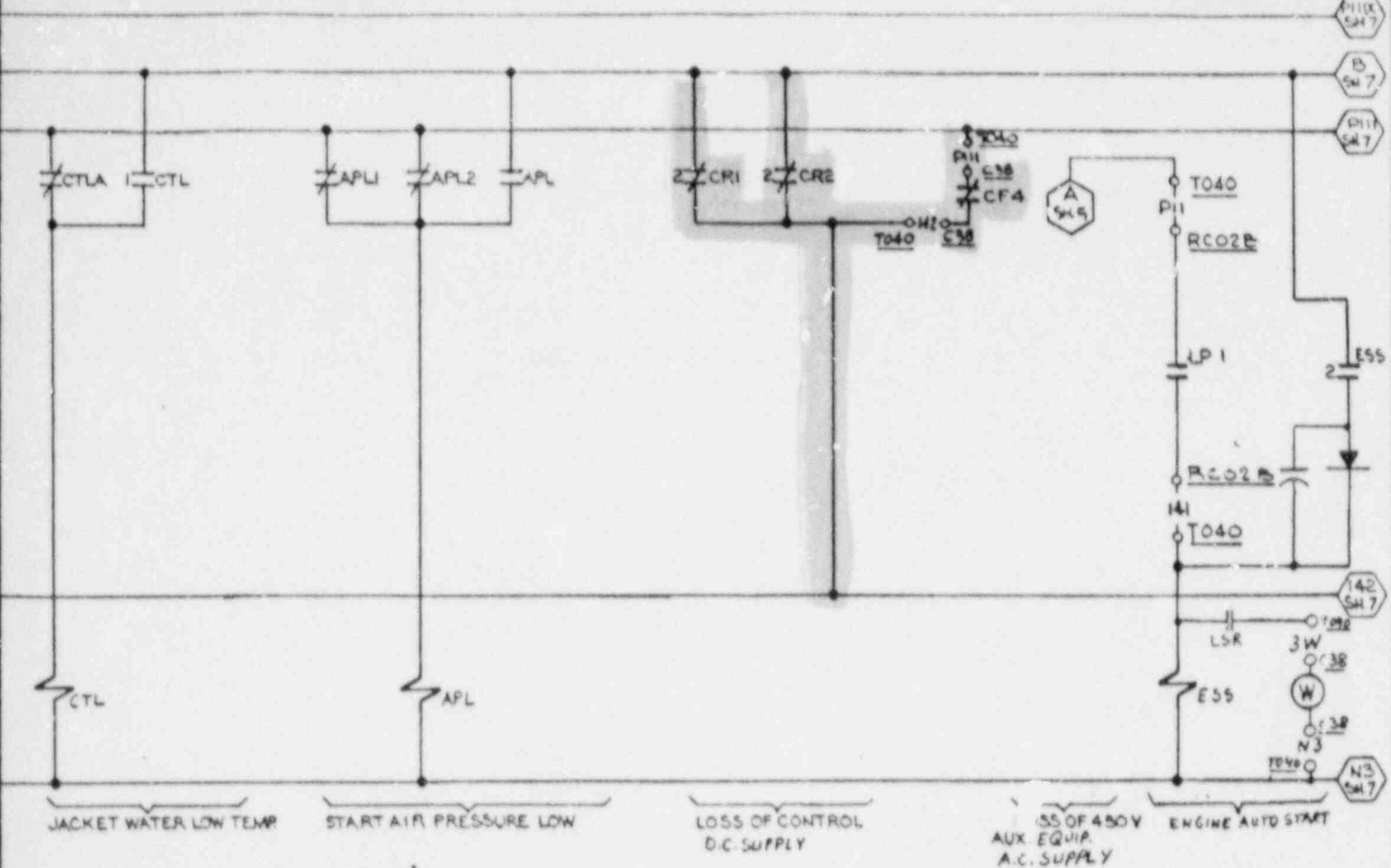
Rev 11

8801190328-03



T111X SH 8
B SH 3
P111 SH 5
OTHA
1 OTH
2 OTH
OTLA
1 OTL
TD3 (30 SEC)
OLLA
1 OLL
142 SH 5
OTH
OTL
OLL
N3 SH 5
LUBE OIL TEMP HIGH
LUBE OIL TEMP LOW
LUBE OIL LEVEL LOW
T040
1 ESS
T040
TO SH. 7
T040
2 APL
T040
TO SH. 11

JUN 23 1987



SCHEME NO. DG03
FACILITY #21

REVISIONS DURING CONSTRUCTION				

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FIG 8.3-2 SH 6

Q.A.

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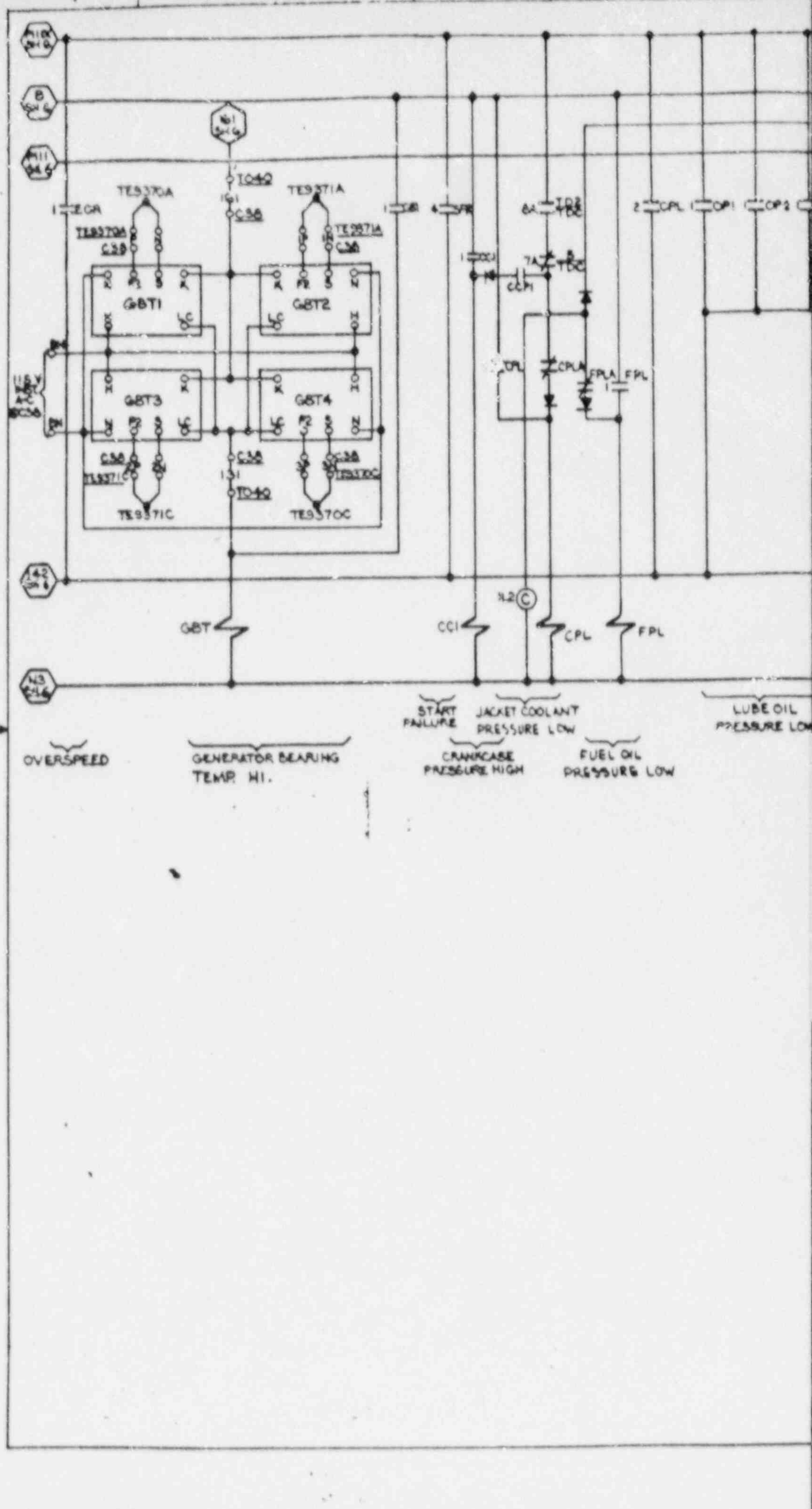
NORTHEAST UTILITIES

TITLE
MILLSTONE NUCLEAR POWER STATION UNIT NO. 2
DIESEL GENERATOR 15G-12U (H7A)
ENGINE CONTROLS

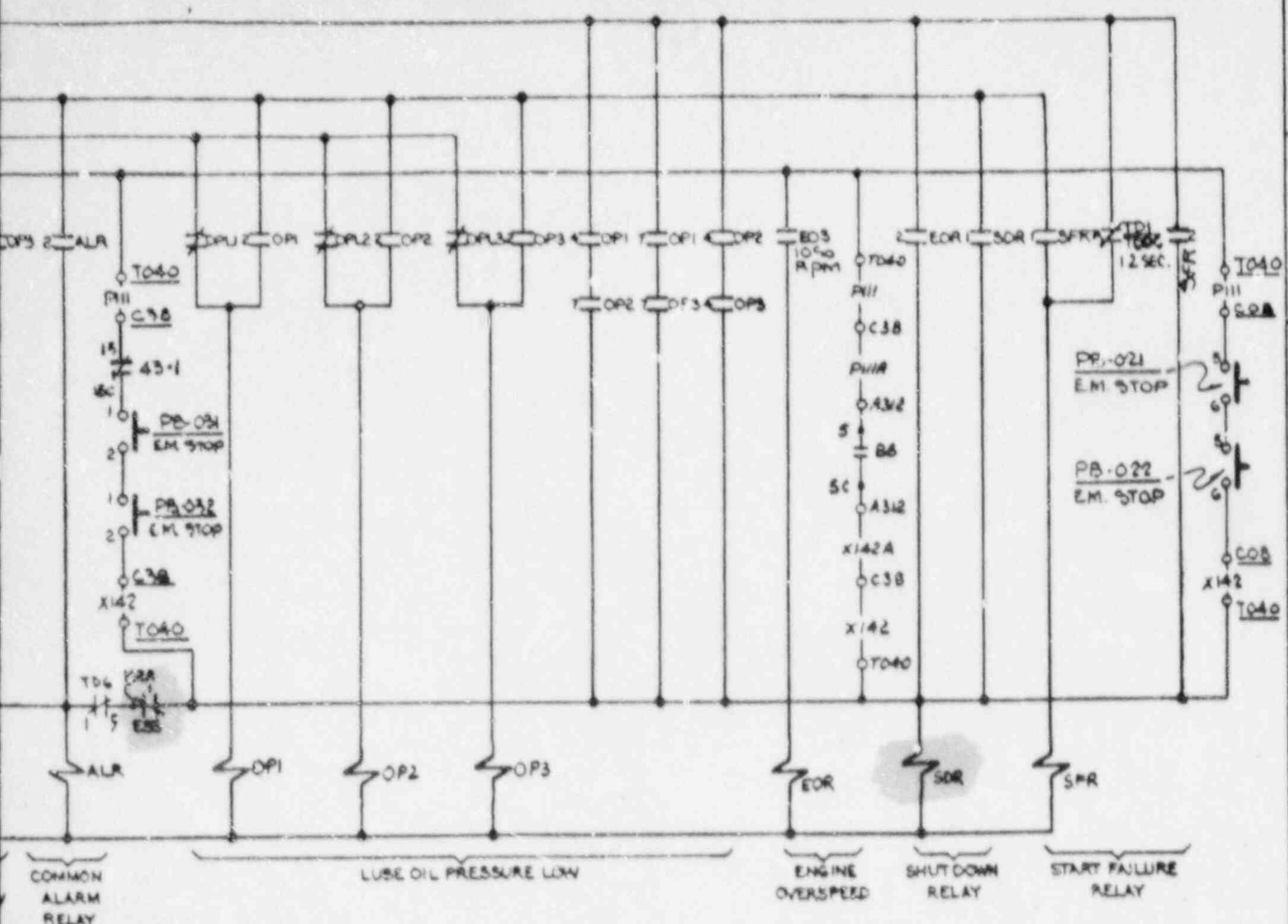
MF	P.A. NO	NO	DATE	REVISION	BY	CHK	APP	APP
		2	2/19/87	AS BUILT PER DCR M2 P 74 84, PDCR 2 87 54	CPA	AW	FND	
TO 703		1	8/21/78	DCR 3. 2-90-77, M2-P-031-78	CSD	AH	SS	RAP
	NOB 023	0	1/14/76	ISSUED AS-BUILT	SH			

BY J. FUHR	CHKD	APP	APP
DATE 2-15-72	DATE 3-2-72	DATE 3-2-72	DATE 1-14-76
SCALE ~	MICROFILM DATE 1-14-76	DWG NO 25203-32041	SH E

8801190328-04



TE9370A
TE9371A
GBT1
GBT2
GBT3
GBT4
TE9371C
TE9370C
T040
C38
GBT
CC1
CPL
FPL
OVERSPEED
GENERATOR BEARING TEMP. HI.
START FAILURE
CRANKCASE PRESSURE HIGH
JACKET COOLANT PRESSURE LOW
FUEL OIL PRESSURE LOW
LUBE OIL



SCHEME NO DG05
FACILITY #Z1

FIG 8.3-2, SH.7

NOTES:
1. FOR BLOCK DIAGRAM SEE SH 5.

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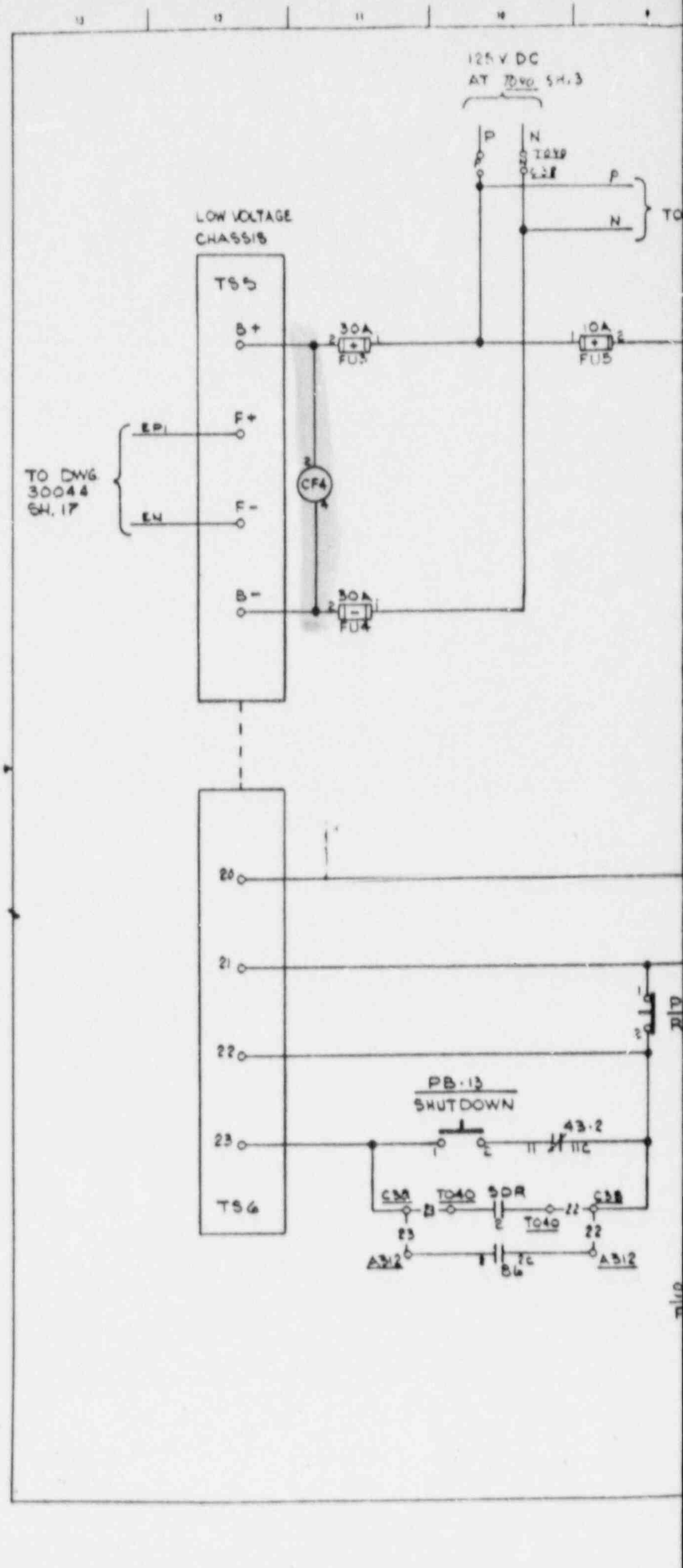
TITLE MILLSTONE NUCLEAR POWER STATION UNIT NO. 2
DIESEL GENERATOR 15G-12U (H7A)
ENGINE CONTROLS

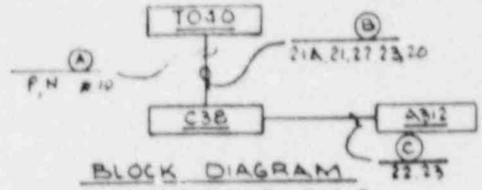
J. FUHR
1-14-76
25203-32046

ISSUED AS-BUILT
DCR'S, 2-152-76, 2-203-76, 2-203-76, 2-40-17 & HQ-P-0X

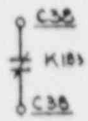
8801190328-05


125 V DC
AT T040 SH. 3
P
N
P
N
TO
LOW VOLTAGE
CHASSIS
TS5
B+
F+
F-
B-
30A
FU3
10A
FU5
30A
FU4
CF4
TO DWG
30044
SH. 17
EP1
EN
20
21
22
23
PB-13
SHUTDOWN
43-2
C38
T040
5DR
TS6
A312
86

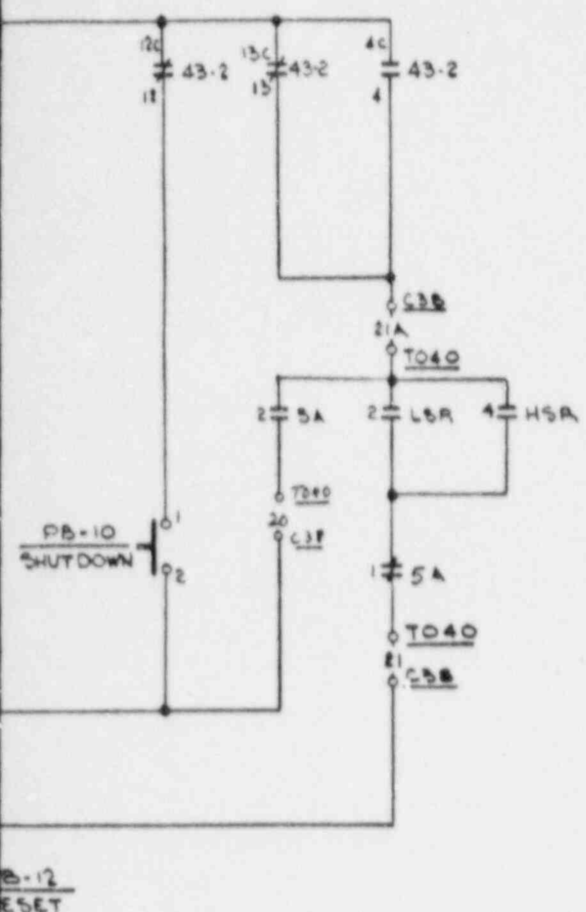
SH. 11



BLOCK DIAGRAM
SCHEME # DGO5, FAC. Z1



EXCITER NOT RESET
ALARM
TO SH. 12



SCHEME # DGO5
FACILITY # Z1

NOTES:

1. FOR STANDARD NOTES, SYMBOLS & EQUIP. LOCATION INDEX SEE DWG 25203-30028.

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FIG. 8.3-2 SH.10

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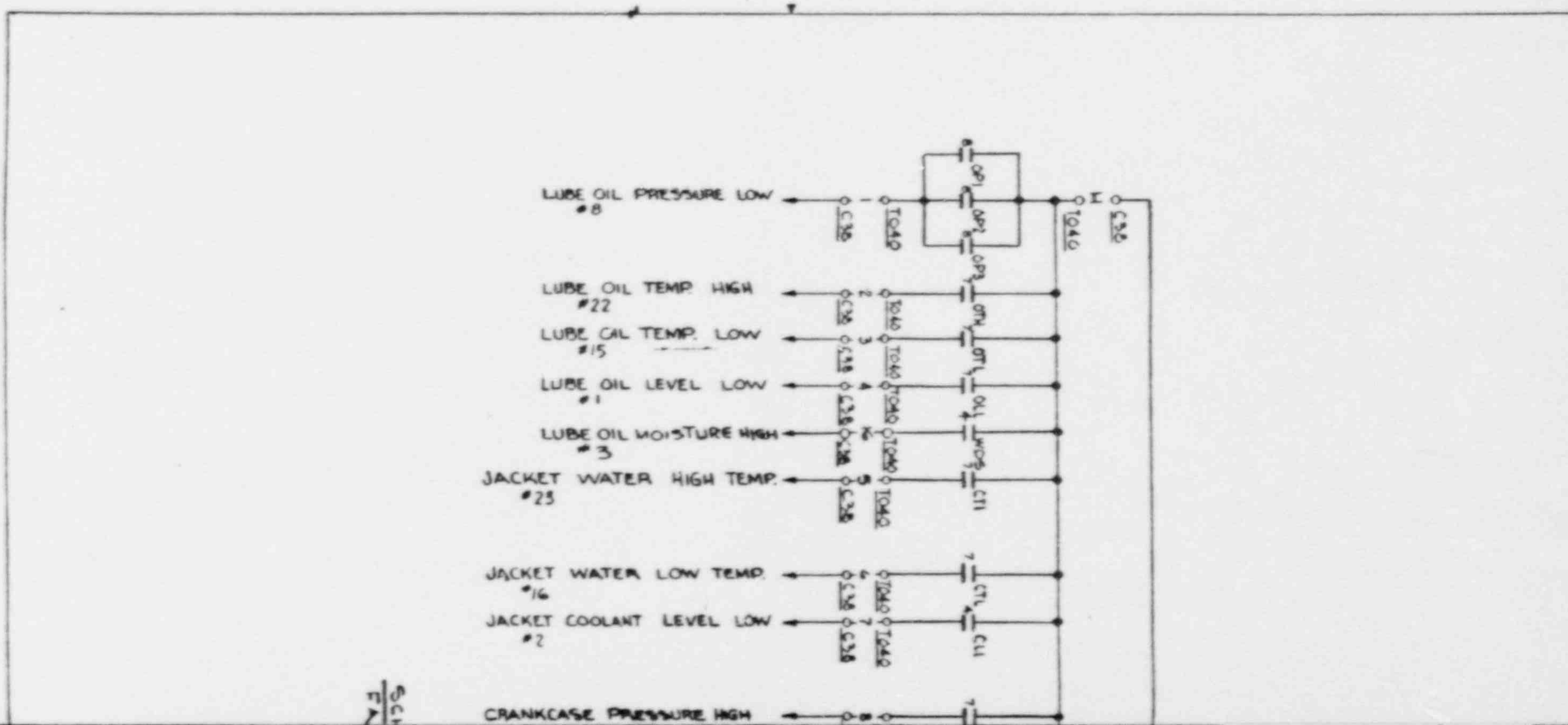
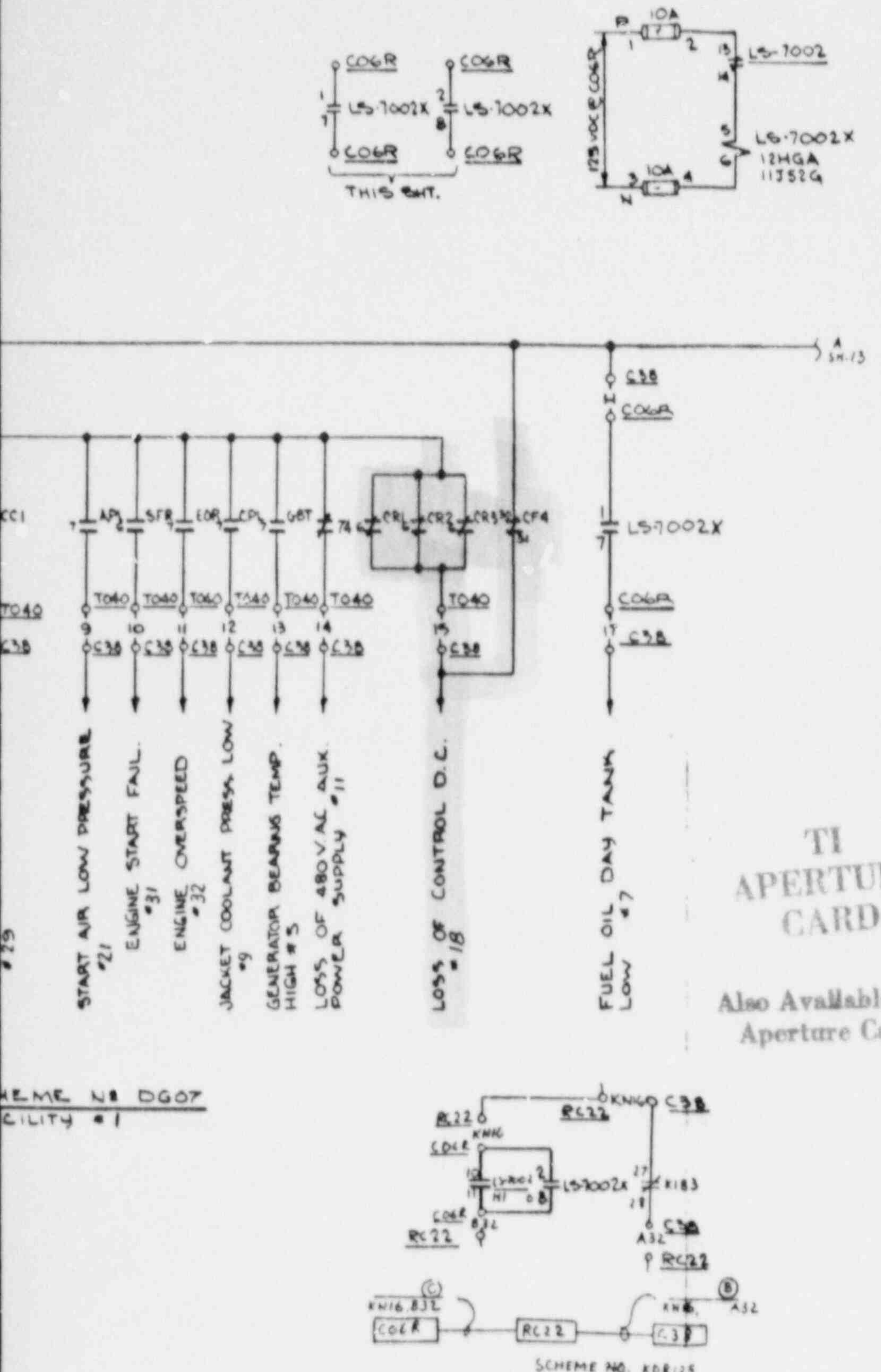
THE MILLSTONE POINT COMPANY SUBSIDIARY OF NORTHEAST UTILITIES	
TITLE MILLSTONE NUCLEAR POWER STATION UNIT NO. 2 DIESEL GENERATOR 15G-12U (H7A) EXCITER CONTROL	
DATE 2-24-72	SCALE NONE
DWG NO 25203-32041	SH.10

Rev 5

8801190328-06


LUBE OIL PRESSURE LOW #8
LUBE OIL TEMP. HIGH #22
LUBE OIL TEMP. LOW #15
LUBE OIL LEVEL LOW #1
LUBE OIL MOISTURE HIGH #3
JACKET WATER HIGH TEMP. #23
JACKET WATER LOW TEMP. #16
JACKET COOLANT LEVEL LOW #2
CRANKCASE PRESSURE HIGH
C38
T040
OP1
OP2
OP3
OTH
OTL
OLL
WOS
CT1
CTL
CLL



NOTES:

1. FOR STANDARD NOTES, SYMBOLS & EQUIP. LOCATION INDEX SEE DWG 25203-30028.
2. FOR BLOCK DIAGRAM SEE DWG 32041, SHEET 13.

JUN 1 0 1982

FIG. 8.3-2 SH 12

BECHTEL CORPORATION

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TITLE
MILLSTONE NUCLEAR POWER STATION UNIT NO. 2
DIESEL GENERATOR 15G-12U (H7A)
LOCAL ALARMS

SCALE NONE

25203-32041 SH12

Rev. 7

8801190328-07

SECTION 4

QUESTION 4.03 a.

The question requires the candidate to state four of the steps which must be taken to place the Enclosure Building Filtration Systems (EBFS) in service during an Electrical Emergency. The guidance for performing this is contained in EOP 2528, Electrical Emergency, step 3.11, Contingency Actions. As such, it is not expected that licensees perform this step from memory. The answer key lists five steps; the procedure lists six steps. Steps four and five of the key answer (EOP 2528 steps 3.11 e and 3.11 f) describe actions that remove the Condenser Air Removal System from Service.

Full credit should be given for describing actions taken which will start EBFS.

QUESTION 4.04 b.

The key answer contains four steps which are performed to initiate emergency boration. In addition to these steps, credit should be given for stating that:

- o If the boric acid pumps fail to start, open the gravity feed valves.
- o If the gravity feed valves are being used, close the volume control tank outlet valve.

These steps are performed if the boric acid pumps fail to start during emergency boration.

Reference: AOP 2558, Rev. 0, steps 4.3 and 4.4.

QUESTION 4.08

The key answer states the guidance that is contained in AOP 2551 for closing the MSIV's from outside the control room. In that the candidate did not have this procedure available when answering the question, full credit should be given for describing alternatives which result in MSIV closure. Two alternatives include:

- o closing the MSIV's from the bottle up panels, C70A and B (The bottle up panels are located outside of the control room)

Reference: AOP 2579A, Rev. 2, step 4.5

- o locally isolating instrument air at the MSIV's and then bleed the air pressure from the operating cylinders and accumulators

Reference: Drawing attached

QUESTION 4.10 a.

The key answer lists five indications of a misaligned CEA which are found in the Entry Conditions to AOP 2556, Dropped CEA Recovery. Additional indications, not used as Entry Conditions, should also receive credit. These include:

1. Rod drop alarm on the RPS.
2. CEA Group Deviation annunciator.
3. CEA Group Gross Deviation annunciator.
4. CEA Group deviation backup annunciator.
5. CEA Motion Prohibit annunciator.
6. Correct discussion of NSS and BOP parameter changes resulting from a power mismatch.

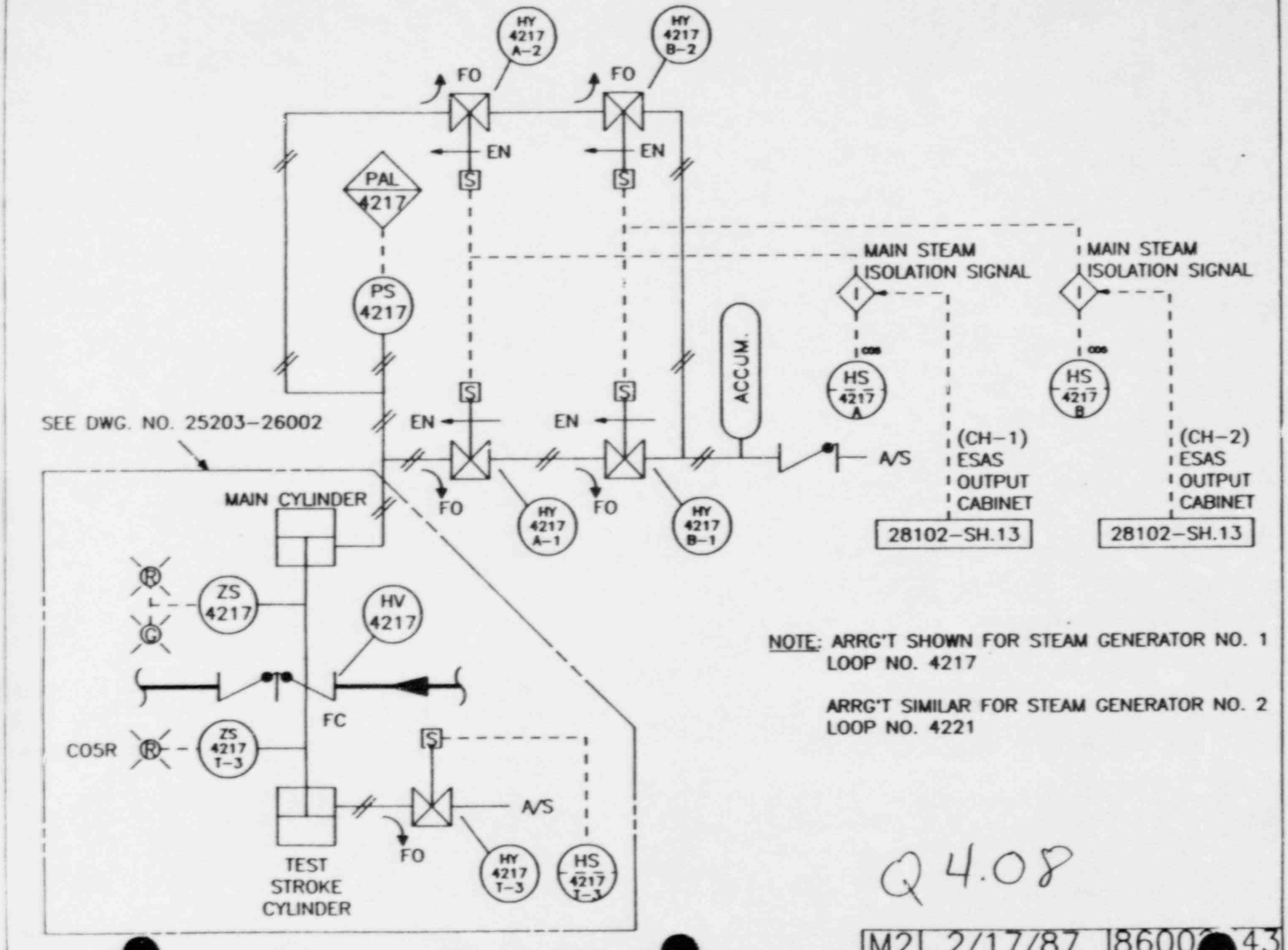
References: M2-OP-RO-I&C-2380-2, pg 19 and 20
OP 2302A, Rev. 9, Sections 8.6, 8.7
8.8, 8.9, 8.15, 8.25

QUESTION 4.11.b.

The question asks for "an" indication of RCS leakage . . . , implying that one answer is required.

The key answer lists two indications, each worth one half of the total point value.

Full credit should be awarded for either of the key answers.



NOTE: ARRG'T SHOWN FOR STEAM GENERATOR NO. 1
LOOP NO. 4217

ARRG'T SIMILAR FOR STEAM GENERATOR NO. 2
LOOP NO. 4221

Q 4.08

M2 | 2/17/87 | 8600_43

thermal power, with a simultaneous loss of the condenser heat sink. No credit is taken for the Atmospheric Dumps in this analysis. Each code safety valve taps off the main steam line and exhausts to the roof of the Enclosure Building separately. The combined flow of all main steam line code safety valves is adequate to relieve 12,700,000 lbm/hour which corresponds to 108% of the steam flow generated at 2700 MWt.

F. Main Steam Isolation Valves (MSIVs); 2-MS-64A/B

The main steam isolation valves (see Figure 13), one per steam line, serve to limit an excessive Reactor Coolant System (RCS) cooldown rate and the resultant reactivity insertion following an excess steam demand event. The MSIVs are air operated, swing disc valves which will automatically close on a low pressure signal from either steam generator at a setpoint of not less than 500 psia. Welded to the downstream portion of the MSIV is a non-return valve (2-MS-1A/B), so the assembly actually consists of two opposing disc check valves, one held open by an air operator and the other opened by the steam flowing through it. Technical Specifications require that the air operated valves close within six seconds.

The air operated MSIV contains a spring which assists it in closing by forcing the disc down into the flow-path. The purpose of the spring is to overcome mechanical binding in the stem and to provide a positive closure. The MSIVs fail closed on a loss of air. To prevent an inadvertent closure of the MSIVs on a loss of

Q4.08

instrument air, accumulators are placed at the valves and will, providing the system is intact, keep the MSIVs open for approximately 30 minutes. An alarm will annunciate in the Control Room (C05) whenever the air pressure downstream of the accumulator is less than 70 psig (see Figure 14). Located at the top of the C05 vertical section, on either side of the main steam isolation valve mimic, are the control switches for the air operated disc. Each MSIV utilizes a pair of thumbswitches to operate the two pairs of solenoid valves that control air supplying the MSIV operator. The solenoid valves are controlled in parallel, such that triggering either circuit (by turning one thumbswitch or actuating one MSI channel) will isolate both air supplies to the MSIV operator and vent any entrapped air, ensuring the MSIV closes. This solenoid valve arrangement will also require that both solenoid operating circuits be 'reset" to allow the MSIV to open.

At a minimum steam generator pressure of 500 psia, as sensed by the Engineered Safeguards Actuation System the (ESAS), both MSIVs will automatically isolate. This is an attempt by ESAS to isolate a potential steam line break and limit the amount of RCS cooldown. When this occurs, an "MSI ACTUATION" alarm on C01 will annunciate. In order to perform a plant cooldown (and consequently drop Main Steam pressure) in which the condenser is utilized, it is necessary to block the MSI signal. When pressure in each SG is less than 600 psia, a permissive signal actuates to provide annunciation on the C01 alarm panel. The operator then initiates the MSI Block by depressing two pushbuttons on C01. When the MSI is blocked, an annunciator on C01 provides confirmation of this, and the plant cooldown may now continue.

SECTION 5

QUESTION 5.08 a.

The answer key gives core size as one of the 4 factors which affect the convergence or divergence of a Xenon Oscillation. While this is true, the design of the core gives a fixed size. The "effective" size of the core can be changed, however, by the positioning of the Group 7 CEAs. Based on this, CEA position as well as core size should be accepted as an adequate answer.

QUESTION 5.10

This question gives reactivity in units of both delta k/k and pcm. At Millstone 2 the operators only use units of delta k/k (or % delta k/k) and are not required to use units of pcm. Based on this it is recommended that no credit is taken off for incorrect conversions between pcm and delta k/k.

QUESTION 5.11 a.

In this part of the question on ECP vs. Actual CEA position, it is stated that one RCP trips two minutes prior to criticality. If this did happen, a Reactor Trip due to RCS Low Flow would occur making the pull to criticality impossible. (Reference attached).

Based on this information, it is recommended that Part a. be deleted.

Q. 5.11a.

TEXT MATERIAL APPROVAL SHEET

I. Text Title: Reactor Protection System Descriptic

ID#: M2-OP-RO-I&C-2380-1 Rev 1 Date 6 -30-87

II. Initiated:

James E Macdonald 6-30-87

DEVELOPER DATE

III. REVIEWED:

Peter L. Smith 7/2/87

TECHNICAL REVIEWER DATE

Thomas Moriarty 7-6-87

INSTRUCTIONAL REVIEWER DATE

IV. APPROVED:

7/6/87

NUCLEAR TRAINING SUPERVISOR DATE

V. RELEASED FOR USE:

7/8/87

NUCLEAR TRAINING SUPERVISOR DATE

SYSDESC #6(5)

The variable setpoint functions as shown on figure 20. As power is reduced from 100% the peak power detector (peak detector) will continually detect the maximum power and keep the trip setpoint within 9.6% of that power. The pretrip and reset alarm setpoints are reduced similarly. During a power increase, setpoints can only be reset manually. When power increases to within 4% of the existing trip setpoint the backlighted pushbuttons on the RPSCIP and C04 will illuminate to alert the operator to the need to reset the trip setpoint. Depressing either of that channel's reset pushbuttons at any time will change the trip setpoint to 9.6% above the existing power level. If actual power approaches to within 2% of the variable trip setpoint a pretrip will occur. Setpoints remain constant at constant power level.

Q. 5.11a

8. Low Reactor Coolant System Flow Trip, (figure 22)

Four differential pressure transmitters per SG continuously monitor the delta P between the SG T cold plenum and its respective T hot leg. The channel A dp for SG 1 is summed with the channel A dp for SG 2 after the square root of the signal is determined. The square root function provides a more linear flow signal to the trip unit. The flow trip setpoint and pretrip setpoint can reduced with the FDSSS if the license is amended to permit less than four pump operation.

The low flow trip can be bypassed with the four Zero Power Mode Bypass keys when power is less than 10^{-4}% to permit low power physics testing.

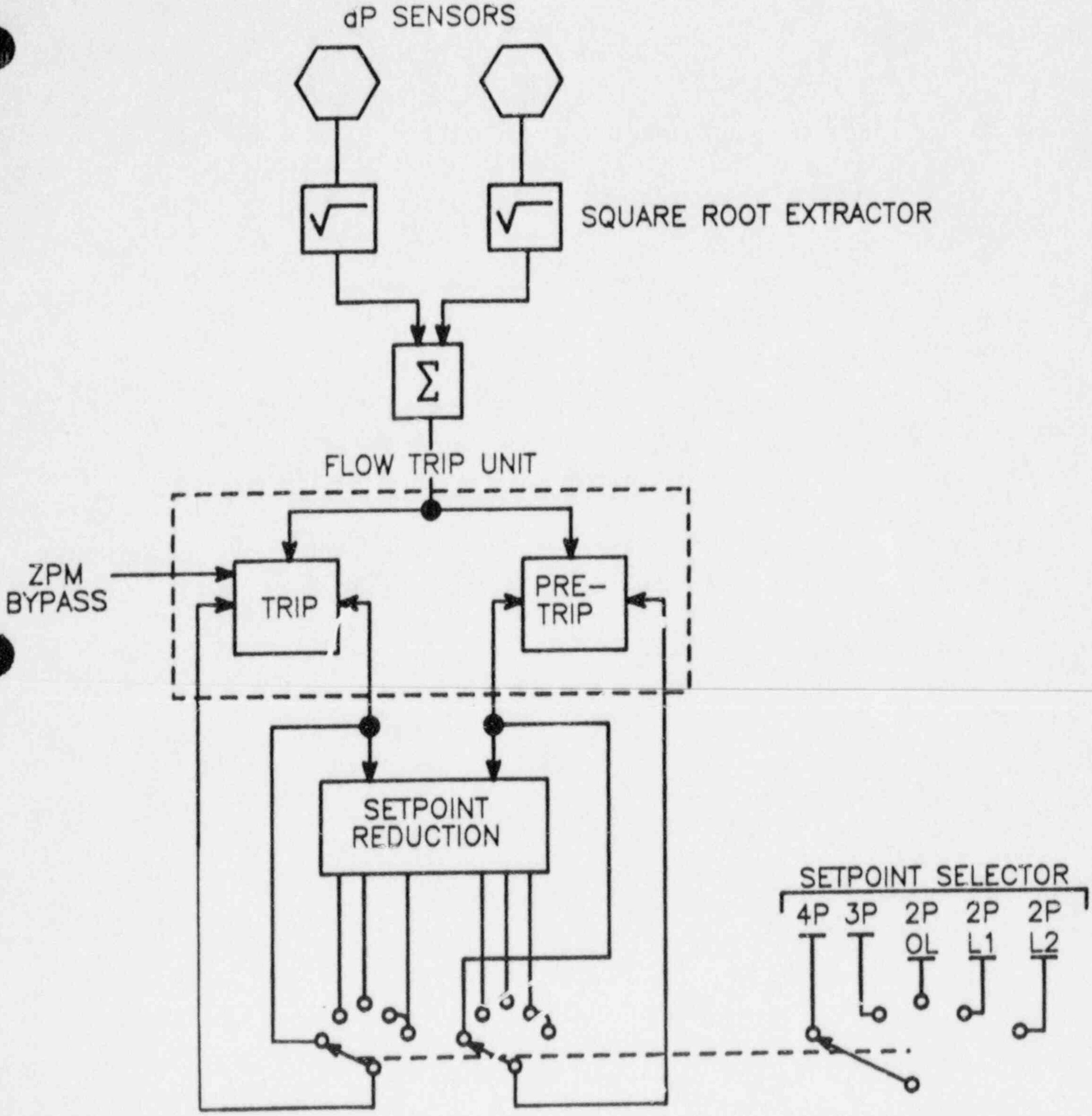
The trip setpoint is 91.7% of actual flow. Since actual flow is 121% of design flow, the reactor will trip before flow decreases to the design full flow value.

Indication of each safety channel's flow is displayed on CO-3. Measured flow is only used for control board display and the low flow trip, other trips requiring a flow input use the number of pumps running to generate an artificial flow value.

9. Local Power Density Trip (figure 23)

Local Power Density (LPD) trip is a complex trip requiring the use of a Core Protection Calculator (CPC) drawer for calculation of the setpoints, and a location for the trip and pretrip contacts.

The uncalibrated linear range nuclear instrumentation upper (U) and lower (L) subchannels are mathematically combined as illustrated on figure 23 to yeild YE which represents the axial distribution of power. YE (external tilt) is modified by two shape annealing factors A and B. "A" accounts for uneven neutron shielding of the detectors by structural materials. "B" compensates for the overlapping of the neutrons emanating from the lower and upper halves of the core. The resultant value, YI, (internal tilt) is displayed on the control board, is compared with the LPD trip and pretrip setpoints, and is provided to the TM/LP calculator.



LOW FLOW TRIP

FIGURE 22

SECTION 6

QUESTION 6.03 .b.

The question requires the candidate to use a HPSI pump curve provided to determine HPSI flow rate at a given pressure.

The key answer allows for + or - 50 gpm when making this determination. Based on the pump curve provided, which does not contain an accurate grid, this allowance should be increased. Plus or minus 100 gpm is recommended.

QUESTION 6.04 b.

The key answer states that (the quick open permissive switch is used) "when there might be radioactivity in a SG." The reference sited (RRS pg 10, 11, 12) includes this information for historical design purposes. The reference uses the words "The switch was included to permit . . . " It is not currently used for this purpose. AOP 2569, Steam Generator Tube Leak, contains no guidance concerning its use.

The answer key should be changed to accept, for full credit, a response that indicates that this switch is used to protect personnel when draining condensation from the valves and mufflers.

Reference: RRS System Description, page 11.

QUESTION 6.06 b.

The key answer indicates that the TMLP trip setpoint will "decrease" as ASI changes from 0.0 to -0.1. This is incorrect. The TMLP trip setpoint will increase under this condition.

QUESTION 6.06 c.

If the candidate assumes that the plant trips due to the RCP trip (as it would), the key answer is correct, the TMLP trip setpoint will decrease to its floor value.

If the candidate considers RCS flow as the only variable of concern when answering the question, then "no effect" is correct. Actual flow is not an input into the TMLP trip circuitry.

QUESTION 6.06 e.

The key answer indicates that the TMLP trip setpoint will decrease when a linear power range channel (safety) fails high. This is incorrect. The TMLP trip setpoint will increase under this condition.

The key answers should be revised accordingly.

Reference: T.S. 2.2 Figures 2.2-3, 2.2-4

QUESTION 6.07 g.

The key answer is "No Effect", describing the response of the MSIV's to a complete loss of instrument air.

The MSIV's are equipped with air accumulators which serve to hold the valves open for a period of time following a degradation in instrument air pressure. Without a time frame for consideration indicated in the exam question, the response could correctly be either "no effect" or "fails closed."

The key answer should be changed to accept for full credit either "no effect" or "Fail Closed."

Reference: Main Steam System Description, pg 8-9

QUESTION 6.08 b.

The key answer requires specific pressure values for various seal conditions. No allowance is included in the key for variations from the specified values.

The key should be changed to allow for ± 15 psi for vapor seal pressures and ± 100 psi for all other pressure.

QUESTION 6.11 c.

The circuit that prevents the containment spray pump from responding under the conditions specified in the exam question is the "Main Generator Final Coastdown Circuit" (Reference: Containment Spray System Description, page 6). Detailed knowledge of this circuit is not required by our learning objectives.

The exam should be changed to eliminate part C.

SECTION 7

QUESTION 7.01

The question refers to a note contained within a procedural step entitled "Boration without Boric Acid Pumps available". The title of the step was not made available to the candidate. Taking the note out of the context prevents the examinee from interpreting the meaning of "automatic boration unavailable". Therefore, an answer giving the boric acid storage tanks as a source of makeup should be accepted for full credit.

Reference AOP 2551, pg. 6 & 7, step 4.20

QUESTION 7.03

The question asks that three alternate methods of depressuring the RCS be given if auxiliary spray is inoperable.

> The objectives listed in the TPG for AOP-2553 do not require the students to memorize alternate actions. In fact, the objectives specifically state that procedures must be used for two of the alternate methods mentioned in the procedure. (Reference attached).

Based on this it is recommended that any reasonable method of depressurizing the RCS should be accepted as an answer.

QUESTION 7.04

1. The answer to Part a. states that the cooldown limit below 300°F is 20°F/Hr. This is incorrect. The cooldown limit below 300°F is 30°F/Hr. (Reference attached).

2. Part b. of the question asks what combination of three RCPs will provide the highest spray flow. The objectives listed in the TPG for OP-2207 do not require the students to memorize these pump combinations. (Reference attached). Additionally, the key answer is incorrect (References attached).

Based on this it is recommended that part b. be deleted.

3. Part d. asks why the charging Header Valves must be closed when securing auxiliary spray. As a matter of fact, these valves must be opened when securing auxiliary spray in order to ensure that the charging pumps have a discharge flowpath. (Reference attached).

Based on this it is recommended that part d. be deleted.

QUESTION 7.06 b.

The question asks for the restrictions on plant operation in Mode 1 based on the stated conditions. The question does not ask for Tech. Spec. references or time limits.

Based on the information given in the question, both D/G's are inoperable (T.S. 3.8.1.1). And both Service Water headers are inoperable based on the provisions of T.S. 3.0.5.

Both of the above technical specifications prevent continued operation in Mode 1.

Additionally, the time limits associated with the actions of these technical specifications do not require memorization.

Based on the above, the correct answer to the question should be that Continued Operation in Mode 1 is not Possible. No other information should be required.

QUESTION 7.10 a.

The answer to this question fails to include the possibility of opening the Gravity Feed Valves to perform a boration of the RCS. This method of boration can be used based on the Emergency Boration Procedure: AOP 2558 and Emergency Operating Procedure 2540A (which is referenced in the boration step, 3.1, of EOP 2525).

Based on this information it is recommended that an additional correct answer would be:

- Open Gravity Feed Valves (2-CH-508, 509)
- Close VCT Outlet Valve (2-CH-501)
- Start all available charging pumps

QUESTION 7.11

1. Part a. of this question asks when it is permissible to not isolate a ruptured Steam Generator. The answer key only gives one answer: If the ruptured SG is the only one available for heat removal. Based on the SGTR EOP, there are additional correct answers:

- If RCS T_H is not below 520°F, the faulted SG should not be isolated.
- The faulted SG may be unisolated to prevent overfilling.
- The faulted SG may be unisolated to cooldown the SG.

Based on this information it is recommended that any of the above answers also be accepted for full credit. (Reference attached).

2. part c. The additional correct information that the bypass key is installed to allow for control of the PORV should be accepted.

4.19.9 Operate the Boric Acid pumps for the required time determined above, then stop the Boric Acid pumps.

4.19.10 Manually close 2-CH-514.

4.19.11 Operate the pressurizer sprays and backup heaters from Panel C-21 to facilitate mixing.

4.19.12 After allowing time for complete mixing, have the Chemistry Department determine the new boron concentration of the reactor coolant system.

4.19.13 Repeat Steps 1 through 12 if necessary, until the desire boron concentration is established.

Q7.01 **4.20 Boration without Boric Acid pumps available.**

CAUTION: When the VCT outlet, 2-CH-501, is shut and charging pump suction is from the RWST, a high level in the VCT will divert letdown to the Clean Radwaste System continuously at the charging rate to the RCS.

4.20.1 Determine total addition time required per Steps 4.19.1 thru 4.19.5.

4.20.2 Open the power supply breakers to 2-CH-508 (B5151), 2-CH-509 (B5149), and 2-CH-501 (B5145).

4.20.3 Open the Boric Acid Gravity feed valves, 2-CH-508 and 2-CH-509, using the local handwheels.

NOTE: No boric acid flow will result if the outlet from the VCT is open, due to the differential in supply head.

4.20.4 Close the outlet valve from the VCT, 2-CH-510 (local manual) and commence timing. When the total addition time has lapsed, align charging pump suction to the RWST by opening 2-CH-504 (local manual) and 2-CH-192 makeup to/from RWST. 2-CH-192 must be opened by installation an air jumper around the solenoid. Ensure 2-CH-196 VCT makeup bypass is closed. If not, fail the air to the air operator and the valve will go closed.

NOTE: With automatic boration unavailable, makeup to the RCS must be from the RWST to ensure that the boron concentration is greater than or equal to that of the RCS.

4.20.5 Close the boric acid gravity feed valves, 2-CH-508 and 2-CH-509.

4.20.6 Carry out Steps 4.19.11 and 4.19.12.

5. FIGURES

None

6. DISCUSSION

It is highly improbable that habitation of the control room could be lost since fire protection is afforded and Scott air packs, as well as air line breathing masks, are available. Communications can be maintained throughout this procedure using in-plant telephones, maintenance jacks or walkie-talkies. All operations will be directed by the Shift Supervisor. In the event that the control room is evacuated because of fire, the fire brigade duties should be performed by Unit 1 personnel, so that Unit 2 personnel can complete operations required for a safe shutdown.

BN:kdy

Harry F. Haynes
Form Approved by Technical Systems Manager

12/20/84
Effective Date

TRAINEE PERFORMANCE GUIDE (TPG)

Training Program: Replacement Operator   Unit: MP-2

TPG Number: 2553(0)/All

Task Area: Plant Cooldown using Natural Circulation

Critical Task: x Yes ____ No   Operations Approval: J. S. Keenan

TERMINAL OBJECTIVE:

While at the control board with the plant in a Hot Standby condition and Natural Circulation in progress conduct a plant cooldown using AOP 2553.

ENABLING OBJECTIVES:

1. From memory discuss with an instructor, the following as they apply to a Plant Cooldown using Natural Circulation.

   a. The indications that Natural Circulation is in progress.

   b. Conditions that contribute to the formation of voids.

   c. Indications that voiding is present.

   d. Criteria that indicates voiding is not interfering with heat removal.

   e. Why cold shutdown boron concentration is maintained 100 ppm greater than required by OP 2208.

Q 7.03

2. Using the guidance provided in AOP 2553, discuss with an instructor actions taken at specified temperatures and/or pressures during the cooldown to include:

   a. Blocking SIAS.

   b. Blocking MSI.

   c. Closing SIT outlet isolation valves.

   d. Shutdown cooling valve lineup.

   e. Shutdown cooling initiation.

   f. Reducing RCS temperature below 230°F.

DIF-106
Rev. 1

*3. Perform shutdown margin and boration calculations using OP 2208. 4.1

a. Calculate a cold shutdown boron concentration given present core burnup. (2208/5.2)

b. Given plant conditions and a desired RCS boron concentration, calculate the required boric acid addition. (2208/5.3)

c. Given plant conditions calculate a blended makeup. (2208/5.3)

*4. Control pressurizer level while RCS heat removal is by Natural Circulation. 4.2

a. Use Figure 2304A-1 and LI-103 (cold calibrated) to determine actual pressurizer level.

b. Operate the letdown flow controller in "manual" to control letdown flow. (2304A/7.3)

c. Operate the letdown back pressure controller in "Auto" to control letdown flow. (2304A/7.3)

d. Manually operate charging pumps using OP 2304E. (2304E/7.0)

e. Use control room switches to manually initiate HPSI flow and verify flow using available indications. (2306/Generic, 01/Generic)

*5. Control pressurizer pressure while RCS heat removal is by Natural Circulation. 4.3

a. Use control room switches and controllers to operate any CVCS component required to initiate auxiliary spray and verify its operation using available indicators. (2304/Generic, 01/Generic)

b. Manually operate charging pumps using OP 2304E. (2304E/7.0)

c. Use control room switches to manually initiate HPSI flow and verify flow using available indicators. (2306/Generic, 01/Generic)

Q. 7.03

d. Reduce pressurizer pressure by providing a flow path from the pressurizer to the Quench Tank through a PORV using OP 2301D. (2301D/7.1.23)

2553(0)/All - Plant Cooldown using Natural Circulation - cont.

*5. cont.-

Q. 7.03 e. Cool the pressurizer by filling and draining using the guidance provided in OP 2207.(2207/5.17)

6. Given plant conditions, use control room reference material to determine the method to use for Steam Generator heat removal and water level control. 4.0

7. Maintain Steam Generator water level when cooling down: 4.0

   a. Operate the "A" turbine bypass valve controller in manual to control cooldown. (2316A/Generic)

   b. Operate the Atmospheric Dump valve(s) in manual to control the cooldown. (2316A/Generic)

   c. Control Steam Generator level with the Main Feedwater System using OP 2321.

   d. Control Steam Generator level with the Auxiliary Feed System using OP 2322.

   e. Operate the Steam Dump temperature controller in manual to control the cooldown using OP 2316A.

8. Given any one of the following the methods to use, cooldown an isolated Steam Generator. 4.0

   a. Start RCP(s) using OP 2301C. (2301C/7.1)

   b. Initiate Steam Generator blowdown using OP 2316A. (2316A/7.5, 7.6)

   c. Initiate Auxiliary Feedwater flow to the Steam Generator using OP 2322. (2322/7.1)

   d. Initiate steam flow with MSIV bypass valve using OP 2316A. (2316A/7.1)

   e. Start up the Main Steam System using OP 2316A. (2316A/7.1)

9. Use control room indicators to monitor the parameters required to ensure Natural Circulation is in progress. (2304/Generic, 2316A/Generic, 2387F, 2301/Generic, 01/Generic) 4.12

10. Use control room switches to operate any CVCS or HPSI System component while monitoring control room indicators to determine if RCS voids exist. (2304/Generic, 2306/Generic) 4.13

11.	Given voiding exists in the RCS, use control room indicators to determine if action is required to eliminate or reduce the voids. (2316A/Generic, 2387F, 01/Generic)	4.11
12.	Make preparations for initiating shutdown cooling using OP 2310. (2310/7.1, 7.2)	4.25
13.	Degas the VCT and establish Nitrogen pressure using OP 2304A. (2304A/7.4)	4.18
14.	Use control room switches to shift RCP seal bleedoff to the Equipment Drain sump tank using OP 2304. (2304/Generic)	4.20
15.	Break condenser vacuum using OP 2329. (2329/7.3)	4.22
16.	Initiate shutdown cooling and establish a cooldown of less than 20°F/hour using OP 2310. (2310/7.3)	4.25
17.	Given shutdown cooling is in operation continue the cooldown using OP 2207. (2207/All)	4.25
18.	Direct a PEO to operate remote components.	4.0
19.	Request chemistry sample for boron concentration.	4.1 4.19

REACTOR COOLANT SYSTEM

3/4.4.9 PRESSURE/TEMPERATURE LIMITS

REACTOR COOLANT SYSTEM

LIMITING CONDITION FOR OPERATION

3.4.9.1 The Reactor Coolant System (except the pressurizer) temperature and pressure shall be limited in accordance with the limit lines shown on Figure 3.4-2 during heatup, cooldown, criticality, and inservice leak and hydrostatic testing with:

a. A maximum heatup of 20°F in any one hour period with T_{avg} at or below 110°F, 30°F in any one hour period with T_{avg} at or below 140°F and above 110°F, and 50°F in any one hour period with T_{avg} above 140°F.

b. A maximum cooldown of 80°F in any one hour period with T_{avg} above 300°F and a maximum cooldown of 30°F in any one hour period with T_{avg} at or below 300°F and above 200°F, and 20°F in any one hour period with T_{avg} at or below 200°F.

c. A maximum temperature change of 5°F in any one hour period, during hydrostatic testing operations above system design pressure.

Q7.04

APPLICABILITY: MODES 1, 2*, 3, 4 and 5.

ACTION:

With any of the above limits exceeded, restore the temperature and/or pressure to within the limit within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the structural integrity of the Reactor Coolant System; determine that the Reactor Coolant System remains acceptable for continued operations or be in at least HOT STANDBY within the next 6 hours and reduce the RCS T_{avg} and pressure to less than 200°F and 500 psia, respectively, within the following 30 hours.

*See Special Test Exception 3.10.3.

Harry F. Haynes
Form Approved by Technical Systems Manager

12/20/84
Effective Date

TRAINEE PERFORMANCE GUIDE (TPG)

Training Program: Replacement Operator   Unit: MP-2

TPG Number: 2207(12)/5.0

Task Area: Plant Cooldown

Critical Task: X Yes ______ No   Operations Approval: J S Keenan

Q 7.04b

TERMINAL OBJECTIVE:

With a normal complement of control room operators, function as a team to perform a plant cooldown, from 532°F and 2250 psia to Mode 6 with the pressurizer flooded and cooled, using OP 2207 and related plant procedures.

ENABLING OBJECTIVES:

*1. From memory, discuss the following items concerning the plant cooldown procedure, OP 2207: 1.0

a. Major evolutions, (e.g.: reduce pressure, cooldown, block SIAS, prepare and initiate SDC, cool pressurizer).

b. The general intent of the procedure.

c. Significant precautions intended to prevent equipment damage, (e.g.: NDT limits, spray delta T limits, PORV operability, LTOP concerns).

d. The personnel safety hazard posed to people in the SG channel heads if the SIT outlets are not tagged closed.

2. Using the guidance provided in OP 2207, discuss with an instructor the prerequisites and initial conditions pertaining to a plant cooldown, to include: 2.0

a. RCS boron concentration.

b. RCS degassification.

c. SG level and pressure control with and without the condenser available.

DIF-106
Rev. 1

3. Operate Auxiliary Feedwater, Condensate, Main Feedwater, and CPF demins. to: 5.4

   a. Secure Main Feedwater using OP 2321 (2321/7.6).

   b. Secure a SGFP using OP 2321 (2321/7.5).

   c. Operate the Condensate System for plant shutdown using OP 2319A (2319A/7.3).

   d. Secure/shift CPF demins. using OP 2319C (2319C/7.3).

   e. Start Auxiliary Feedwater pumps using OP 2322 (2322/7.1, 7.2).

   f. Feed SG's with Auxiliary Feedwater using OP 2322 (2322/7.3).

4. Break condenser vacuum using OP 2329 (2329/7.3) 5.16.3

5. Use control room switches to close the MSIV's and depressurize the Main Steam header. (2316/Generic, 01/Generic) 5.16.4

*6. Direct a PEO to operate and tag remote components. 5.7

*7. Operate CVCS to:

   a. Dilute/borate to the charging pump suction using OP 2304A (2304A/7.8, 7.13). 5.1

   b. Provide Auto makeup to the VCT using OP 2304C (2304C/7.2). 5.4

   c. Degas the VCT using OP 2304A (2304A/7.9). 5.10 Note

   d. Align for RCS excess purification using OP 2304F (2304F/7.1). 5.28

   e. Align for excess letdown on SDC using OP 2304F (2304F/7.3). 5.23

   f. Equalize RCS/pzr boron concentration using OP 2654 (2654/7.10). 5.1 Note

8. Control pressurizer level during plant cooldown by:

   a. Using Figure 2304A-1 and LI-103 to determine actual pressurizer level. 5.2

8. - cont.

   b. Operating the letdown flow controller in "Manual" to control letdown flow. 5.2

   c. Operating the letdown back pressure controller in "Auto" to control letdown flow. 5.13

   d. Manually starting additional charging pumps using OP 2304E (2304E/7.3). 5.2

*9. Control pressurizer pressure during plant cooldown by:

   a. Securing all pressurizer heaters. 5.5

   b. Operating the Main Spray valve controllers in "Manual". 5.5

   c. Aligning control board switches to initiate, increase, and secure Auxiliary Spray. 5.18.2 Note

10. Stop a RCP using OP 2301C (2301C/7.2). 5.3

11. Operate the atmospheric dump/steam bypass controller in "Manual" to establish and maintain any specified cooldown rate. 5.4

*12. Operate control board switches to: (01/Generic)

   a. Block SIAS. 5.6

   b. Disable a HPSI train. 5.7

   c. Block MSI. 5.9

   d. Shift PORV setpoints to low. 5.17.5

   e. Secure CVCS. 5.27

   f. Close the SIT outlet MOV's. 5.17.5 Caution

13. Request chemistry samples. 5.1

14. Operate control board switches to secure the stack Hi-Range Radmonitor. 5.21.4

15. Operate the SDCS to:

   a. Perform boron equilization using OP 2310 (2310/7.1). 5.8

15. - cont.

   b. Warmup the SDCS using OP 2310 (2310/7.2). 5.8

   c. Initiate SDC on the RCS, establish and maintain any specified cooldown rate using OP 2310 (2310/7.3) 5.20

16. Operate ESAS bypass switches to inhibit all four channels of SRAS using OP 2384 (2384/7.3). 5.21.3

17. Open the PORV's by pulling any two RPS high pressurizer pressure modules. 5.25

18. Adjust the RCS QT level and pressure using OP 2301A (2301A/7.2). 5.26

19. Explain the method for cooling the SG's below 212°F. 5.33

*20. Verify cooldown rate and pressurizer spray delta T limits being met by performing SP 2602B-1 and evaluating the data. 5.4 Caution

*21. Perform boration/dilution calculations using OP 2208 (2208/5.3). 5.1

*22. Given the results of RCS boron samples, use OPS Form 2208-12 to determine if the cold shutdown boron concentration requirements are being met for any existing RCS temperature and time in core life. 5.11

*23. Use OP 2301B, Figure 10.1 to determine the minimum allowable RCS pressure for any given temperature and RCP configuration. 5.15

24. Locate and open any specified "fingers" in test switches 94TG-1 and 94TG-2. 5.19 Note

25. State which temperature indicators are used to monitor the RCS cooldown rate during: 5.4

   a. RCP operation.

   b. SDCS operation.

   c. Natural circulation.

Q7.04b

4.24 Certain combinations of operating RCP's will result in ineffective pressurizer spray capability and potential "hardness" of pressure response. To ensure effective spray and minimize the need to use auxiliary spray one of the following pump combinations should be operating (whenever other pump constraints permit).

A,B,C,D

A,B,C A,B,D

A,C,D

B,C,D

B,D

A,B

If one of the above combinations cannot be maintained, minimize RCS temperature changes and pressurizer level changes as pressure response on level increase will be similiar to operating with a "hard" bubble.

4.25 During plant cooldown monitor containment temperature and pressure. Adjust containment cooling as necessary to ensure containment pressure is maintained between -12" water gauge and +2.1 PSIG.

4.26 Prior to entering mode 5, obtain the ESAS Bypass Keys for SRAS from the Unit Superintendent. Bypass all four (4) channels of SRAS after entering mode 5 to prevent tripping the LPSI pumps in the event of an inadvertent SRAS initiation. If the keys are unavailable bypassing the SRAS may be defered until the next working day (normal hours).

4.27 Maintain pressurizer level within the limits set forth in Tech. Specs 3.4.4.

4.28 If steam generators are to be drained down ensure auto aux. Feedwater bypass keys are installed to prevent auto aux. feed initiation while draining the steam generator(s).

4.29 Prior to initiation of shutdown cooling ensure 94TG-1 test switch TS-8, fingers G, H and I and 94TG-2 test switch TS-7B, Fingers B, C and E are opened and caution tagged (C07R). This will prevent inadvertent tripping of the LPSI pump(s) and loss of shutdown cooling from turbine testing or 345KV breaker operation during shutdown cooling operation.

5.24 Cut in excess letdown from SDC as follows:

5.24.1 Establish communications from 2-CH-603 to the control room.

5.24.2 Open 2-SI-040.

5.24.3 Open 2-CH-603 and maintain letdown flow and pressure using the back pressure regulators 2-CH-201P and 2-CH-201Q.

5.24.4 5.25 If depressurization is required, adjust SDC flow to reduce RCS temperature to approximately 130°F. add: Rev. 14 Chg. 1

5.26 In order to cool and flood the pressurizer perform the following:

5.26.1 Open the manual isolation valves to the out of service back pressure control valve 2-CH-348 and 350 for PCV 2-CH-201P or 2-CH-347 and 349 for PCV 2-CH-201Q.

5.26.2 Set the back pressure controller PIC 201 to match RCS pressure (this will close the PCV's interrupting CVCS flow).

5.26.3 Place the back pressure control valve selector switch to "Both" (HS-201).

5.26.4 Place the letdown flow controller selector switch to "Both" (HS-110-1). Both letdown flow control valves will now respond to the output of HIC-110.

5.26.5 Open the letdown flow control valves fully (HIC-110). Pressurizer level will now be controlled by the back pressure control valves.

5.26.6 Slowly adjust the back pressure controller setpoint to 100 PSIA. Both back pressure control valves will open in response to the pressure error, and flow through the CVCS is re-established.

Q7.04d

CAUTION: Prior to securing anxiliary spray flow ensure 2-CH-518 or 2-CH-519 is opened to provide a flow path for the changing pumps to prevent damage to pumps.

[signature] 2-1-85
Form Approved By Station Superintendent — Effective Date

STATION PROCEDURE OR FORM CHANGE

A. IDENTIFICATION

(PROCEDURE) OR FORM NUMBER EOP 2534 REV. 3 CHANGE NO. 1
(Circle One)

(PROCEDURE) OR FORM TITLE Steam Generator Tube Rupture
(Circle One)

INITIATED BY J.F SMITH Q 7.11a

B. CHANGE

Replace page 23 with the attached.

Q 7.11a

C. REASON FOR CHANGE

Human Factors Engineering proposed revised wording for Note 2 of the Minimum Required Safety Injection Delivery Curve (Figure 4.3).

D. NON-INTENT CHANGE AUTHORIZATION (N/A for Intent Changes)

TITLE	SIGNATURE	DATE
Shift Supervisor (on duty)		

E. REVIEWED

Department Head [signature] 3/18/87

Unreviewed Safety Question Evaluation Documentation Required:
(Significant change in procedure method or scope as described in FSAR) [ ] YES [✓] NO
(If yes, document in PORC/SORC meeting minutes)

ENVIRONMENTAL IMPACT

(Adverse environmental im :t) [ ] YES [✓] NO
(If yes, document in PORC. 'RC meeting minutes)

F. INTEGRATED SAFETY REVIEW REQUIRED [ ] YES [✓] NO

(Affects response of Safety Systems, performance of safety-related control systems or performance of control systems which may indirectly affect safety system response.)
(If yes, document in PORC/SORC meeting minutes.)

G. (PORC)/~~SORC~~ RECOMMENDS APPROVAL (or confirmation of interim change within 14 days)

(PORC)/~~SORC~~ Meeting Number 2-87-38

H. APPROVAL AND IMPLEMENTATION

The change is hereby implemented and is effective this date, except for interim changes which were implemented and effective per the Authorization of D above.

[signature] 3/20/87
Station Superintendent/Unit Superintendent — Date

SF 302
Rev. 7
Page 1 of 1

W. D. Romberg	3-11-86	86-9
Form Approved by Station Superintendent	Effective Date	SORC Mtg. No.

STATION PROCEDURE COVER SHEET

A. IDENTIFICATION

Number EOP 2534 Rev. 3

Title STEAM GENERATOR TUBE RUPTURE

Prepared By J. Becker

B. REVIEW

I have reviewed the above procedure and have found it to be satisfactory.

TITLE	SIGNATURE	DATE
DEPARTMENT HEAD	[signature]	3/10/87
Shift Supervisor	[signature]	3-3-87

C. UNREVIEWED SAFETY QUESTION EVALUATION DOCUMENTATION REQUIRED: YES [ ] NO [✓]
(Significant change in procedure method or scope as described in FSAR)
(If yes, document in PORC/SORC meeting minutes)

ENVIRONMENTAL IMPACT YES [ ] NO [✓]
(Adverse environmental impact)
(If yes, document in PORC/SORC meeting minutes)

D. INTEGRATED SAFETY REVIEW REQUIRED YES [ ] NO [✓]
(Affects response of Safety Systems, performance of safety-related control systems or performance of control systems which may indirectly affect safety system response.)
(If yes, document in PORC/SORC meeting minutes.)

E. PROCEDURE REQUIRES PORC/SORC REVIEW YES [✓] NO [ ]

F. SAFETY EVALUATION REQUIRED YES [ ] NO [✓]

G. PORC/SORC APPROVAL
PORC/SORC Meeting Number 2-87-34

H. APPROVAL AND IMPLEMENTATION
The attached procedure is hereby approved, and effective on the date below:

[signature] 3/20/87
~~3/25/87~~ JSK 3/20/87

Station/Service/Unit Superintendent Effective Date

SF 301
Rev. 8
Page 1 of 1

UNIT 2

STEAM GENERATOR TUBE RUPTURE

Page No.	Eff. Rev.
1 - 23	3

STEAM GENERATOR TUBE RUPTURE

1. PURPOSE

To provide the subsequent operator actions which must be accomplished in the event of a steam generator tube rupture. These actions are taken after completion of the Standard Post Trip Actions and a steam generator tube rupture has been diagnosed. The actions in this procedure are necessary to ensure that the plant results in a stable safe condition.

2. ENTRY CONDITIONS

a. The Standard Post Trip Actions have been accomplished.

and

b. Plant conditions indicate that a steam generator tube rupture has occurred by one or more of the following

i. Steam generator blowdown radiation high ala[illegible]
ii. SJAE Radiation monitor high alarm (RC14)
iii. Unbalanced charging and letdown flows (CO2,[illegible]
iv. Standby charging pumps start (CO2)
v. Decreasing pressurizer level and pressure (CO3)
vi. Main steam line radiation monitor(s) alarming (RC05E)

3. OPERATOR ACTIONS

Instructions	Contingency Actions
____3.1 Verify Standard Post Trip Actions, EOP 2525, have been performed	3.1 Perform Standard Post Trip Actions, EOP 2525

Instructions | Contingency Actions

CAUTION

SS/SCO must be notified immediately of any safety function criteria not satisfied.

____3.2 Perform Safety Function Status checks

a. Complete OPS Form 2534-1 at approximately 10 minute intervals until plant conditions stabilize

and

b. Direct STA qualified individual to review report and verify acceptance criteria are satisfied

3.2 If safety function status check criteria are not satisfied, Then

a. Diagnose problem and go to appropriate EOP

i. If any break is suspected, Then refer to Break Identification Chart, Figure 4.1 to assist in diagnosis

and

ii. Go to appropriate break EOP

or

b. If diagnosis of one event is not apparent, Then go to Functional Recovery, EOP 2540

Instructions | Contingency Actions

CAUTION

Pressurizer level may not provide an accurate indication of total RCS inventory due to voids. Voids may exist, especially if RCPs are not running. However, pressurizer level in conjunction with a subcooled RCS is an indication that the core is covered. The reactor vessel level monitor gives an indication of void size above the core.

Instructions	Contingency Actions
____3.3 Confirm the diagnosis of a steam generator tube rupture a. Refer to Break Identification Chart, Figure 4.1 and b. Direct Chemistry to sample steam generators for activity	3.3 a. If a loss of primary coolant is indicated, Then go to EOP 2532 or b. If excess steam demand is indicated, Then go to EOP 2536
____3.4 If pressurizer pressure decreases to 1600 psia (C03), Then do the following a. Verify SIAS, CIAS and EBFAS (C01X) b. Stop all RCPs (C03) c. Refer to Figure 4.3 for acceptable safety injection system delivery flow	3.4 Manually initiate SIAS, CIAS and EBFAS (C01)

Instructions	Contingency Actions
____3.5 <u>If</u> EBFAS has initiated, <u>Then</u> align Condenser Air Removal System to Unit 2 Stack by the following a. Verify Condenser Air Removal Fan, F-55A or F-55B, running (or manually start) (C06) <u>and</u> b. Open 2-EB-57 (C06)	3.5 <u>Continue</u> with this procedure

Q. 7.11a

Instructions	Contingency Actions

CAUTION

RCS T_h should be reduced to less than 520°F in both loops before isolating a steam generator to minimize the potential for subsequent lifting of steam generator safeties.

NOTE

Narrow range T_h stops at 515°F. Wide range T_h is available on C101.

Instructions	Contingency Actions
____3.6 Initiate a plant cooldown using both steam generators to reduce T_h to less than 520°F in both loops (C04) a. Operate steam dump and bypass valves to reduce RCS T_h at 50-75°F per hour (C05) and b. Refer to Plant Cooldown using Natural Circulation, AOP 2553	3.6 a. Operate atmospheric dump valves (C05) and b. Log opening and closing times in SS Log

CAUTION

Use of the steam driven auxiliary feedwater pump will result in an unmonitored radioactivity release.

Instructions	Contingency Actions
____3.7 During the cooldown, maintain steam generator level 50-70% (C05)	3.7 Manually control main or auxiliary feedwater (C05)
____3.8 During the cooldown, When permitted, block MSI (C01)	3.8 If MSI occurs, Then maintain steam in the turbine building by opening the MSIV bypass valves

Instructions	Contingency Actions

CAUTION

If maximum spray water temperature differential exceeds 350°F an Engineering evaluation must be performed following the event. Notify Engineering if spray water temperature differential exceeds 200°F.

NOTE

1. Auxiliary spray depressurization rate may be as high as 50 psi/min. PORV depressurization rate will be even faster. Auxiliary spray should provide better control of the depressurization process.
2. Reducing pressure may require throttling HPSI flow. Step 3.16 provides HPSI termination criteria.

Instructions	Contingency Actions
_____3.9 Reduce and maintain RCS pressure using main or auxiliary spray until one of the following conditions is is reached. a. RCS pressure is approximately equal to steam generator pressure (C05) or b. RCS T_h subcooling approaches 30°F (ICC display)	3.9 Depressurize using PORV(s). Refer to Functional Recovery of RCS Inventory and Pressure, EOP 2540C, Step 3.4

_____3.10 <u>Determine</u> which steam generator has the rupture. Symptoms are

a. High radiation on main steam line rad monitors (RC05E)

b. Higher steam generator activity (sample results)

c. Higher boron concentration (sample results)

d. Increasing steam generator level (C05)

e. Lower feedwater flow rate as indicated by valve position (C05)

3.10 <u>Select</u> steam generator with higher radiation readings to be isolated

Instructions | Contingency Actions

CAUTIONS

Q.7.11a

1. Steam generators are vital for RCS heat removal. One steam generator must be used for this purpose even if ruptures are detected in both steam generators.
2. Do not isolate atmospheric dump valves, unless they have failed open.

_____ 3.11 When RCS T_h is less than 520°F (C05), Then isolate the affected steam generator. Do the following

a. Raise the setpoint of the associated atmospheric dump to 975 psia (C05)

b. Close the MSIV (C05)

c. Verify the MSIV bypass closed (C05)

d. Close the feed regulating valve (C05)

e. Close the main feed block valve (C05)

f. Close the auxiliary feed regulating valve (C05)

g. Close the auxiliary feed air assisted check valve (C05)

h. Verify blowdown is isolated

i. Close steam supply to steam driven auxiliary feed pump (C05)

j. Close main steam low point drains (C07)

3.11 Manually close valves

Instructions	Contingency Actions
____3.12 Verify the correct steam generator has been isolated by chemistry analysis	3.12 a. If the wrong steam generator has been isolated, Then unisolate that generator and isolate the affected steam generator (Step 3.11). b. If both steam generators are suspected, Then only isolate the steam generator with the highest radioactivity determined by chemistry sample or radiation readings on main steam line rad monitors (RC05E)
____3.13 Determine if RCPs can be restarted by the following a. Pressurizer level greater than 35% and constant or increasing (C03) b. Pressure temperature limits of Figure 4.2 satisfied for T_h in the operating loop (C03) c. One steam generator is removing heat (C05) d. RCPs starting prerequisites are met per OP 2301C	3.13 Continue with this procedure

Instructions | Contingency Actions

CAUTION

Pressurizer level and pressure can be expected to decrease upon starting RCPs due to loop shrinkage and/or void collapse. The level decrease may be large enough to drain the pressurizer. RCP operation with a drained pressurizer may continue provided HPSI and charging pumps are operating and NPSH requirements are met.

____ 3.14 If conditions exist for RCP operation, Then

a. Start HPSI and charging pumps (or verify operating) to make up for RCS contraction (C01/2)

b. Start one RCP in each loop (operating loop first) (C03)

c. Monitor RCS pressure and corresponding T_c for adequate pump NPSH (C03)

d. Operate HPSI and charging pumps to restore pressurizer level 35-45% (C03)

3.14

a. Verify Natural Circulation flow in the operating loop

i. Pressurizer level greater than 20% (C03)

ii. Verify heat removal from unaffected steam generator

iii. Pressure/Temperature limits of Figure 4.2 satisfied for T_h in the operating loop (C03).

iv. Loop delta T (T_h - T_c) between 10 and 45°F (C03)

v. T_c constant or decreasing (C03)

vi. T_h constant or decreasing (C03)

or

Instructions	Contingency Actions
	b. Verify adequate core cooling by incore thermocouple less than 555°F and constant or decreasing
	c. If adequate core cooling cannot be verified, Then go to Functional Recovery, EOP 2540
____3.15 If Pressurizer pressure is greater than 360 psia and stable, Then stop the LPSI pumps (C01)	3.15 Continue with this procedure
____3.16 When all the following conditions exist, Then, one facility at a time, HPSI pumps may be throttled or stopped a. Pressurizer level greater than 35% and constant or increasing (C03) b. Pressure/Temperature limits of Figure 4.2 satisfied for T_h in the operating loop. c. Heat removal from the unaffected steam generator d. Reactor vessel level above top of Hot Leg (≥ 43%) (ICC display)	3.16 If the HPSI pump termination conditions do not exist, Then continue to operate HPSI pumps (C01)

Instructions	Contingency Actions
____3.17 Control HPSI and/or Charging pumps flow to restore and maintain a. Pressurizer level 20-80% (C03) and b. RCS operating loop subcooling at least 30°F subcooled (ICC display)	3.17 Continue with this procedure
____3.18 If EBFAS was initiated and Unit 1 Stack recorder indicates less than 10 cps above pre-event value, Then return Condenser Air Removal Discharge to Unit 1 Stack by the following a. Override and stop "A" and "B" EBFS Fans (C01) b. Close 2-EB-40, 2-EB-41, 2-EB-50, and 2-EB-51 (C01) c. Open Condenser Air Removal discharge dampers, 2-EB-55 and 2-EB-56 (C06) d. Close 2-EB-57 (C06)	3.18 a. Continue running EBFS Fans and b. Continue discharging Air Removal to Unit 2 Stack.

Instructions

_____3.19 Continue RCS cooldown to cold shutdown

a. Verify cold shutdown boron concentration,
   Then
   i. Override and open 2-CH-192, RWST to charging pump suction (C02)
   ii. Open 2-CH-504, RWST to charging pump suction (C02)
   iii. Stop the boric acid pumps (C02)
   iv. Close 2-CH-514, Emergency Borate Valve (C02)
   v. Close 2-CH-508 and 509, gravity feed isolation valves (C02)
   vi. Complete OPS Form 2208-13, shutdown margin
   and
b. Refer to Plant Cooldown, OP 2207

Contingency Actions

3.19 Refer to Plant Cooldown using Natural Circulation, AOP 2553

Instructions | Contingency Actions

_____3.20 Throughout the cooldown, monitor for RCS voiding. Indications of voiding are

a. Pressurizer level increases greater than expected while using auxiliary spray (C03)

or

b. Pressurizer level increases slower than expected for existing HPSI and charging flow (C03)

or

c. Unheated thermocouples in upper head indicated saturated conditions (ICC display)

or

d. Reactor vessel level less than 100% (ICC display)

3.20 Continue with this procedure

_____3.21 Throughout the cooldown, verify RCS voiding not inhibiting adequate core cooling by

a. Pressure/Temperature limits of Figure 4.2 are satisfied for incore thermocouple temperature (ICC display)

and

b. At least one steam generator is removing heat

3.21 If RCS voiding is inhibiting core cooling, Then go to Functional Recovery, EOP 2540

Instructions

____3.22 Control level in the isolated steam generator less than 90% (C05) by maintaining RCS pressure

a. Nearly equal to the isolated steam generator pressure (C05)

   and

b. Within the Pressure/Temperature limits of Figure 4.2 for T_h in the operating loop

Contingency Actions

3.22

a. If condenser is available, Then do the following.

   i. If level increases above 90%, Then open MSIV bypass valves (C05)

   ii. When level decreases below 50%, Then close the MSIV bypass valves (C05)

b. If the condenser is not available, Then operate atmospheric dump valves to reduce level.

Instructions	Contingency Actions

CAUTION

Use of the Blowdown Treatment System involves processing water that may be highly contaminated. Radiation and contamination levels will be much higher than during normal operation.

Instructions	Contingency Actions
____3.23 If RCPs cannot be restarted, Then cool the isolated steam generator by the following	3.23 Do the following
a. Lower steam generator level by the following	a. Lower steam generator level by steaming to the condenser
i. Obtain management concurrence to override blowdown isolation signal	i. Open affected steam generator MSIV bypass valve (C05) and
ii. Place steam generator blowdown treatment system in operation per Main Steam System, OP 2316A	ii. When steam generator level decreased to 20%, Then close MSIV bypass valve (C05).
iii. Establish drain rate of 75 gpm (local)	
iv. When steam generator level reaches 20%, Then stop draining	
b. Raise steam generator level to 90% using auxiliary feedwater pumps at approximately 150 gpm (C05)	b. Raise steam generator level to 90% using auxiliary feedwater pumps at approximately 150 gpm (C05)
	c. Repeat fill and drain process until desired steam generator pressure

Q. 7.11a

Instructions	Contingency Actions
c. Repeat fill and drain process until desired steam generator pressure and temperature obtained (local/C05)	and temperature obtained (local/C05)
_____3.24 Align turbine building sumps to the CPF sumps (local). Refer to OP 2336A, Station Sumps and Drains	3.24 Align the turbine building sumps to the Aerated Waste System a. Close 2-AR-36 (14'6" TB) b. Open 2-AR-37 (14'6" TB) c. Open 2-SSP-76 (-45' 6" Aux Bldg)
_____3.25 Verify [illegible]-CN-334, Atmospheric Drain Collecting Tank drain to LIS, is closed (local)	3.25 Continue with this procedure
_____3.26 Direct Chemistry to sample the secondary systems for activity	3.26 Continue with this procedure
_____3.27 Refer to AOP 2569, Steam Generator Tube Leak, for guidance on operation with a contaminated secondary system	3.27 Continue with this procedure
_____3.28 As time permits, Refer to Reactor Trip Recovery, EOP 2526, and perform additional steps as necessary	3.28 Not applicable

4. FIGURES

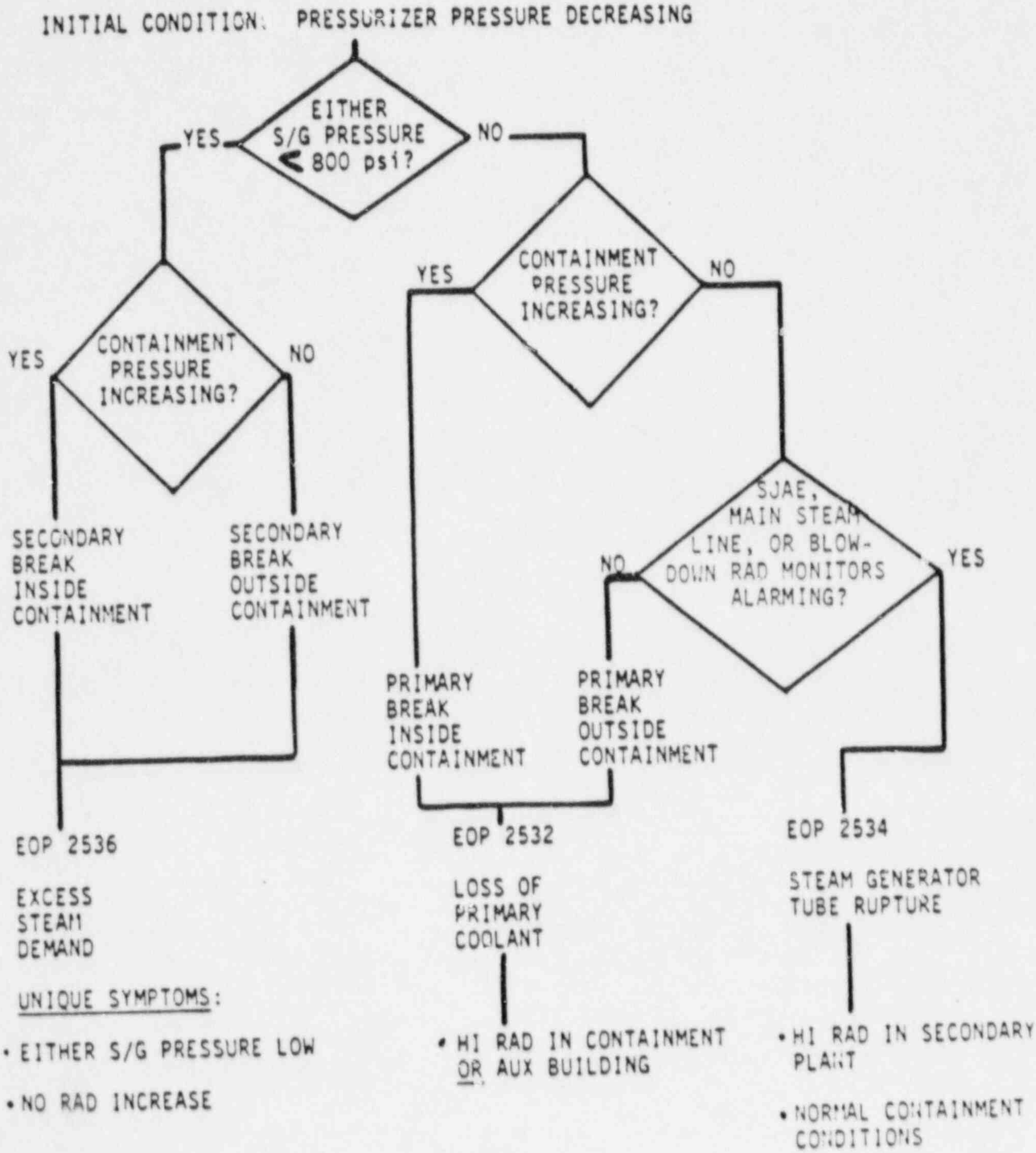
4.1 Break Identification Chart

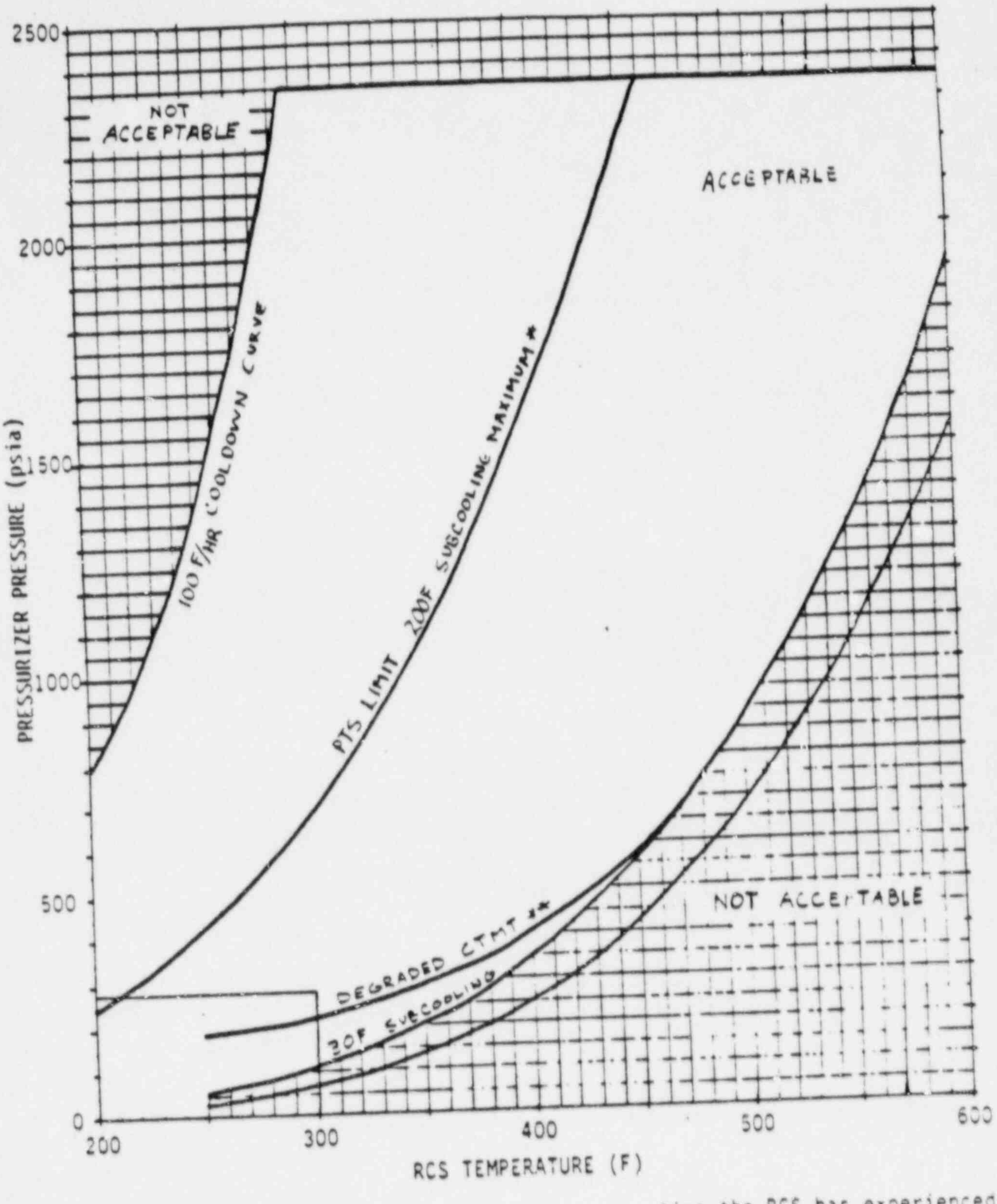
4.2 RCS Pressure/Temperature Limits

4.3 Safety Injection System Delivery Flow

Figure 4.1

BREAK IDENTIFICATION CHART





* This curve supercedes the 100F/HR cooldown curve any time the RCS has experienced an uncontrolled cooldown to below 500F.

** This curve supercedes the 30F subcooling curve if, at any time, the containment pressure has exceeded 5psig.

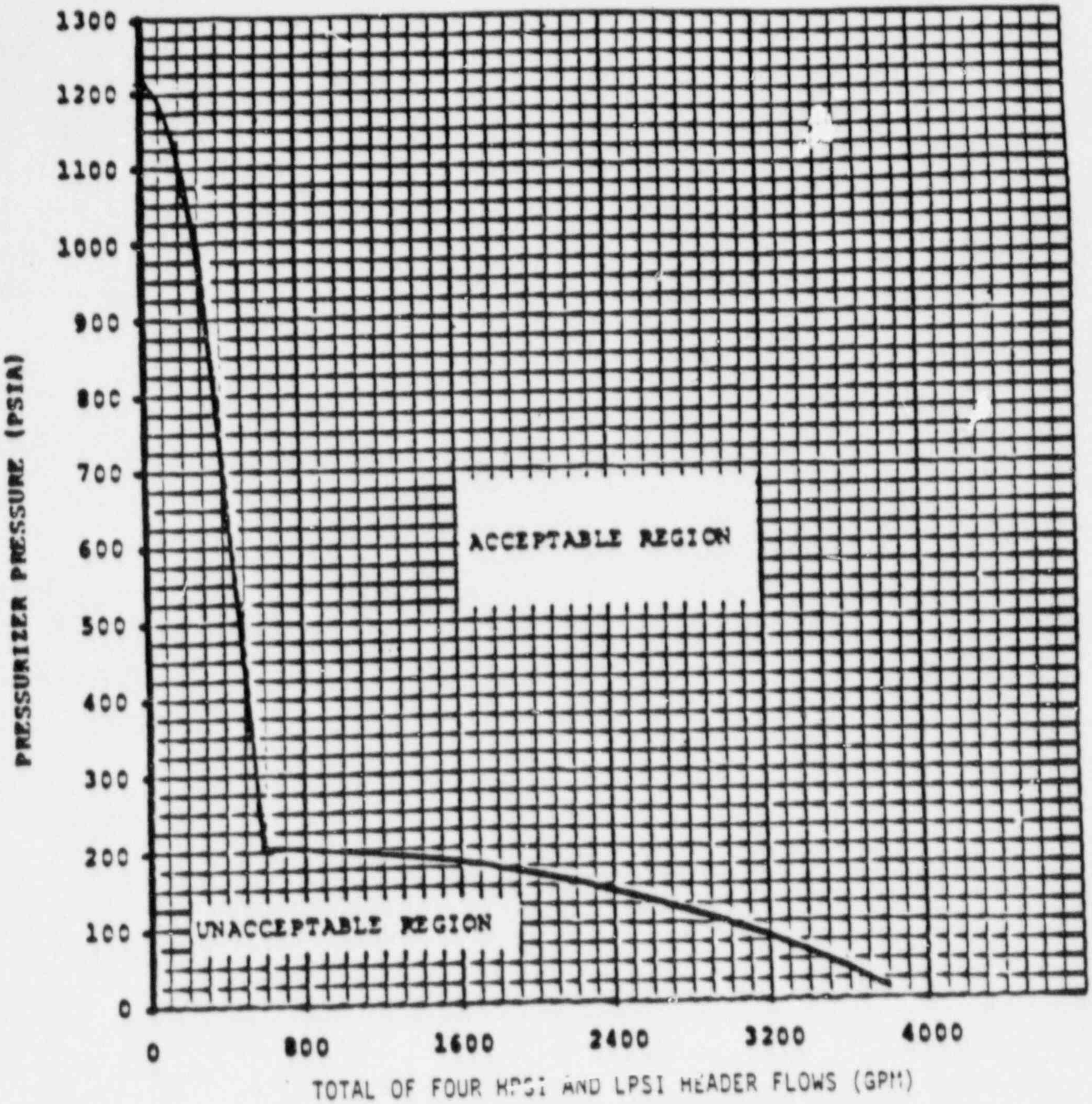
FIGURE 4.2 RCS PRESSURE/TEMPERATURE LIMITS

RCS PRESSURE/TEMPERATURE LIMIT DATA

RCS TEMP (°F)	SATURATION PRESSURE (psia)	30°F SUBCOOLED MINIMUM PRESSURE (psia)	DEGRADED CTMT MINIMUM PRESSURE (psia)	PTS LIMIT 200°F SUBCOOLED MAXIMUM PRESSURE (psia)	100°F/HR COOLDOWN CURVE MAXIMUM PRESSURE (psia)
600	1543	1919	1919	Upper Limit of 2350	
595	1487	1852	1852		
590	1432	1787	1787		
585	1378	1723	1723		
580	1326	1662	1662		
595	1276	1602	1602		
570	1227	1543	1543		
565	1180	1487	1487		
560	1133	1432	1432		
555	1089	1378	1376		
550	1045	1326	1326		
545	1003	1276	1276		
540	963	1227	1227		
535	924	1180	1180		
530	885	1133	1133		
525	848	1089	1089		
520	813	1045	1045		
515	778	1003	1003		
510	744	963	963		
505	712	924	924		
500	681	885	885		
495	650	848	848		
490	621	813	813		
485	593	773	773		
480	566	744	744		
475	540	712	712		
470	515	681	687		
465	490	650	657		
460	467	621	633	2350	
455	434	593	607	2286	
450	423	566	582	2208	
445	402	540	561	2133	
440	382	515	540	2060	
435	362	490	522	1989	
430	344	467	502	1919	
425	326	434	483	1852	
420	309	423	467	1787	
415	292	402	451	1723	
410	277	392	436	1662	
405	262	362	408	1602	
400	247	344	406	1543	

RCS PRESSURE/TEMPERATURE LIMIT DATA (Cont'd)

RCS TEMP (°F)	SATURATION PRESSURE (psia)	30°F SUBCOOLED MINIMUM PRESSURE (psia)	DEGRADED CTMT MINIMUM PRESSURE (psia)	PTS LIMIT 200°F SUBCOOLED MAXIMUM PRESSURE (psia)	100°F/HR COOLDOWN CURVE MAXIMUM PRESSURE (psia)
395	233	326	392	1487	Upper Limit
390	220	309	378	1432	of 2350
385	208	292	366	1378	
380	196	277	353	1326	
375	184	262	340	1276	
370	173	247	329	1227	
365	163	233	319	1180	
360	153	220	309	1133	
355	144	208	299	1089	
350	135	196	289	1045	
345	126	184	281	1003	
340	118	173	275	963	
335	110	163	265	924	
330	103	153	256	885	
325	96	144	251	848	
320	90	135	242	813	
315	84	126	236	778	
310	78	118	230	744	
305	72	110	224	712	
300	67	103	219	681	
395	62	96	214	650	
290	58	90	210	621	2230
285	53	84	205	593	2100
280	49	78	202	566	1970
275	45	72	198	540	1850
270	42	67	196	515	1730
265	39	62	192	490	1620
260	35	58	190	467	1530
255	32	53	188	434	1450
250	30	49	184	423	1370
245	27			402	1300
240	25			382	1230
235	23			362	1170
230	21			344	1100
225	19			326	1040
220	17			309	980
215	16			292	930
210	14			277	880
205	13			262	840
200	12			247	800



NOTES 1. This curve is based on one facility operating and at least one charging pump in operation.

2. _If_ containment pressure has exceeded 5 psig at any time during an event, _then_ do not use this curve. Its accuracy is in doubt. When determining Safety Function status:

Consider the Safety Function satisfied if all other safety function parameters meet criteria.

MINIMUM REQUIRED SAFETY INJECTION DELIVERY CURVE

FIGURE 4.3

Ch-

INSTRUCTOR AIDS	CONTENT	INSTRUCTOR/STUDENT ACTIVITY
	3) A 15 volt dummy signal is applied to the trip unit relays to keep them from tripping.	
	b. LPD trip is bypassed similarly because of calculation inaccuracies at low power.	RO-7, LPD bypass
	2. Individual trip unit inhibit keys (12) covered in section II.D.7.b.5.	
TP-9	a. Each logic ladder has 20 key bypass contacts, not including spares.	
Q. 7.11c	b. Key number 6 operates the High Pressurizer Pressure trip inhibit relay and the PORV bypass logic relay K 29 for that channel.	Discuss PORV control by pulling two TU-6s and using key #6.
PP-2380-14	3. Zero Power Mode Bypass	RO-7, ZPM bypass
	a. Permits low temperature, low pressure, and low flow control rod operation.	RO-1, purpose of bypass key
	b. Provided for low power physics testing	

Q. 7. 11c

TEXT MATERIAL APPROVAL SHEET

I. Text Title: Reactor Protection System Description

ID#: M2-OP-RO-I&C-2380-1 Rev 1 Date 6-30-87

II. Initiated:

James E. Macdonald — DEVELOPER — 6-30-87 DATE

III. REVIEWED:

Peter L. Smith — TECHNICAL REVIEWER — 7/2/87 DATE

Thomas Moriarty — INSTRUCTIONAL REVIEWER — 7-6-87 DATE

IV. APPROVED:

NUCLEAR TRAINING SUPERVISOR — 7/6/87 DATE

V. RELEASED FOR USE:

NUCLEAR TRAINING SUPERVISOR — 7/8/87 DATE

SYSDESC #6(5)

trip and the low pressure trip receive their process variable signal from the same transmitter.

If pressure increases from normal, a pre-trip alarm will occur at 2350 psia and at 2400 psia a reactor trip signal and a PORV open signal will be fed into their respective two out of four channel logics. The trip unit key bypass is provided to inhibit both the trip and PORV opening signal for its respective channel.

Q. 7.11c

Physical removal of any trip unit from the RPS panels results in activation of all of that trip unit's functions. Removal of two high pressurizer pressure trip units would cause a reactor trip and PORVs to open. Use of the trip unit bypass key to bypass one of the "pulled" trip units would permit open/close control of the PORVs. The trip inhibit relay K 36 and the PORV bypass relay K 29 are located in the RPS auxiliary logic drawers (4) and are activated by key number 6.

4. Steam Generator Water Level Low

Each steam generator has four differential pressure sensors (channel A, B, C, D) which measure the difference between downcomer level and a reference leg. The reference leg is maintained full by an air cooled steam condensing chamber at its top. Level sensing and indication is narrow range only, covering a span of 184 inches as 0 to 100% with zero being 294 inches above the tube sheet. The 36% trip setpoint is 3% above the top

SECTION 8

QUESTION 8.01

The answer key should be changed to allow for different, correct responses which indicate relationships between LCO's, LSSS's, and Safety Limits. One such response would be:

If the safety limits are not exceeded, fuel and RCS integrity will be maintained. LSSS's serve to trip the reactor to ensure that safety limits will not be exceeded, assuming that LCO's are being met.

Reference: 10CFR 50.36, M2-OP-RO-ADMIN-2001, T.S. 2.1 and Bases.

QUESTION 8.02

Technical Specification 4.02 b. specifies "the combined time interval for any 3 consecutive surveillance intervals not to exceed 3.25 times the specified surveillance interval". The period between 7/6/86 and 5/6/87 incorporates 3 consecutive surveillance intervals and exceeds 3.25 times the surveillance interval. The question asks "EXPLAIN WHETHER OR NOT a surveillance interval has been exceeded and if so WHICH ONE.

Based on this an acceptable alternative answer should be

"The interval from 7/6/86 to 5/6/87 (for 3 consecutive surveillance intervals) [0.5] exceeds the required 3.25 times the surveillance interval [0.5]"

QUESTION 8.03

This question asks "What action, if any, is required . . . " "and why?" It does not ask for the time in which this action must be completed nor the reference, by paragraph, for this action. Therefore, the answer should read "A plant shutdown should be started (within 1 hour) [1.0] as required by Technical Specifications [0.5] with subsequent action to bring the plant to cold shutdown in accordance with T.S. [0.5].

QUESTION 8.04

TPG ACP-QA-2.06A EO #9d requires the operator to: "Given ACP-QA-2.06A and a request for clearing tags explain the conditions required for clearing including documentation of restoration".

Question 8.04 c. specifically addresses the topic with regard to documentation of restoration but did not provide the candidate the requisite procedure.

Additionally the reference sited in the answer key specifies that "Normally the "Restoration Performed" block should not be filled in when the tags are issued". The question addressed a specific exception from this normal practice as allowed by the cited reference.

It is recommended that 8.04 c. be deleted.

QUESTION 8.05

The question does not ask for the time frame during which "Actions and notifications must be completed" but only for "WHAT" actions and notifications must be completed".

Additionally MP2 learning objectives do not require memorization of one hour (immediate) reporting criteria.

The answer key should be changed to allow full credit if the candidate stated that RCS pressure must be restored to within its limits and that notifications are conducted in accordance with procedures.

QUESTION 8.07

This question specifies "B HPSI pump was taken out of service for maintenance". No reference is made to either A or C HPSI pumps. OP 2308 paragraph 7.5 provides operational guidance for removal of B HPSI pump from service that results in "Restoring HPSI pump A to service as Fac I pump or HPSI pump C as Fac II pump . . . " Therefore two HPSI pumps would be available on separate facilities. T.S. 3.5.2 requires "Two separate and independent ECCS subsystem shall be operable with each subsystem comprised of one operable HPSI pump . . ." Therefore operability of ECCS is not relying on the action statement.

The answer should read "The startup can be commenced [1.0] because the ECCS is operable provided both A & C HPSI pumps are properly aligned [1.0].

Additionally, full credit should be awarded if the candidate assumed that the A or C HPSI pump was inoperable and answered in accordance with key.

QUESTION 8.08

ACP-QA-3.02 provides guidance for non intent changes in Section 6.9.1. Since temporary changes to procedures meet the definition of non intent changes as specified in paragraph 4.7, they could be treated as a non intent change. Therefore an acceptable alternative answer is:

1. The change is a non intent change [.6]

2. The change is approved by two licensed SRO's from the unit involved, at least one of whom shall be the on duty SS [0.7]

3. The change shall be reviewed within 14 days of implementation (by PORC/SORC) [0.7]

Additionally, in that temporary changes are only allowed if the intent of the procedure is not altered, then credit should be awarded if the candidate describes those provisions which distinguish between intent and non intent changes.

QUESTION 8.10

The cited TPG states "Define non compliance per 3.02". No TPG for Shutdown Cooling Refueling or Technical Specification requires the licensed operator to know from memory those times/conditions when both trains of SDC are not required, when in mode 6.

The operator is thus encouraged and trained to reference Tech Specs and Procedures prior to removing a SDC loop from Service.

Based on those points it is recommended that this question be deleted.

QUESTION 8.11

The point distribution of the key answer is unclear.