HUMAN FACTORS ENGINEERING

GUIDANCE MANUAL

TURKEY POINT

NUCLEAR POWER PLANT UNITS 3 & 4

FEBRUARY 1986

PREPARED BY:

BECHTEL POWER CORPORATION

EASTERN POWER DIVISION

FOR

FLORIDA POWER AND LIGHT COMPANY

8604080305 860401
PDR ADOCK 05000250
P PDR

HUMAN FACTORS ENGINEERING GUIDANCE MANUAL
TURKEY POINT NUCLEAR POWER PLANT UNITS 3 & 4

TABLE OF CONTENTS

List of Exhibits

List of References

1. NUREG-0660, Volume 1, "NRC Action Plan Developed as a Result of the TMI-2 Accident," U.S. Nuclear Regulatory Commission, May 1980; Revision 1, August 1980.

2. NUREG-0737, Supplement 1, "Clarification of TMI Action Plan Requirements," U.S. Nuclear Regulatory Commission, December 1982.

3. NUREG-0700, "Guidelines for Control Room Design Reviews," U.S. Nuclear Regulatory Commission, September 1981.

4. NUREG-0801 Draft, "Evaluation Criteria for Detailed Control Room Design Reviews," U.S. Nuclear Regulatory Commission, October 1981.

5. "St. Lucie Units 1 and 2, Turkey Point Units 3 and 4 Detailed Control Room Design Reviews Program Plan," Florida Power and Light Company, April 1983.

6. "Review of St. Lucie and Turkey Point Detailed Control Room Design Review Program Plan Submittals," U. S. Nuclear Regulatory Commission, October 20, 1983.

7. "Summary Report: Detailed Control Room Design Review of the Plant Turkey Point Units 3 and 4 Nuclear Power Station," Florida Power and Light Company, NRC Accession Number: 83110803311, October 1983.

8. "Evaluations of Detailed Control Room Design Reviews for St. Lucie 1, St. Lucie 2, and Turkey Point 3 and 4," Science Applications, Inc., January 13, 1984.

9. "Draft SER for Florida Power and Light Company (FP&L) Detailed Control Room Design Reviews of St. Lucie 1 and 2 and Turkey Point 3 and 4," U.S. Nuclear Regulatory Commission, January 18, 1984.

10. NRC Letter: Results of Pre-implementation Audit of Detailed Control Room Design Reviews for Turkey Point and St. Lucie, May 1984.

11. Control Room Enhancements, Waterford 3 SES, Louisiana Power and Light, February 1983.

12. NP-3659, "Human Factors Guide for Nuclear Power Plant Control Room Development," Essex Corporation for EPRI, August 1984.

13. "Human Factors Guidelines for Power Plant Control Rooms," Bechtel Power Corporation, 1982.

14. "Guidelines for Applying Human Factors Engineering Principles to Control Panel Design Changes," Torrey Pines Technology, May 1985.

15. "Summary Report: The Detailed Control Room Design Review for SNUPPS," SNUPPS, June 1984.

16. EPRI NP-1118-SY, "Human Factors Methods for Nuclear Control Room Design, June 1979.

17. PGE-1041, Vol.3, "Human Factors Design Input and Review Program for the Trojan Nuclear Plant," September 1985.

1.0 INTRODUCTION

The following keywords, abbreviations, and acronyms are used throughout the manual.

DCRDR - Detailed Control Room Design Review

CR/CB - Control Room/Control Board

PTN - Turkey Point Nuclear Plant

HFE - Human Factors Engineering

HED - Human Engineering Discrepancy

PC/M - Plant Change/Modification

FP&L - Florida Power and Light Company

1.1 GENERAL

To comply with Supplement 1 to NUREG-0737 requirements, a detailed Human Factors Engineering Review of the Florida Power & Light Turkey Point Plant Units 3 and 4 control room/control board was performed. The objective was to identify and correct design discrepancies and improve the ability of control room operators to prevent or cope with accidents. The basic guidance document for this effort was NUREG-0700, Guidelines For Control Room Design Review.

Human engineering discrepancies were identified by the ESSEX Corporation. Resolution of discrepancies was accomplished by FP&L and Bechtel Engineering staff. The implementation of enhancements was performed by FP&L's construction department.

1.2 OBJECTIVE

This document provides guidance in the application of HFE principles during the design and evaluation of future changes at the Turkey Point Nuclear Power Plant. It contains guidance for future control panel modifications to ensure continuity and consistency with the existing panel layout and enhancement schemes. In addition to general HFE guidelines, it also contains standard hardware specifics as well as established practices and provisions that are adopted and approved for use at PTN.

Certain sections in this guidance manual are subject to change as the plant and its systems are modified. These sections should be updated periodically to reflect current plant configuration. The most vulnerable sections are in Appendices A and B, Main Control Board Layout and Annunciation Window Layouts, respectively.

1.3 SCOPE

This document is written in the context of reviewing HFE conformance for plant change/modifications involving changes to an existing system in the plant. If an existing system is to be replaced in its entirety by a totally different system, guidelines for such evaluation may go beyond the scope of this document.

Criteria for reviewing an item that is unlikely to be changed or replaced, such as the control room itself or its ventilation system, are not included in this document. The ventilation system must be reviewed against NUREG-0700, Section 6.1.5.2.

For all practical purposes, the use of PTN standard hardware, as listed, is encouraged. If a nonstandard part is used, e.g., a slide switch, it must be reviewed against NUREG-0700, Section 6.4.5.2.

In the event a plant standard component part is no longer available or a model has been discontinued, it is the responsibility of the design

engineer to decide on an acceptable alternate. The requirements of NUREG-0588 must be considered.

1.4 STRUCTURE AND USE

This document is structured with the user's convenience in mind. It is organized to provide general guidelines first, followed by a component section which addresses each panel component in turn. Section 4.0 stipulates HFE requirements for computer-driven instrumentation. The document concludes with the appendices.

When a PC/M involves work in the control room/control board, the responsible engineer must determine the type of hardware to use and its location on the control board. Section 2.1 of this document provides control room layout. The new device should be installed in the panel section to which it is closely related. Then from Section 2.2, control board layout arrangement drawing, it is possible to determine if sufficient panel space is available for the addition or if it is necessary to reorganize existing panel mounted devices to accommodate the new change. In all probability, this step must be verified in the control room to ensure that the desired location has not been previously used for other changes. Back of panel interference possibilities also must be investigated.

Insofar as components are concerned, every effort should be made to use standard hardware if at all possible. Standard hardware is listed under Section 3.0. HFE considerations for each type of hardware are delineated under the appropriate subsection.

Section 4.0 is dedicated to computer-driven instrumentation. This refers to systems such as the SPDS/SAS, DDPS, and QSPDS that are currently installed. Future additions of this type of equipment should include HFE considerations delineated in this section.

A checklist is provided after each subsection in Sections 2.0, 3.0, and 4.0. The responsible engineer or other reviewers may use the applicable checklists for verification of HFE conformance.

Plant specific practices, guidelines exclusively adopted for PTN 3 & 4, are listed under the appendices. Exhibits and references are listed in the Table of Contents for the user's convenience.

2.0 GENERAL

2.1 MAIN CONTROL ROOM (MCR) ORGANIZATION

2.1.1 Description

The MCR area is common for the two nuclear units in an arrangement assuming complete separation of equipment, instrumentation, and cabling between them.

The MCR area consists of:

- o A functional operating area, commonly identified as MCR, containing the main control boards where the operation of both units is monitored and controlled under normal and accident conditions

- o An instrumentation area containing the various instrumentation cabinets of the plant

Exhibit 2.1-1 illustrates the general layout of the MCR area, including the MCR. The MCR, extending along a north-south axis is divided in two sections, one at the north for Unit 3 and one at the south for Unit 4.

Each MCR section contains the following equipment:

- o The main control board (MCB) of the unit consisting of:

  - Two vertical panels (A and B) that are perpendicular to each other, with a third vertical corner panel (C) between them; these vertical panels are on two sides delimiting the MCR section

EXHIBIT VI-1: Main Control Room Layout

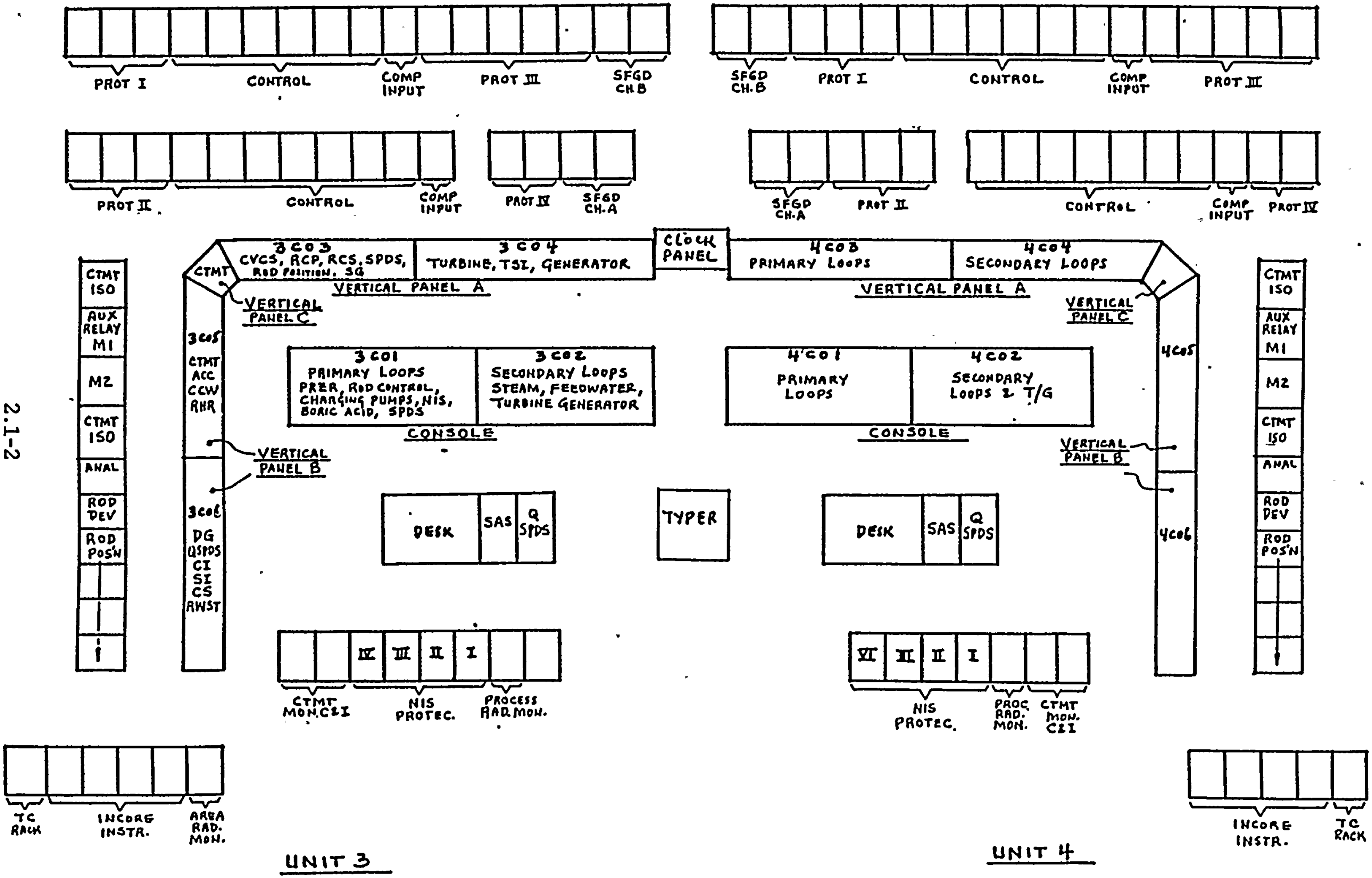


EXHIBIT 2.1-1: Main Control Room Layout

- One standing, "see-over" benchboard console in front of the vertical panel A

- One operator desk facing the console and the vertical panel A

- Instrument cabinets (eight for Unit 3 and seven for Unit 4) disposed in a row, parallel to vertical panel A, behind the operator and delimiting the MCR section on a third side

- A typer desk and SPDS/SAS color plotter between the two operator desks

Common for both units and centrally located between the vertical panels A of the two units is a clock panel.

The instrumentation area for each unit extends behind the vertical control panels of its MCR to the adjacent walls, delineating the MCR area. It comprises instrument cabinets disposed in two rows parallel to vertical panel A, one row parallel to vertical panel B, and a row closing this area, extending between vertical panel B and its nearest wall.

The equipment between the two MCR sections for Unit 3 and Unit 4 is symmetrically arranged with respect to an east-west axis through the MCR center.

The vertical panels A of the two units, separated by the common clock panel, are in a row extending north-south. The corresponding vertical panels B are facing each other.

The distribution of process system instrumentation and controls on the consoles and on the vertical panels A and C is identical for the two units while it is symmetrically opposite (mirror-imaged) for the vertical panels B, as seen by an operator facing them.

Only a portion of the MCB (vertical panels A, B, and C, the consoles, and the clock panel) should be considered for future expansions or

additions of instrumentation in the MCR, since it was custom designed by the A/E for FPL. Modification to vendor supplied cabinets is not advisable since it may affect various vendor liabilities, guarantees, etc. Modifications to vendor cabinets must be coordinated with the respective vendors.

2.1.2 Design Concepts

The MCR was designed to satisfy the following requirements:

- o Each unit is equipped in the MCR with all the controls, instrumentation displays, and alarms required for safe operation and shutdown.

- o Separation of equipment, instrumentation, and cabling of the two units avoids interference in operation between the MCR sections.

- o Adequate radiation protection for personnel during accident conditions is provided.

- o Separate ventilation system with a large percentage of recirculated air allows safe operation within the MCR under accident conditions.

- o MCR location over the cable spreading room allows all control wiring to enter the MCR via slots in the floor, directly beneath the panels in which the wires are terminated.

- o Fire prevention design minimizes combustible material in the MCR, and uses flame resistant boards, metal enclosures for all electrical wiring and devices, amd flameproof sealing of cable slots in the floor.

- o Functional, system-oriented distribution of the instrumentation and controls on the main control boards (MCB) of the MCR

minimizes operator errors and the response time to events requiring timely action.

- Instrumentation and controls most frequently utilized during the normal operation are installed in the consoles.

- Instrumentation and controls for less frequent operation modes such as startup, shutdown, or accident conditions are installed in the vertical panels.

- Selection of systems and the distribution of corresponding instrumentation and controls among the available console and panels to separate the primary loops or Nuclear Steam Supply Systems (NSSS) from the secondary loops or the Balance of Plant (BOP) systems.

- The vertical panel A and the console provide complimentary distribution of functions within the NSSS and BOP instrumentation, e.g. meters and trend recorders on the vertical panel A positioned in front of the console sections, containing functionally related control stations and position indicators.

2.2 MAIN CONTROL BOARD (MCB) ORGANIZATION

2.2.1 Criteria

The main objective of an efficient MCB organization is to provide an arrangement that allows the operator to have within his view and reach, with a minimum effort, the displays and controls required during the various modes of operation of the unit. The MCB organization for Turkey Point Units 3 and 4 has pursued this objective while applying the following criteria:

- o Functional, system-oriented arrangement of displays and controls.

- o Separation of NSSS and BOP instrumentation.

- o Grouping of systems required for various operating modes of the unit on different sections of the MCB.

  - Special emphasis for a central arrangement with easy access for those required during the normal operation of the plant.

  - Systems utilized in less frequent operations, like startup and shutdown or those for post-accident conditions, are assigned to MCB sections in the vertical panels, so as not to interfere with the normal operation from the console.

2.2.2 Specific PTN Design

The adopted design for the MCB, as indicated in Section 2.1, consists of:

- o Two vertical panels A and B (VPA and VPB)

- One vertical panel C (VPC)
- One "see-over" benchboard console (BC)

The BC, VPA, and VPB are each divided in adjacent sections (U = unit number): UC01 and UC02 for the console; UC03 and UC04 for VPA; and UC05 and UC06 for VPB. UC01 and UC03 contain instrumentation for NSSS; UC02 and UC04 for BOP systems.

The process systems assigned to BC and VPA are essentially the same and their physical location follows a similar spatial distribution. All of these process systems and the corresponding instrumentation are required for the normal operation of the plant.

The vertical panels VPA, VPB, and VPC contain an upper portion, slightly sloped (≅12 degrees) towards the MCR, on which the unit annunciator windows, functionally grouped in ten modules, are installed. The VPA contains most of the displays consisting of meters (which can be seen by an operator standing in front of the BC), recorders, infrequently used controls, and annunciators. The VPB and VPC contain the engineered safety features, systems required for post-accident conditions, and plant auxiliary systems.

The benchboard console (BC) is designed to allow a standing operator access to most of the controls required during normal operation, and while looking over it, being able to monitor displays on VBA and VBC. The BC comprises a vertical panel used basically for several meters and recorders, and a sloping panel utilized for controls and status indicators. The BC contains the majority of controls (i.e., control switches, selector switches, controls stations), status indicators, and a limited number of displays (i.e., meters and recorders).

The common clock panel (CP) contains a window annunciator module, two clocks, and indicating lights of the vital ac ground detector. The CP extends between the VPAs of Units 3 and 4 at the level of their sloped upper annunciator panel portions.

The MCR instrumentation is distributed on the MCB panels according to the following spatial allocation of the main process systems:

<u>Bench Console (BC)</u>

<u>UC01</u>

RCS; NIS; RCCS; CVCS; SPDS

<u>UC02</u>

SG; FWS; TURB; GEN; DG; AFW; COND SYS; EL SYS

<u>Vertical Panel A (VPA)</u>

<u>UC03</u>

CVSC; RCS; SPDS; SG; RCCS

<u>UC04</u>

TURB; CWS; GEN; EL SYS

<u>Vertical Panel C</u>

CTMT

<u>Vertical Panel B (Unit 3)</u>

<u>3C05</u>

ECCS; CTMT VENT; ACC; RHR; CCW; AUX BLDG VENT

<u>3C06</u>

MISC; DG; QSPDS; CI; SI; CS

<u>Vertical Panel B (Unit 4)</u>

<u>4C05</u>

CCW; RHR; ACC; CTMT VENT; ECCS; AUX BLDG VENT

<u>4C06</u>

CS; SI; CI; QSPDS; DG; MISC

The VPAs and BCs of both units are identical. The VPBs are mirror images as follows:

Section 3C05 is mirror image of Section 4C05.

Section 3C06 is mirror image of Section 4C06.

3.0 COMPONENTS

3.1 ANNUNCIATOR SYSTEM

3.1.1 Each PTN unit is equipped with ten annunciator alarm panels (A through J). Panel X is shared by both units. Each panel consists of 54 windows arranged in a 6 x 9 matrix. See Exhibit 3.1-1 for details.

3.1.2 The Constalert Series 5000 annunciator system manufactured by the BETA Corporation is standard for the PTN plant.

3.1.3 The system is comprised of the following equipment:

Lamp Logic Cards CSF-7	#301831-8C8K
Lamp Logic Card DSF-9	#301617-1C1K
Flasher Control Card	#300830-1
Reflasher Relay Card	#301975-1
Power Supply Card	#300841
Multiple Input Card	#301937-1
Dim Light Control Card	#301133-1A21
Power Supply	AC-151
DC to DC Converter	#301509

3.1.4 The system has three operating sequences: the CSF-7, standard dim-flashing-momentary-self-reset sequence; the reflash sequence; and the DSF-9, first-out sequence as shown in Exhibits 3.1-2 and 3.1-3. The reflash sequence is the repeat of the standard sequence.

3.1.5 Control function consists of one set of three pushbutton switches for each unit: Acknowledge, Silence, and Reset (for first-out only).

3.1.6 A single horn with a different sound pattern for each unit is provided for audible annunciation.

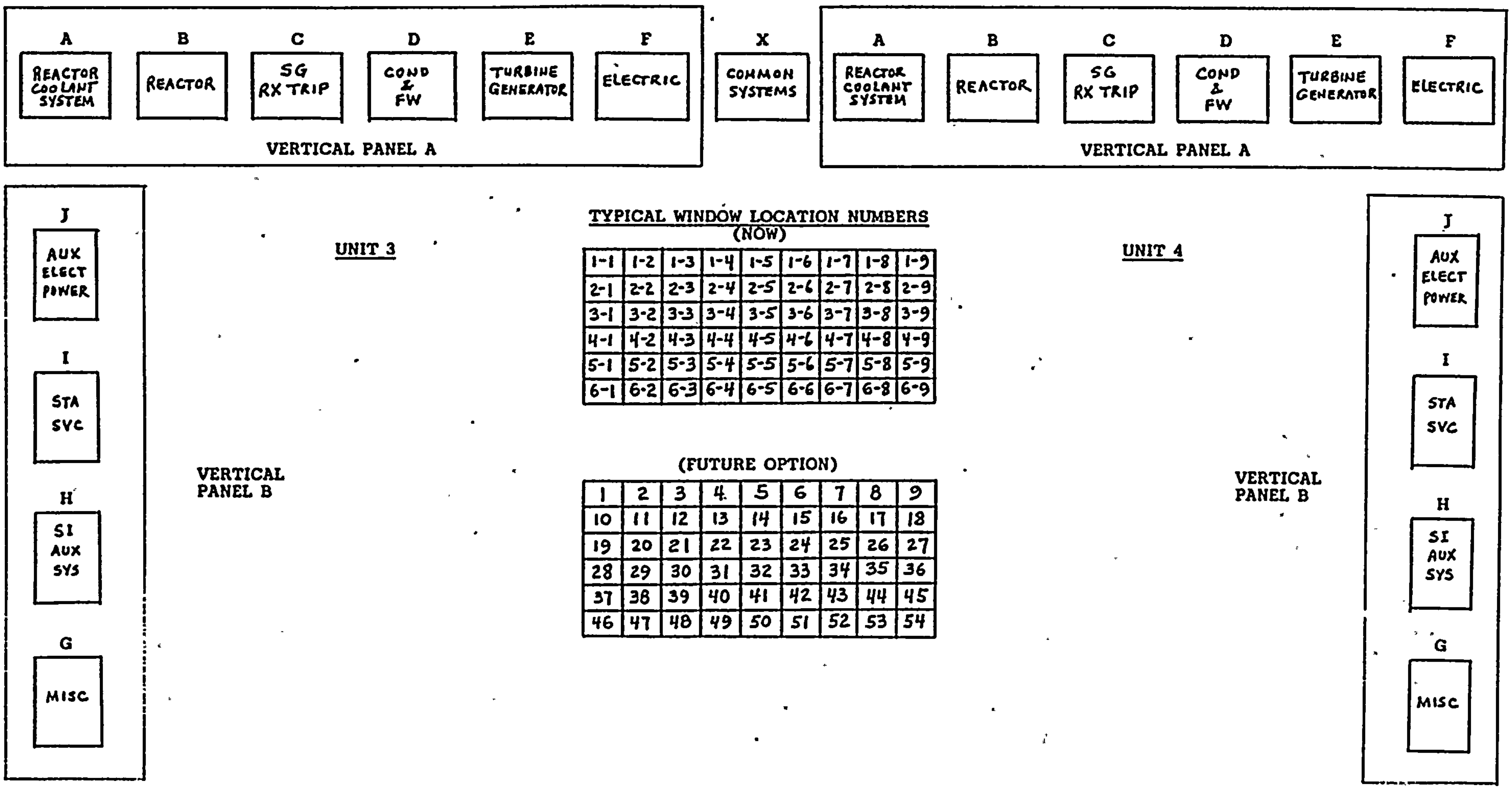


EXHIBIT 3.1-1: Annunciator Panel Arrangement

	Field Contact Normal	Field Contact Off-Normal	Return to Normal Before Acknowledge	Alarm Acknowl-edged	Return to Normal
Flashing, Momentary, Self-Reset	DIM / OFF	FLASHING / ON	FLASHING / ON	ON / OFF	DIM / OFF

EXHIBIT 3.1-2: Standard Sequence

Flashing Color First Out, Momentary	Field Contact Normal	Field Contact Off-Normal	Return to Normal Before Acknowledge	Alarm Acknowl-edged	Reset
1st Point	DIM / OFF	RED FLASHING / ON	RED FLASHING / ON	RED LAMP ON / OFF	DIM / OFF
Subsequent Point	DIM / OFF	FLASHING / ON	FLASHING / ON	ON / OFF	DIM / OFF

EXHIBIT 3.1-3: First-Out Sequence

3.1.7 The system is powered by 125 VDC. Lamps are on 24 VDC and logics are on 12 VDC.

3.1.8 When a new alarm window is required, the window should be located close to its related instruments and controls (see Exhibit 3.1-1 and Appendix B for available spare window locations).

3.1.9 In addition, the new window should be grouped together with its associated subsystem alarm windows (see Appendix B).

3.1.10 Consideration should be given to the use of a single window for a number of related alarm inputs from a single system.

3.1.11 For a multi-input alarm window, consideration should be given to the need for reflash capability. For example, with tank level high/low alarms, it is apparent that after a low level alarm, it is unlikely that a high level alarm will occur shortly afterward; thus reflash capability is not a necessity. On the other hand, for tank level high/high-high alarms, the high-high alarm could occur shortly after the high level alarm if no corrective action is taken; thus the reflash capability is a desirable feature for this alarm function.

3.1.12 Each multi-input card can accommodate a maximum of four independent alarm inputs.

3.1.13 Where a multi-input annunciator is used, an alarm printout capability should be provided. The specifics of the alarm should be printed on an alarm typer with sufficient speed and buffer storage to capture all alarm data.

3.1.14 Alarms for a shared plant system should be located on Panel X or displayed on both units.

3.1.15 To maintain a "dim board" concept, all alarm windows should be designed to maintain on dim when the plant is operating normally.

3.1.16 The annunciator circuit should be designed such that failure of the annunciator circuit will not cause failure in the equipment associated with the alarm.

3.1.17 The set point for initiating the alarm should not occur so frequently as to be considered a nuisance by the operator.

3.1.18 The set point should be established to give operators adequate time to respond to the warning condition before a serious problem develops.

3.1.19 When general alarms are used, sufficient time should be allowed for auxiliary operator action and subsequent control room operator action.

3.1.20 All first-out annunciator windows for reactor trip should be grouped together within the demarcated area on Panel C.

3.1.21 All first-out annunciator windows for turbine generator trip should be grouped together within the demarcated area on Panel E.

3.1.22 All window tiles should be prioritized as follows:

Red	Level 1	Immediate operator action required.
Blue	Level 2	Prompt operator action required.
White	Level 3	Operator attention or action required only after level 1 and 2 alarms have been attended.

3.1.23 For window tile details, see Appendix B. Tiles are numbered 1 through 54, preceded by a panel alphabet. To prevent the possibility of interchanging tiles, all tiles are identified by unique location designators. (Examples: A7 is on Panel A, Row 1, Column 7; B23 is on Panel B, Row 3, Column 5.)

3.1.24 If an alarm window is deleted, its tile should be replaced by a blank tile.

3.1.25 This document does not provide guidance to modify or change the auditory alert system. Any changes to the auditory system require a human factors review.

CHECKLIST

ANNUNCIATOR SYSTEM

		Yes	No	Comment Number
1.	Is the window located close to its related instruments and controls?	[ ]	[ ]	[ ]
2.	Is the window grouped together with its associated subsystem alarm windows?	[ ]	[ ]	[ ]
3.	Has consideration been given to the use of a single window for a number of related alarm inputs from a single system?	[ ]	[ ]	[ ]
4.	If a multi-input alarm window has been used, has consideration been given to the need for reflash capability?	[ ]	[ ]	[ ]
5.	Are there four or less independent alarm inputs for each multi-input card?	[ ]	[ ]	[ ]
6.	Has consideration been given to provide alarm printout capability for multi-input annunciators?	[ ]	[ ]	[ ]
7.	Are alarms for shared plant systems located on panel X or displayed on both units?	[ ]	[ ]	[ ]
8.	Is the alarm window designed to be dim when the plant is operating normally to maintain a "dim board" concept?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
9. Is the annunciator circuit designed such that failure of annunciator circuit will not cause failure in the equipment associated with the alarm?	[ ]	[ ]	[ ]
10. Is the set point for initiating an alarm set such that frequency of annunciation is not considered a nuisance by the operator?	[ ]	[ ]	[ ]
11. Was the set point established to give operators adequate time to respond to the warning condition before a serious problem develops?	[ ]	[ ]	[ ]
12. If a general alarm is used, has sufficient time for auxiliary operator action and subsequent control room operator action been provided?	[ ]	[ ]	[ ]
13. Are first-out annunciator windows for reactor trip grouped together within the demarcated area of Panel C?	[ ]	[ ]	[ ]
14. Are first-out annunciator windows for turbine generator trip grouped together within the demarcated area on Panel E?	[ ]	[ ]	[ ]
15. Do level 1 windows, which require immediate operator action, have red window tiles?	[ ]	[ ]	[ ]
16. Do level 2 windows, which require prompt operator action, have blue window tiles?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
17. Do level 3 windows, which require operator action after level 1 and 2 alarms have been attended, have white window tiles?	[ ]	[ ]	[ ]
18. Do window tiles meet the requirements of Appendix A?	[ ]	[ ]	[ ]
19. Are all tiles identified by a unique location designator?	[ ]	[ ]	[ ]
20. If alarm window is deleted, is its tile replaced by a blank tile?	[ ]	[ ]	[ ]
21. Does the auditory alert system remain the same after this alarm change?	[ ]	[ ]	[ ]

3.2 METERS

3.2.1 Select the appropriate meter type for the intended application (see Exhibit 3.2-1).

3.2.2 The meter should be located in close proximity to its associated controls and annunciator.

3.2.3 The meter should give operators all parameter values in normal, abnormal, and emergency situations except for narrow range displays.

3.2.4 To prevent operator confusion, it is essential that the meter be identified as to whether it reflects demand or actual status.

3.2.5 To prevent interference with the readability of the meter, it is essential that there is no glare on the meter.

3.2.6 When the meter fails or becomes inoperative, the failure should be apparent to the operator (e.g., through off-scale indication).

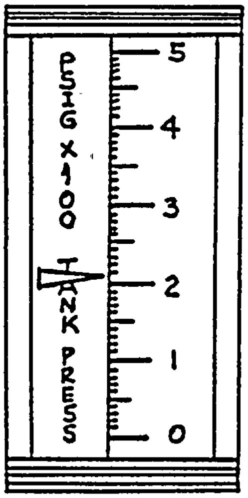
3.2.7 An identifying label should be installed on top of the meter. The label should carry the meter's tag number and its function. For label details, see Appendix E.

3.2.8 Meter scales should be graduated and numbered so that readings are related in a direct and practical way to the operator's task.

3.2.9 Scale units should be consistent with the degree of precision and accuracy needed by the operator.

3.2.10 All displays should indicate values in a form immediately usable by the operator without requiring conversion.

3.2.11 Percentage indication may be used when the parameter is meaningfully reflected by percentage.



MFG'R: Westinghouse

MODEL: VC252 and VX252

TYPE: Electronic

SIGNAL: 4-20 mA

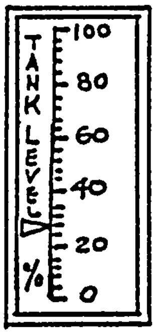
CLASS: 1E

DIMENSION: 2" x 6" high

COLOR: Black Bezel, White Scale,
Black Letters, Red Pointer

USE: All Process Indications

NOTE: Sigma 1151/1251 has been used interchangeably with Westinghouse 252's. Sigma 1151 is a qualified meter.



MFG'R: Bailey

MODEL: PS

TYPE: Pneumatic

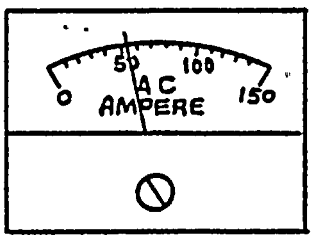
SIGNAL: 3-15 psig/3-27 psig

CLASS: Non-1E

DIMENSION: 1¼" x 4½" high

COLOR: Black Bezel, White Face,
Black Letters, Black Pointer

USE: Screen ΔP
Instrument Air Pressure
Condenser Vacuum
Secondary Loop Indication



MFG'R: Westinghouse or Weschlier

MODEL: GA332/WEC-9412E

TYPE: Electric

SIGNAL: 0-5 amps

CLASS: Non-1E

DIMENSION: 3" x 2" high nominal

COLOR: Black Bezel, White Scale,
Black Letters, Black Pointer

USE: Current Measurement of Large Motors

EXHIBIT 3.2-1: Meter Specification

3.2.12 Scale ranges may be expanded or contracted by multiplying or dividing indicated scale values by powers of ten. All such scales should be clearly marked as to whether the indicated value should be multiplied or divided, and the factor involved (e.g., 10, 100, 1000).

3.2.13 Scales for quantitative reading should contain graduations differing in length as shown in Exhibit 3.2-2.

3.2.14 No more than nine graduations should separate numerals. Major and minor graduations should be used if there are up to four graduations between numerals. Major, intermediate, and minor graduations should be used if there are five or more graduations between numerals.

3.2.15 Graduation heights as a function of viewing distance should be as indicated in Exhibit 3.2-3.

3.2.16 Unless a scale is truncated, successive values indicated by unit graduations should be one of those preferred series shown in Exhibit 3.2-4, or those values multiplied by some power of 10.

3.2.17 Logarithmic scales should be avoided unless needed to display a large range of values.

3.2.18 When two or more meters of the same parameter must be compared, scales should be compatible in numerical progression and scale organization.

3.2.19 Where positive and negative values are displayed around a zero or null position, the zero or null position should be located at the 12 o'clock position.

3.2.20 Character height should subtend a minimum visual angle of 15 minutes, or 0.004X viewing distance in feet. The preferred visual angle is 20 minutes, or 0.006X viewing distance.

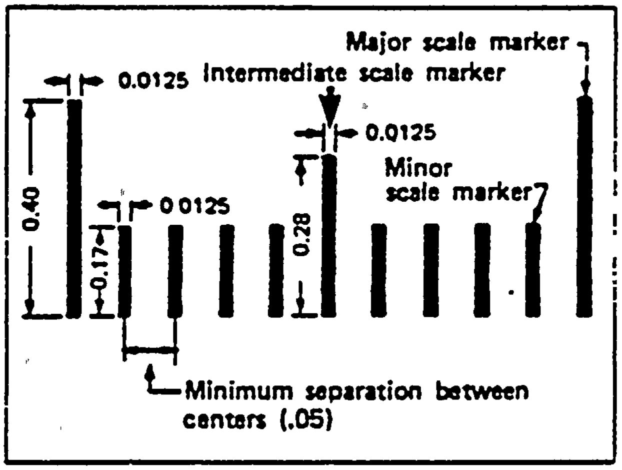


EXHIBIT 3.2-2: Meter Scale Details

VIEWING DISTANCE (feet)	INDEX HEIGHT (inches) MAJOR	INTERMEDIATE	MINOR
1½ or less	0.22	0.16	0.09
3 or less	0.40	0.28	0.17
6 or less	0.78	0.56	0.34
12 or less	1.57	1.12	0.65
20 or less	2.63	1.87	1.13

EXHIBIT 3.2-3: Meter Scale Graduation Heights

0	1	2	3	4	5	Preferred
0	5	10	15	20	25	Preferred
0	2	4	6	8	10	Acceptable
0	3	6	9	12	15	Acceptable
1	4	7	10	13	16	Poor

EXHIBIT 3.2-4: Meter Scale Numbering

3.2.21 Type style should be simple and consistent and characters should be uppercase letters.

3.2.22 Recommended dimensional characteristics of visual display characters and spacing are as follows:

- o Stroke-width-to-character-height ratio should be between 1:6 and 1:8.
- o Letter width-to-height ratios should be between 1:1 and 3:5.
- o Numeral width-to-height ratios should be 3:5.
- o Minimum space between characters should be one stroke wide.
- o Minimum space between words should be the width of one character.
- o Minimum space between lines should be one-half the character height.

3.2.23 Individual numbers and other information on a circular scale should always be vertical.

3.2.24 Besides scale markings and scale numbering, other brief printed material should be included on the face of the meter, such as identification of the displayed parameter, indication of the units shown, and indication of transformations required for reading (e.g., multiply by 10).

3.2.25 The needed message may be communicated by printing on the face of the meter or by an appropriate label adjacent to the meter.

3.2.26 Extraneous information not needed in using the meter should be avoided (e.g., manufacturer's trademark or address).

3.2.27 The message should be written as briefly as clarity permits.

3.2.28 Only standard manufacturer's abbreviations and commonly accepted abbreviations should be used.

3.2.29 The meter display should normally contain black markings on a white background.

3.2.30 For vertical meter scales, scale values should increase with upward movement of the meter pointer.

3.2.31 For circular meter scales, scale values should increase with clockwise movement of the meter pointer.

3.2.32 For horizontal straight scales, scale value should increase with pointer movement to the right.

3.2.33 Pointer tips should be of shapes and colors shown in Exhibit 3.2-1.

3.2.34 Pointer tips should be positioned to minimize concealment of scale graduation marks or numerals and should be close to the scale to avoid parallax errors.

3.2.35 Zone markings should be used to show the operational implications of various readings such as operating range, upper limits, lower limits, or danger zone. Exhibit 3.2-5 shows examples of desirable zone markings.

3.2.36 Careful consideration should be given in marking the zones. In many cases, the normal range increases as power increases. Following a plant trip most parameters will read differently, probably lower, and may reach out-of-tolerance coded band ranges. The relationship between annunciator alarm set points and meter band range should also be

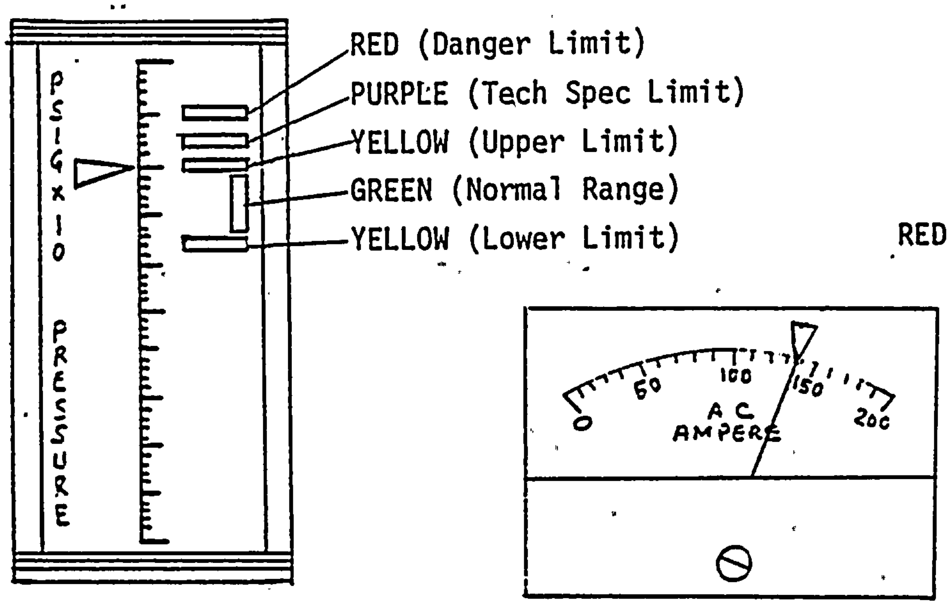


EXHIBIT 3.2-5: Meter Zone Markings

evaluated. The best approach is to initially apply the green/normal band. Other zone bands will be applied at a later date as use definitions are established. The bands are to be adjusted with operating experience.

3.2.37 Zone markings should be conspicuous and distinctively different for different zones.

3.2.38 Zone markings should not interfere with readings on the face of the scale.

3.2.39 Zone markings should be designed for clear visibility for the planned viewing distance.

CHECKLIST

METERS

		Yes	No	Comment Number
1.	Has the appropriate meter been selected for the intended application?	[ ]	[ ]	[ ]
2.	Has the location of the meter been chosen?	[ ]	[ ]	[ ]
3.	Is the meter located close to its associated controls and annunciator windows?	[ ]	[ ]	[ ]
4.	Does the meter have the required range to display parameter values in normal, abnormal, and emergency situations?	[ ]	[ ]	[ ]
5.	Is it clearly identified whether the meter display reflects demand or actual status?	[ ]	[ ]	[ ]
6.	Is there any glare displayed on the meter?	[ ]	[ ]	[ ]
7.	Is it apparent to the operator when the meter fails or becomes inoperative?	[ ]	[ ]	[ ]
8.	Is the meter adequately identified by a label?	[ ]	[ ]	[ ]
9.	Does the label conform to the specifications under Appendix E?	[ ]	[ ]	[ ]
10.	Is the meter scale graduated and numbered so that readings are related in a direct and practical way to the operator's task?	[ ]	[ ]	[ ]

		Yes	No	Comment Number
11.	Are scale units consistent with the degree of precision and accuracy needed by the operator?	[ ]	[ ]	[ ]
12.	Are scale displays immediately usable by the operator without requiring conversion?	[ ]	[ ]	[ ]
13.	Has a percentage scale been considered for this application?	[ ]	[ ]	[ ]
14.	Has an expanded or contracted scale range been considered?	[ ]	[ ]	[ ]
15.	If an expanded or contracted scale range is used, is the multiplier clearly indicated on the scale?	[ ]	[ ]	[ ]
16.	Do scale graduations conform to the guidelines in Exhibits 3.2-2 and 3.2-3?	[ ]	[ ]	[ ]
17.	For an untruncated scale, do successive values conform with one of the preferred number series in Exhibit 3.2-4?	[ ]	[ ]	[ ]
18.	For a large range of values, have logarithmic scales been considered?	[ ]	[ ]	[ ]
19.	If two or more meters of the same parameter must be compared, are scales compatible in numerical progression and scale organization?	[ ]	[ ]	[ ]
20.	Where positive and negative values are displayed around a zero or null position, is the zero or null position located at the 12 o'clock position?	[ ]	[ ]	[ ]
21.	Does character height subtend a minimum visual angle of 15 minutes or 0.004X viewing distance?	[ ]	[ ]	[ ]
22.	Is the type style simple, consistent, and in uppercase letters?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
23. Do dimensional characteristics of visual display characters and spacing conform with the guidelines in paragraph 3.2.22?	[ ]	[ ]	[ ]
24. For a circular scale, are individual numbers and other information printed vertically?	[ ]	[ ]	[ ]
25. Does the face of the meter include all information required by the operator?	[ ]	[ ]	[ ]
26. If additional information is needed and cannot be accommodated on the meter face, has a separate label been provided alongside the meter?	[ ]	[ ]	[ ]
27. Are the messages written on the meter face and the label brief and clear?	[ ]	[ ]	[ ]
28. Has all extraneous information been removed from the meter?	[ ]	[ ]	[ ]
29. Do abbreviations and acronyms used conform to standards in Appendix F?	[ ]	[ ]	[ ]
30. Do meter displays contain black markings on a white background?	[ ]	[ ]	[ ]
31. For vertical meter scales, do scale values increase with upward movement of the meter pointer?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
32. For circular meter scales, do scale values increase with clockwise movement of the meter pointers?	[ ]	[ ]	[ ]
33. For horizontal meter scales, do scale values increase with pointer movement to the right?	[ ]	[ ]	[ ]
34. Does meter pointer tip conform to the shape and color shown in Exhibit 3.2-1?	[ ]	[ ]	[ ]
35. Does the pointer tip interfere with scale graduation marks or numbers?	[ ]	[ ]	[ ]
36. Is the pointer tip located close to the face of the scale to avoid parallax errors?	[ ]	[ ]	[ ]
37. Are zone markings applied in accordance with the guidelines in paragraphs 3.2.35 through 3.2.39?	[ ]	[ ]	[ ]

3.3 RECORDERS

3.3.1 Select the appropriate recorder type for the intended application (see Exhibit 3.3-1).

3.3.2 The recorder should be located within the primary operating area, near its associated controls and annunciation, rather than on back panels.

3.3.3 Pens, inks, and paper should be of a quality to provide clear, distinct, and reliable marking.

3.3.4 Scales printed on the recording paper should be the same as the scales shown on the recorder.

3.3.5 An identifying label should be installed on top of the recorder. For label details, see Appendix E.

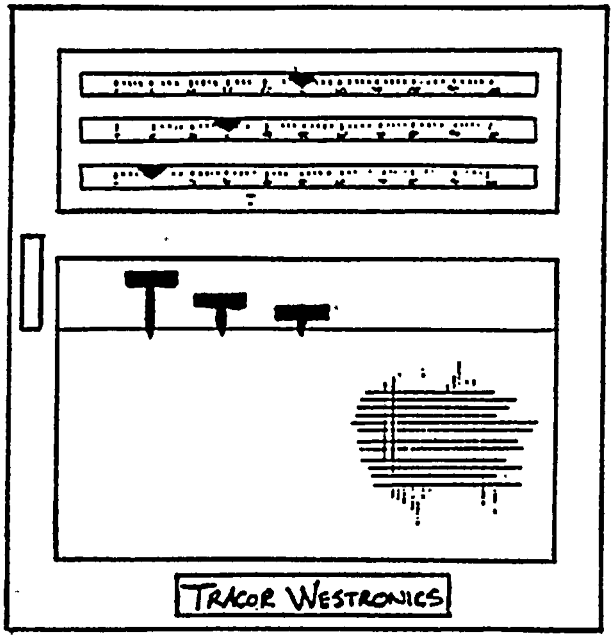
3.3.6 Recorder scales should be graduated and numbered so that readings are related in a direct and practical way to the operator's task.

3.3.7 Scale units should be consistent with the degree of precision and accuracy needed by the operator.

3.3.8 Scales for quantitative reading should contain graduations differing in length, as shown in Exhibit 3.2-2.

3.3.9 Graduation heights as a function of viewing distance should be as indicated in Exhibit 3.2-3.

3.3.10 No more than nine graduations should separate numerals. Major and minor graduations should be used if there are up to four graduations between numerals. Major, intermediate, and minor graduations should be used if there are five or more graduations between numerals.



MFG'R: Tracor Westronics

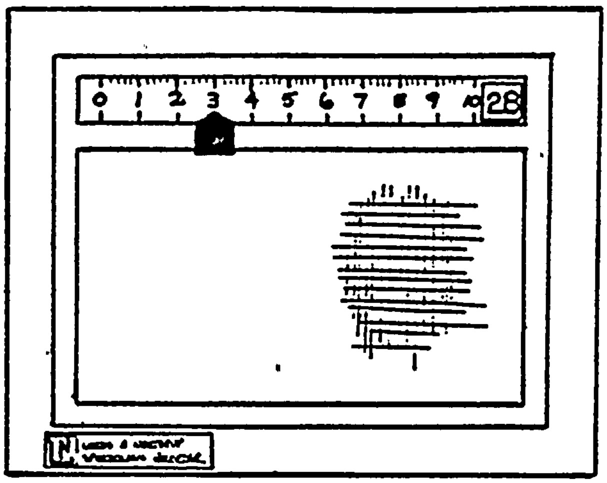
MODEL: S4E (1 Pen)
D4E (2 Pen)
T4E (3 Pen)

DIMENSION: 6.8" x 6.8"

PENS: Up to 3 Pens

POINTERS: As Shown

USE: Pressurizer Pressure
Pressurizer Level
RCS T Avg
Steam Generator Flows and Levels
RCS Cold Leg Temperature
RCS Hot Leg Temperature



MFG'R: Leeds & Northrop

MODEL: Speedomax 165 Series
Speedomax 250 Series

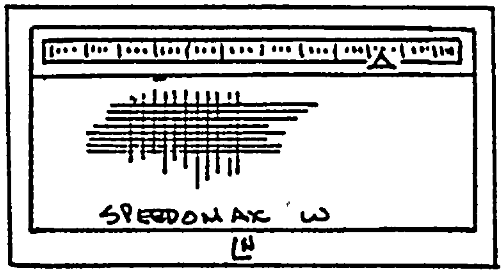
DIMENSION: 13-1/2" x 12-7/32" (165 Series)
16-27/32" x 12-7/32" (250 Series)

CHANNELS: 2 to 15 Points (165 Series)
2 to 30 Points (250 Series)

POINTER: As Shown

USE: RCP Bearing Temperature
Charcoal Filter Temperature
RCP Vibration
Turbine Vibration
Turbine Valve Positions

EXHIBIT 3.3-1: Recorder Specifications



MFG'R: Leeds & Northrop

MODEL: Speedomax W

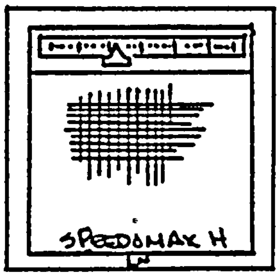
DIMENSION: 15" x 12"

CHANNELS: Up to 24 Points

POINTER: As Shown

USE: Turbine Lube Oil Temperature
Turbine Metal Temperature
Containment Cooling System Temperature
Transformer/Generator Temperature
Circulating Water Temperature

*Replaced by Speedomax 250 Series



MFG'R: Leeds & Northrop

MODEL: Speedomax H

DIMENSION: 11" x 12"

CHANNELS: Up to 12 Points

POINTER: As Shown

USE: Reheat Steam Temperature
Turbine Thrust Bearing Temperature

*Replaced by Speedomax 165 Series

EXHIBIT 3.3-1: (Continued)

3.3.11 Unless a scale is truncated, successive values indicated by unit graduations should be one of those preferred series shown in Exhibit 3.2-4, or those values multiplied by some power of 10. All such scales should be clearly marked as to the multiplication factor involved (e.g., 10, 100, 1000).

3.3.12 Logarithmic scales should be avoided unless needed to display a large range of values.

3.3.13 A take-up spool should be provided to receive completed recordings.

3.3.14 A means should be provided for tearing off completed recordings for storage.

3.3.15 Paper, ink, and other operator-maintained expendables should be provided and accessible in the control room.

3.3.16 Recorder design should permit quick and easy replenishment of paper and ink.

3.3.17 High paper speed option should be provided to run out records for detachment.

3.3.18 A selection of slower speeds should be provided to permit adjustment of the time scale so that rate-of-change information can be indicated.

3.3.19 It should be convenient to annotate recordings with date and time markings, with paper speed if varied from normal, with parameter identification, or any other relevant information.

3.3.20 Recorder design should ensure that all data will be visible through the window of the recorder and not require open-door operation to expose it.

3.3.21 Provisions should be made to avoid glare and reflections from window coverings.

3.3.22 For continuous recorders, labels should identify the parameters recorded. With multi-pen recorders, parameters should be listed in order of the associated pens of the recorder.

3.3.23 For continuous recorders, each pen should use a different colored ink to permit channel identification from line color. Colors selected should be distinctly different and should afford good contrast with the paper.

3.3.24 For continuous recorders, critical points that must be observed while recordings are being made should not be obscured by the pen assembly arm or other hardware.

3.3.25 For discrete recorders, the recorder should not be loaded beyond its designed channel capacity because this complicates the analysis and prolongs the sampling cycle time.

3.3.26 For discrete recorders, the recorder should be equipped to display in an easily viewed manner the channel being plotted.

3.3.27 For discrete recorders, the number-printing mechanism should be designed and maintained to provide clear, sharp, and small numbering to avoid crowding of data and consequent analysis problems.

3.3.28 For discrete recorders, provision should be made to select any single channel for immediate display without awaiting completion of the sampling cycle.

CHECKLIST

RECORDERS

		Yes	No	Comment Number
1.	Has the appropriate recorder been selected for the intended application?	[ ]	[ ]	[ ]
2.	Is the recorder located within the primary operating area?	[ ]	[ ]	[ ]
3.	Is the recorder located near its associated instrumentation, controls, and annunciation?	[ ]	[ ]	[ ]
4.	Do pens, inks, and paper provide clear, distinct, and reliable marking?	[ ]	[ ]	[ ]
5.	Is the scale printed on the recording paper the same as the scale shown on the recorder?	[ ]	[ ]	[ ]
6.	Does the label conform with specifications in Appendix E?	[ ]	[ ]	[ ]
7.	Is the recorder scale graduated and numbered so that the readings are related in a direct and practical way to the operator's task?	[ ]	[ ]	[ ]
8.	Are scale units consistent with the degree of precision and accuracy needed by the operator?	[ ]	[ ]	[ ]
9.	Do scale graduations conform to guidelines in Exhibits 3.2-2 and 3.2-3?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
10. For an untruncated scale, do successive values conform with one of the preferred number series in Exhibit 3.2-4?	[ ]	[ ]	[ ]
11. For a larger range of values, was a logarithmic scale considered?	[ ]	[ ]	[ ]
12. Has a take-up spool been provided to receive completed recordings?	[ ]	[ ]	[ ]
13. Is there a means for tearing off completed recordings for storage?	[ ]	[ ]	[ ]
14. Are paper, ink, and other operator-maintained expendables provided and accessible in the control room?	[ ]	[ ]	[ ]
15. Does recorder design permit quick and easy replenishment of paper and ink?	[ ]	[ ]	[ ]
16. Has a high paper speed option been provided?	[ ]	[ ]	[ ]
17. Has a selection of slower speeds been provided?	[ ]	[ ]	[ ]
18. Is it convenient to annotate recordings with date and time markings, with paper speed if varied from normal, with parameter identification, or any other relevant information?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
19. Is recorder designed such that all data will be visible through the window of the recorder and not require open-door operation to expose it?	[ ]	[ ]	[ ]
20. Have provisions been made to avoid glare and reflections from window coverings?	[ ]	[ ]	[ ]
21. For a continuous recorder, is there a label(s) to identify the parameter(s) recorded?	[ ]	[ ]	[ ]
22. For a continuous multi-pen recorder, are parameters listed in order of the associated pens of the recorders?	[ ]	[ ]	[ ]
23. For a continuous multi-pen recorder, does each pen use a distinctly different colored ink, that affords good contrast with the paper?	[ ]	[ ]	[ ]
24. For a continuous recorder, are critical points that must be observed while recordings are being made obscured by the pen assembly arm or other hardware?	[ ]	[ ]	[ ]
25. For a discrete recorder, is the recorder loaded within its designed channel capacity?	[ ]	[ ]	[ ]
26. For a discrete recorder, is the recorder equipped to display in an easily viewed manner the channel being plotted?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
27. For a discrete recorder, is the number-printing mechanism designed and maintained to provide clear, sharp, and small numbering?	[ ]	[ ]	[ ]
28. For a discrete recorder, is there a provision to select any single channel for immediate display without awaiting completion of the sampling cycle?	[ ]	[ ]	[ ]

3.4 CONTROLLERS

3.4.1 Select the appropriate controller type for the intended application (see Exhibit 3.4-1).

3.4.2 The controller should be located near its associated instrumentation and annunciation.

3.4.3 An identifying label should be installed on top of the controller. For label details, see Appendix E.

3.4.4 Knobs should be round in shape with knurled or serrated edges.

3.4.5 Fingertip grasp knobs should conform to the following dimensions:

Height
Minimum 0.5 in. (13 mm)
Maximum 1.0 in. (25 mm)

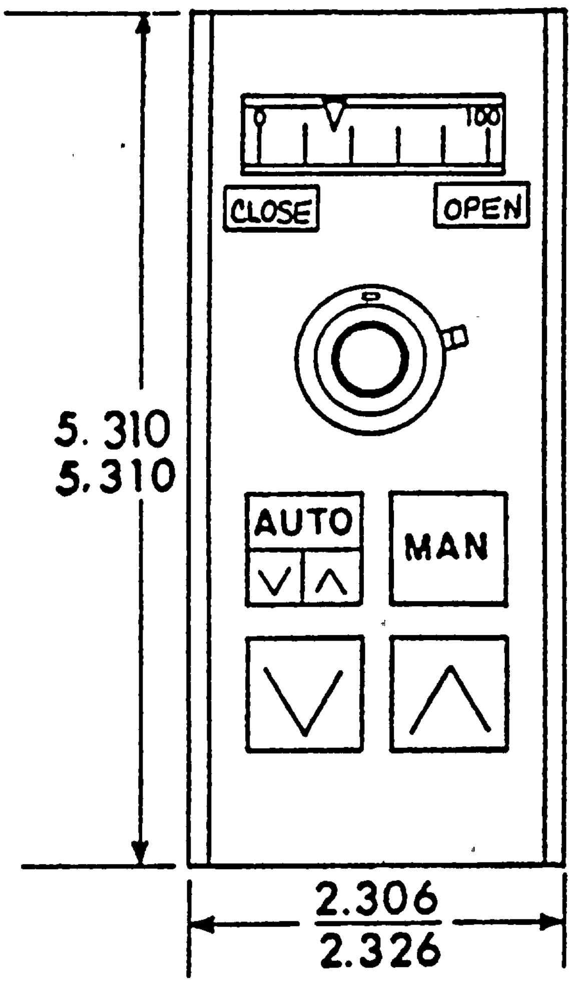
Diameter
Minimum 0.375 in. (10 mm)
Maximum 4.0 in. (100 mm)

3.4.6 Thumb and forefinger encircled knobs should conform to the following dimensions:

Diameter
Minimum 1.0 in. (25 mm)
Maximum 3.0 in. (75 mm)

3.4.7 Knob torque should be within the range of 4.5 to 6.0 in.-oz. (32 to 42 mN-m).

3.4.8 Controller should have multiturn potentiometer for bias or set point adjustment for AUTO/MAN (full station) controller and manual control for MAN (half station) controller.



MFG'R: Westinghouse-Hagan

MODEL: 102

TYPE: Hagan Powr Mag
Control Station - Full Station

SIGNAL: 4-20 mA

CLASS: 1E

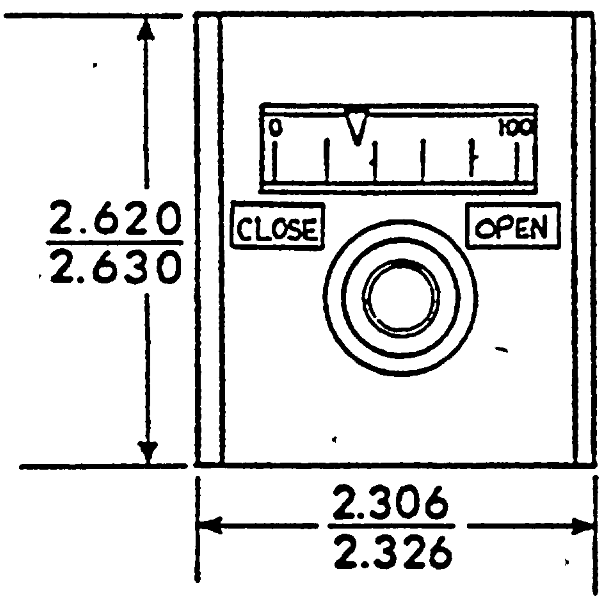
DIMENSION: As Shown

POINTER: As Shown

USE: Process Control
Manual-Auto Station

FINISH: Black Face, White Dial,
Black Lettering, Red Pointer,
Chrome Knob

CONVENTION: Turning Control Knob clockwise, Meter Pointer moves right and Valve opens wider.



MFG'R: Westinghouse-Hagan

MODEL: 102

TYPE: Hagan Powr Mag, Control Station
Half Station with Potentiometer

SIGNAL: 4-20 mA

CLASS: 1E

DIMENSION: As Shown

POINTER: As Shown in Red

USE: Valve Control - Manual

FINISH: Black Face, White Dial,
Black Lettering, Chrome Knob

CONVENTION: Same as Above

EXHIBIT 3.4-1: Controller Specification

3.4.9 Controller should have meter to indicate 0 to 100 percent drive position.

3.4.10 Scale units should be consistent with the degree of precision and accuracy needed by the operator.

3.4.11 Scale value should increase with pointer movement to the right. Scale series should be as follows: 0 20 40 60 80 100.

3.4.12 Pointer tip should be positioned to minimize concealment of scale graduation marks or numbers and should be close to the scale to avoid parallax errors.

3.4.13 The meter display normally should have black markings on a white background.

3.4.14 Scales should contain graduations of differing lengths as shown in Exhibit 3.2-2.

3.4.15 No more than nine graduations should separate numerals. Major and minor graduations should be used if there are up to four graduations between numerals. Major, intermediate, and minor graduations should be used if there are five or more graduations between numerals.

3.4.16 Graduation height as a function of viewing distance should be as indicated in Exhibit 3.2-3.

3.4.17 To prevent interference with readability of the meter, it is essential that there is no glare on the meter.

3.4.18 Turning the potentiometer clockwise should move the meter pointer to the right and the valve should open wider. Turning the potentiometer counterclockwise should move the meter pointer to the left and the valve should close.

3.4.19 The half station controller should be used for valves that require only manual control. These controllers consist of a 0 to 100 percent indication meter and potentiometer only.

3.4.20 The full station controller should be used where both manual and automatic control are desired.

3.4.21 The full station controller should include the following features:

- o 0 to 100 percent indication meter.
- o Lighted, colored pushbuttons to indicate operating modes and system conditions.
- o Bumpless transfer to allow the operator to switch automatic to manual mode or manual to automatic mode without first balancing the system.
- o Increase and decrease pushbuttons for manual control.
- o An electronic comparator to compare the demand with the actual position. The output of the comparator goes to the lights to indicate whether the increase or decrease button should be depressed to balance the position demand and actual position signals.
- o A safety interlock to ensure that no component damage or system unbalance occurs if the increase and decrease buttons are pressed simultaneously.
- o Indication that upper or lower limits have been reached (i.e., valve is fully open or fully closed).
- o Indication to show valve motor overload.

CHECKLIST

CONTROLLERS

		Yes	No	Comment Number
1.	Has the appropriate controller been selected for its intended application?	[ ]	[ ]	[ ]
2.	Is the controller located near its associated instrumentation and annunciation?	[ ]	[ ]	[ ]
3.	Has an identifying label been installed on top of the recorder in accordance with Appendix E?	[ ]	[ ]	[ ]
4.	Are knobs round in shape, with knurled or serrated edges?	[ ]	[ ]	[ ]
5.	Do fingertip knobs conform to the indicated dimensions?	[ ]	[ ]	[ ]
6.	Do thumb and forefinger knobs conform to the indicated dimensions?	[ ]	[ ]	[ ]
7.	Is knob torque within the range of 4.5 to 6.0 in.-oz?	[ ]	[ ]	[ ]
8.	Does controller contain a multiturn potentiometer?	[ ]	[ ]	[ ]
9.	Does controller contain a meter to indicate 0 to 100 percent drive position?	[ ]	[ ]	[ ]
10.	Is the meter display black markings on a white background?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
11. Are scale units consistent with the degree of precision and accuracy needed by the operator?	[ ]	[ ]	[ ]
12. Does scale value increase with pointer movement to the right?	[ ]	[ ]	[ ]
13. Is scale series as indicated?	[ ]	[ ]	[ ]
14. Is pointer tip positioned to minimize concealment of scale graduation marks or numerals?	[ ]	[ ]	[ ]
15. Is pointer close to scale to avoid parallax errors?	[ ]	[ ]	[ ]
16. Does meter contain graduations of differing lengths as shown in Exhibit 3.2-2?	[ ]	[ ]	[ ]
17. Are there fewer than nine graduations separating numerals?	[ ]	[ ]	[ ]
18. Are major and minor graduations used if there are up to four graduations between numerals?	[ ]	[ ]	[ ]
19. Are major, intermediate, and minor graduations used if there are five or more graduations between numerals?	[ ]	[ ]	[ ]
20. Is the height of graduations a function of viewing distance as indicated in Exhibit 3.2-3?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
21. Has the controller been placed to avoid glare on its meter?	[ ]	[ ]	[ ]
22. When turning the potentiometer clockwise, does the meter pointer move to the right and the valve open wider?	[ ]	[ ]	[ ]
23. When turning the potentiometer counterclockwise, does the meter pointer move to the left and the valve close?	[ ]	[ ]	[ ]
24. If the valve required only manual control, was a half station used?	[ ]	[ ]	[ ]
25. If the valve required automatic and manual control, was a full station used?	[ ]	[ ]	[ ]
26. Does the half station controller consist of a 0 to 100 percent indication meter and potentiometer only, as shown in Exhibit 3.4-1?	[ ]	[ ]	[ ]
27. Does the full station controller contain a 0 to 100 percent indication meter?	[ ]	[ ]	[ ]
28. Does the full station controller have lighted, colored pushbuttons to indicate operating modes and system conditions?	[ ]	[ ]	[ ]
29. Does the full station controller possess a bumpless transfer for switching between automatic and manual modes?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
30. Does the full station controller have increase and decrease pushbuttons?	[ ]	[ ]	[ ]
31. Does the full station controller have an electronic comparator to compare the difference between demand and actual position?	[ ]	[ ]	[ ]
32. Is the output of the comparator indicated on the controller to show if the increase or decrease button should be pressed to balance actual and demand position signals?	[ ]	[ ]	[ ]
33. Does the full station controller contain a safety interlock for protection in the event that the increase and decrease buttons are pushed simultaneously?	[ ]	[ ]	[ ]
34. Does the full station controller indicate when upper and lower limits have been reached?	[ ]	[ ]	[ ]
35. Does the full station controller have indication to show valve motor overload?	[ ]	[ ]	[ ]

3.5 STATUS INDICATORS

3.5.1 System/equipment status should be given by illuminated status indicators (indicator lights or legend lights).

3.5.2 Indicator lights are used to show equipment status, not control position.

3.5.3 Legend lights are used to signal critical conditions.

3.5.4 Indicator lights and legend lights should not be used in lieu of alarm functions.

3.5.5 Select the appropriate indicator light or legend light for the intended application (see Exhibit 3.5-1).

3.5.6 If the light is associated with a control device or a system, it should be located close to the device or its system displays and controls.

3.5.7 Where the meaning is not apparent, labeling must be provided close to the indicator light to explain the message intended by its glowing.

3.5.8 The cover of the indicator light should conform to the following criteria:

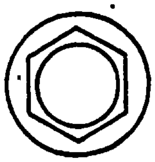
Red: Danger, valve open, motor running, breaker closed.

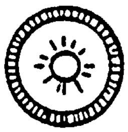
Green: Safe, valve closed, motor stopped, breaker open.

Amber: Caution, breaker trip.

Blue: Lockout resets (underfrequency generator, diesel generator, startup transformer)

White: General status.





MFG'R: Westinghouse Minalite.

MODEL: 33B0745G Series

TYPE: Minalite

DIMENSION: 3/4" Dia.

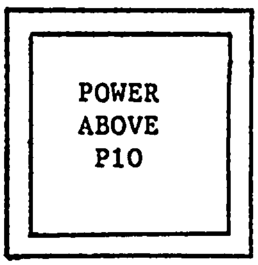
USE: Equipment/System Status

LAMP BULB: One White

LENS COLOR: Red, Green, Amber, Blue, White

NOTE: Westinghouse EZC Minalite, Style 449D187G Series is used interchangeably with the above.

Dimension: .930" Dia.



MFG'R: Microswitch

MODEL: CMC

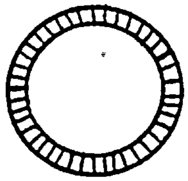
DIMENSION: 2-1/8" x 2-1/8"

USE: System Status

LAMP BULB: Four White

LENS COLOR: White Tile on Grey Frame

EXHIBIT 3.5-1: Status Indicator Specifications



MFG'R: General Electric

MODEL: ET-16

DIMENSION: 7/8" Dia.

USE: Equipment/System Status

LAMP BULB: One White

LENS COLOR: Red, Green, Amber, Blue, White

EXHIBIT 3.5-1: (Continued)

3.5.9 The color of indicator lights should be clearly identifiable.

3.5.10 The color of the legend light cover should be white with black engraved lettering.

3.5.11 The light intensity of the illuminated indicator or legend lights should be at least 10 percent greater than the surrounding panel.

3.5.12 For legend lights, legends should be legible under ambient illumination with lights off.

3.5.13 Legend lettering should conform to the following guidelines:

- No more than four lines per tile
- No more than eight characters per line
- Character height: 5/16"
- Character width: 3/16"
- Stroke width: 1/16"
- Space between lines: 3/16"
- Space between words: 1 character

3.5.14 Legend design should be simple and consistent throughout the control room.

3.5.15 Text should be short, concise, and unambiguous.

3.5.16 Abbreviations and acronyms should be standard (see Appendix F).

3.5.17 Legend lights should be distinguishable from legend pushbutton switches.

3.5.18 Legend light covers should be keyed to prevent the possibility of interchanging the covers.

3.5.19 Lamp test capability should be provided to quickly identify burned out lamp bulbs unless this can be verified otherwise.

3.5.20 When an item of shared equipment is operated from one unit, a status display should be provided in the other unit which could potentially control this equipment (Example: safety injection pumps).

CHECKLIST

STATUS INDICATORS

		Yes	No	Comment Number
1.	Has the appropriate status indicator been selected for the intended application? (Exhibit 3.5-1)	[ ]	[ ]	[ ]
2.	Has the location of the light on the panel been decided?	[ ]	[ ]	[ ]
3.	Is there sufficient panel space for the light and its associated controls and instruments?	[ ]	[ ]	[ ]
4.	Has it been determined that the light is not used for an alarm function?	[ ]	[ ]	[ ]
5.	Is the light located in close proximity to its related controls and instruments?	[ ]	[ ]	[ ]
6.	If a label is desirable for clarity, has a label been provided?	[ ]	[ ]	[ ]
7.	Does the color of the indicator light cover conform to the criteria in Section 3.5.8?	[ ]	[ ]	[ ]
8.	Is illumination of the light at least 10 percent greater in light intensity than the surrounding panel?	[ ]	[ ]	[ ]
9.	Is the legend legible under ambient illumination with lights off?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
10. Is the legend light cover white with engraved characters in black?	[ ]	[ ]	[ ]
11. Is the legend lettering in conformance with the guidelines stipulated in Section 3.5.13?	[ ]	[ ]	[ ]
12. Do the abbreviations and acronyms used conform to standards in Appendix F?	[ ]	[ ]	[ ]
13. Are legend light covers keyed to prevent the possibility of interchanging the covers?	[ ]	[ ]	[ ]
14. Has lamp test capability been provided to quickly identify burned out lamps?	[ ]	[ ]	[ ]
15. For a shared device by the two units, are status lights provided for on both units?	[ ]	[ ]	[ ]

3.6 CONTROL SWITCHES

3.6.1 Standard switches to be used on PTN Units 3 & 4 main control boards are shown in Exhibit 3.6-1.

3.6.2 Select the appropriate switch for the intended application. Consider panel space for the switch and its associated controls and instrumentation.

3.6.3 The switch is to conform to operator expectations, matching other controls for similar functions, and generally conforming to conventional practice throughout the control room.

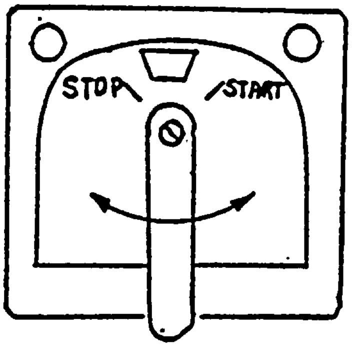
3.6.4 Control switches should be located so as not to be inadvertently actuated.

3.6.5 For protective purposes, a switch may be recessed, shielded, or otherwise surrounded by physical barriers. It may be covered or guarded with movable barriers. When the guard is in the open position, it should not interfere with the operation of the guarded control or other adjacent controls. For movable covers or guards, no safety or lock wires are to be used.

3.6.6 Control switches should be located so that they may be easily related to functions and functional groupings with respect to associated instruments and annunciators.

3.6.7 Control switches should be properly identified by device tag numbers, functions, on-off-auto-lock out or other discrete functional control positions, either on the switch itself, on its escutcheon, or on a separate label affixed on top of the switch.

3.6.8 Rotating the knob controls for different types of control functions should be distinguishable by sight and touch in accordance with standards delineated in Exhibit 3.6-1.



MFG'R: Electroswitch

MODEL: 24 Series

TYPE: Rotary

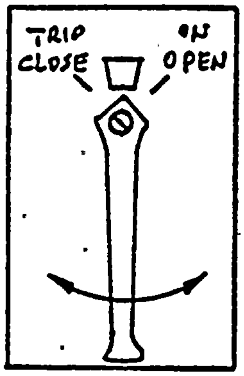
DIMENSION: 2.81" x 2.91" high

HANDLE: J-Handle/Pistol Grip
Round-notched
Oval

FINISH: Black Matte

USE: Breaker Control
Large Motors
Ammeter/Voltmeter Select

CLASS: 1E



MFG'R: Westinghouse

MODEL: W-2

TYPE: Rotary

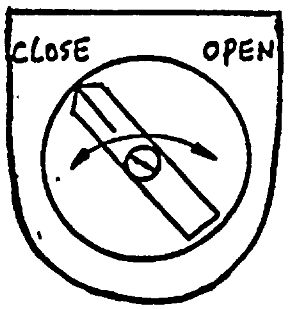
DIMENSION: 2¼" x 3" high

HANDLE: J-Handle
Oval

FINISH: White with Black Handle

USE: Mode Selector
Large and Small Motors
Large Valves
Breakers

CLASS: 1E



MFG'R: Westinghouse

MODEL: OT2

TYPE: Rotary

DIMENSION: 1 inch diameter

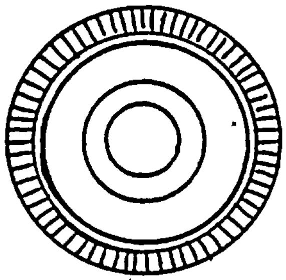
HANDLE: J-Handle
Straight Knob

FINISH: Chrome with Red Pointer

USE: Valve Control

CLASS: 1E

EXHIBIT 3.6-1: Control Switch Specifications



MFG'R: Westinghouse

MODEL: 0T2

TYPE: Pushbutton

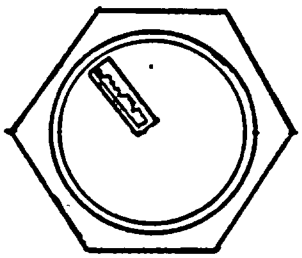
DIMENSION: 1¼ inch diameter

OPERATOR: OT2B1

FINISH: Black or Red

USE: Quick Actuation:
Red - Safety System Initiation
Black - Safety System Reset;
Annunciator Reset,
Acknowledge, Silence

CLASS: Non-1E



MFG'R: General Electric

MODEL: CR2940/CR104P

TYPE: Key-operated Rotary

DIMENSION: 1¼ inch diameter

OPERATOR: Key

FINISH: Stainless Steel Natural

USE: Vents to ATM, Przr. Vent,
Vessel Head Vent, Sample Drain/Fill

NOT TO BE USED IN EMERGENCY SITUATIONS OR IN TIME CONSTRAINED CONDITIONS OR WHERE FREQUENT OPERATORS ARE REQUIRED

CLASS: 1E

EXHIBIT 3.6-1: (Continued)

3.6.9 Color coding should be uniform throughout the control boards.

3.6.10 The rotary selector switch is to have the exact number of positions for the intended application. There should be no unused positions. Numbers indicating positions should increase in a clockwise direction.

3.6.11 Rotary control movements should conform to the following convention:

- Right (clockwise): start, breaker closed, valve open
- Left (counterclockwise): stop, breaker tripped, valve closed
- Center (spring-return): auto, last position achieved, off
- Selected position: selected function

3.6.12 Indicator lights associated with rotary switches should be placed on top of the switch above the label. Green lights should be placed on the left; red on the right; and amber or white, if used, in the middle. Indicator lights should indicate equipment state and not control position. For indicator light specifics, see Exhibit 3.5-1.

3.6.13 Pushbuttons in a row or matrix should be positioned in a logical order, or in an order related to the procedural sequence.

3.6.14 Legend pushbuttons should be readily distinguishable from legend lights. The legend should be clearly readable under ambient light conditions, with or without internal illumination. The legend message should be specific. It should contain no more than three lines of lettering. The engraved message should conform with standard abbreviations and acronyms (see Appendix F).

3.6.15 The lamp test feature should be provided to quickly identify burned out lamp bulbs, unless this can be verified otherwise.

3.6.16 Legend covers should be keyed to prevent the possibility of interchanging the covers.

3.6.17 Barriers should be used when legend pushbuttons are continuous. Barriers should have rounded edges.

3.6.18 Key-operated controls are installed as a precaution against inadvertent use. See Exhibit 3.6-1 for specifics.

3.6.19 Keys with a single row of teeth should be inserted into the lock with the teeth pointing up or forward. If keys have teeth on both edges, they should fit the lock with either side up or forward.

3.6.20 Locks should be oriented so that the switch is OFF (or safe) when the key is in the vertical position. The key should be removable at this position only. Control positions should be correctly labeled.

CHECKLIST

CONTROL SWITCHES

	Yes	No	Comment Number
1. Has the proper switch been selected for the intended application? (Exhibit 3.6-1)	[ ]	[ ]	[ ]
2. Has the location of the switch on the panel been decided?	[ ]	[ ]	[ ]
3. Is there sufficient panel space for the switch and its associated controls and instruments?	[ ]	[ ]	[ ]
4. Is the switch location compatible with its functionality?	[ ]	[ ]	[ ]
5. Is the switch located close to its associated instruments and annunciators?	[ ]	[ ]	[ ]
6. Is the switch location adequate to prevent inadvertent actuation?	[ ]	[ ]	[ ]
7. If inadvertent actuation could occur, have protective shields or barriers been provided?	[ ]	[ ]	[ ]
8. For a selector switch, does it have the exact number of positions for its intended application?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
9. For a rotary control switch, does its movement conform to the standard convention under paragraph 3.6.11?	[ ]	[ ]	[ ]
10. Has the switch been equipped with the proper type of knob/handle?	[ ]	[ ]	[ ]
11. For pushbutton switches, are they arranged in some logical sequence?	[ ]	[ ]	[ ]
12. Are legend pushbuttons readily distinguishable from legend lights?	[ ]	[ ]	[ ]
13. Is the legend clearly readable under ambient light conditions?	[ ]	[ ]	[ ]
14. Is the legend message specific and clear?	[ ]	[ ]	[ ]
15. Are legend covers keyed to prevent the possibility of interchanging the covers?	[ ]	[ ]	[ ]
16. For continuous legend pushbuttons, are barriers provided?	[ ]	[ ]	[ ]
17. For key-operated switches, are they position-oriented so that key is inserted with teeth up when switch is off?	[ ]	[ ]	[ ]
18. Are indicator lights associated with a rotary switch located in the correct location with respect to the switch?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
19. Are the indicator lights indicating equipment status rather than switch position?	[ ]	[ ]	[ ]
20. Has a lamp test feature been provided?	[ ]	[ ]	[ ]

3.7 VENDOR MODULES

3.7.1 The following is a list of vendor modules installed in the MCB:

MODULE DESCRIPTION	DESIGNATION	LOCATION	VENDOR
SPDS Keyboard	-	3C01	TEC
SPDS CRT	-	3C03	RAMTEK
Annunciator Alarm Panel	Panel A	3C03	Beta Corporation
Annunciator Alarm Panel.	Panel B	3C03	Beta Corporation
Annunciator Alarm Panel	Panel C	3C03	Beta Corporation
Annunciator Alarm Panel	Panel D	3C04	Beta Corporation
Annunciator Alarm Panel	Panel E	3C04	Beta Corporation
Annunciator Alarm Panel	Panel F	3C04	Beta Corporation
Generator Core Hydrogen Monitor	ME	3C04	Gulton Industries, Inc.
Annunciator Alarm Panel	Panel I	3C05	Beta Corporation
Annunciator Alarm Panel	Panel J	3C05	Beta Corporation
Status Light Panel	JA	3C05	Westinghouse
Status Light Panel	KA	3C05	Westinghouse
Status Light Panel	LA	3C05	Westinghouse
Annunciator Alarm Panel	Panel G	3C06	Beta Corporation
Annunciator Alarm Panel	Panel H	3C06	Beta Corporation
QSPDS Plasma Display	-	3C06	CE
QSPDS Page Control Module	-	3C06	CE
SPDS Keyboard	-	4C01	TEC
SPDS CRT	-	4C03	RAMTEK
Annunciator Alarm Panel	Panel A	4C03	Beta Corporation
Annunciator Alarm Panel	Panel B	4C03	Beta Corporation
Annunciator Alarm Panel	Panel C	4C03	Beta Corporation
Annunciator Alarm Panel	Panel D	4C04	Beta Corporation
Annunciator Alarm Panel	Panel E	4C04	Beta Corporation
Annunciator Alarm Panel	Panel F	4C04	Beta Corporation
Generator Core Hydrogen Monitor	ME	4C04	Gulton Industries, Inc.

MODULE DESCRIPTION	DESIGNATION	LOCATION	VENDOR
Annunciator Alarm Panel	Panel J	4C05	Beta Corporation
Annunciator Alarm Panel	Panel I	4C05	Beta Corporation
Status Light Panel	JA	4C05	Westinghouse
Status Light Panel	KA	4C05	Westinghouse
Status Light Panel	LA	4C05	Westinghouse
Annunciator Alarm Panel	Panel H	4C06	Beta Corporation
Annunciator Alarm Panel	Panel G	4C06	Beta Corporation
QSPDS Plasma Display	-	4C06	CE
QSPDS Page Control Module	-	4C06	CE
Annunciator Alarm Panel	Panel X	Clock Panel	Beta Corporation

3.7.2 The vendor module must be seismically supported.

3.7.3 The vendor module should be located near its associated controls, instrumentation, and alarms.

3.7.4 Vendor module labels should be requested which are in keeping with control room use to avoid the use of different terms to convey the same meanings. For label details, see Appendix E.

3.7.5 There shall be no modifications, excluding field cables, to vendor modules unless approved by vendor.

CHECKLIST

VENDOR MODULES

		Yes	No	Comment Number
1.	Has vendor module been seismically installed?	[ ]	[ ]	[ ]
2.	Is vendor module located near associated controls, instrumentation, and alarms?	[ ]	[ ]	[ ]
3.	Are vendor module labels in accordance with existing control room conventions and Appendix E?	[ ]	[ ]	[ ]
4.	Were any modifications performed to vendor modules?	[ ]	[ ]	[ ]

3.8 COMMUNICATION EQUIPMENT

3.8.1 General Operations Considerations

3.8.1.1 The communication systems presently installed at Turkey Point Units 3 and 4 consist of the Bell Telephone system, the W7 communication system, Page/Pax system, sound-powered telephone system, intercoms, walkie-talkies, and the radio system.

3.8.1.2 The sound-powered telephone system is used by both maintenance and operations.

3.8.1.3 The W7 communications system consists of plug-in headphones (with amplifier) for communication between the control room, turbine deck, spent fuel pit, and the containment.

3.8.1.4 The intercoms are used for communication between the control room console, back of the control room near Hagan racks, computer room, and the cable spreading room.

3.8.1.5 The radio system is used to communicate with the NRC, Dispatcher, and Civil Defense.

3.8.1.6 If an existing communication system is to be modified or replaced, operating instructions should be provided for use of the communication system, including suggested alternatives if the system becomes inoperable.

3.8.1.7 Periodic maintenance tests should be performed on the communication system to ensure that the system is normally operative and effective under changes in ambient noise levels.

3.8.1.8 Priority procedures should be established for the transmission of emergency messages from the control room by the communication system.

3.8.1.9 Procedures should be established for handling communications during an emergency and these procedures must be known by all operators.

3.8.1.10 The requirements for switching depend on the procedures for use of the sound-powered telephone system.

3.8.1.11 A complete set of cords should be provided at each patch panel, when used for sound-powered phones, if cord-type patching is used.

3.8.1.12 Use of walkie-talkies should be prohibited in areas close to low level analog or digital equipment which is affected by the frequency bands used.

3.8.1.13 When there are more than two parties on a channel operating at separate locations, procedures must provide for speaker identification.

3.8.1.14 A supply of replacement walkie-talkie batteries should be stored in an accessible, well-marked space and a sufficient stock kept to support long periods of continuous operation in case of emergency.

3.8.1.15 Procedures should be established for the use of the fixed-base UHF system.

3.8.1.16 Operators should be familiarized with the proper way to speak on the announcing system.

3.8.1.17 Emergency face masks should be equipped with diaphragms that are specially designed to transmit speech. The diaphragms should be able to separate voice from exhaust valve action.

3.8.1.18 If not equipped with diaphragms, masks should be equipped with an electronic speech system which picks up the voice with an internal microphone and transmits it to a loudspeaker attached outside the mask.

3.8.1.19 Provisions should be made to ensure complete internal and external backup communications during an emergency.

3.8.1.20 Communications equipment should be usable by personnel wearing protective gear without impeding their tasks.

3.8.2 Conventionally Powered Telephone System

3.8.2.1 Communication devices should be easily accessible and unobstructed. They should be labeled and color-coded.

3.8.2.2 A conventionally powered telephone system must provide good frequency response in that portion of the auditory spectrum most essential for intelligibility. Standard telephone bandpass (200-3300 Hz) is acceptable.

3.8.2.3 Handsets for a conventionally powered telephone system should incorporate the following features:

- Size and shape should be compatible with operator's hand size and mouth-ear distance (standard telephone dimensions are acceptable).
- Should maintain firm ear contact by receiver while transmitter is positioned to receive voice waves directly from mouth.
- Cords should be of non-kink or self-retracting type.
- Cords should be of sufficient length to permit reasonable operator mobility.
- Cords should be positioned so as to avoid entangling critical controls or endangering passing traffic.
- Vertically mounted handset cradles should be designed and located to prevent the handset from being knocked out of the cradle by passing traffic.
- Where multiple telephones are located close together, they should be coded to indicate circuit or function.

- o If a press-to-talk button is used, the button should be convenient for both left- and right-hand operation.

3.8.2.4 For a conventionally powered telephone system, switching should be designed and/or programmed to minimize delay in making desired connections under both normal and emergency conditions and to give the control room automatic priority of access to the switching system.

3.8.2.5 For a conventionally powered telephone system, loudness of ringing should be adjustable at the individual telephone equipment.

3.8.2.6 When transmitters within the conventionally powered telephone system are used as a microphone input to the announcing system, the transmitter should be compatible with the rest of the announcing system.

3.8.3 Sound-Powered Telephone System

3.8.3.1 Sound quality of a sound-powered telephone system should provide good frequency response from 200 to 3300 Hz and in-phase feedback to the user.

3.8.3.2 Headsets for a sound-powered telephone system should incorporate the following features:

- o Earphone cushioning should provide comfort for extended periods of wear. Earphones should cover the outer ear, without causing uncomfortable pressure.

- o Supporting structure of earpieces should not impose discomforts of weight, concentrated pressures, or metal contact with the skin.

- o The earpiece should be held firmly in place, yet be easy to remove.

- o Headsets should provide hands-free operation. This may have to be compromised to accommodate a push-to-talk switch in anticipation of possible use in areas of high ambient noise.

- o Binaural headsets should be available for use by control room personnel when they must leave the control room for plant areas with high ambient noise levels in order to communicate with the control room from these areas. Headsets should attenuate the ambient noise level to less than 85 dB(A).

- o A well-marked and accessible place should be provided for headset storage.

3.8.3.3 The need for ringing must be determined depending on the sound-powered telephone system procedures. If ringing is not installed, the user should be provided with the capability for directly switching

the sound-powered transmitter to the page system so that a desired party can be called to the line.

3.8.3.4 Plug-in jacks for the sound-powered telephone system should be provided within the control room. Jacks should be located close to the work stations to prevent the need for long cords and should not accommodate plugs of conventionally powered phones.

3.8.3.5 Patch panels, when used for sound-powered phones, should be conspicuously marked and located in reasonably accessible areas.

3.8.4 Walkie-Talkie Radio Transceivers

3.8.4.1 Walkie-talkie radios should provide good frequency response from 200 to 3300 Hz, and sufficient dynamic range and gain to handle instantaneous speech pressures and to develop the necessary signal level at the headphone or loudspeaker of the walkie-talkie.

3.8.4.2 Radio frequency should be chosen to provide broad area walkie-talkie communication to the control room. One consideration of frequency selection should be radio-wave penetration of metal or reinforced concrete barriers which at certain frequencies would tend to attenuate or bounce the signal.

3.8.4.3 Walkie-talkies should be small, light, and easy to carry. Their use should leave one hand (preferably both) available most of the time for other tasks and the microphone should be integrated into the transceiver package.

3.8.5 Fixed-Base UHF Transceivers

3.8.5.1 Fixed-base UHF transceivers should provide good frequency response from 200 to 3300 Hz, and sufficient dynamic range and gain to handle instantaneous speech pressures and to develop the necessary signal level at the loudspeaker of the transceiver.

3.8.5.2 For a fixed-base UHF system, gain should be adjustable, but the gain control should be limited so that even at its lowest setting an audible signal is still present.

3.8.6 Announcing System

3.8.6.1 The announcing (page) system should provide a good frequency response. At a minimum, telephone quality is required (200 to 3300 Hz); higher intelligibility is achieved by a band of 200 to 6100 Hz.

3.8.6.2 The need to page only certain selected areas should be determined depending on the announcing system procedures.

3.8.6.3 Microphones for an announcing system should be protected against breath blast and moisture condensation.

3.8.6.4 Frequency response of the microphone should be compatible with that of the rest of the announcing system. Microphones should have high sensitivity to speech signals.

3.8.6.5 If the powered telephone system is used to provide microphone input to the announcing system, the telephone system should contain transmitters of quality compatible with that of the announcing system.

3.8.6.6 Microphone input should be provided in the control room and dynamic range should permit 50 dB variations in signal input.

3.8.6.7 Loudspeakers should be provided in the control room and other areas where control room personnel might be (e.g., restrooms, eating areas, locker rooms, etc.). Speakers should be placed to yield an intelligible level of signal throughout the area.

3.8.6.8 Loudspeakers should be placed to adequately cover all necessary areas without "dead spots."

3.8.6.9 Where speaker reverberation is a problem, many low power speakers should be considered rather than a few powerful speakers.

3.8.6.10 Speaker volume should be adjusted to ensure that speaker communications will not prevent detection of auditory alarms. Loudspeakers located within the control room should have individual volume controls.

3.8.6.11 Audio gain control should be limited to preclude reducing volume below an audible level.

3.8.6.12 Control room inputs to the announcing system should have priority over any other input. The control room input should be capable of interrupting or bypassing announcements.

3.8.7 Point-To-Point Intercom System

3.8.7.1 A point-to-point intercom system should interconnect the control room with important plant areas.

3.8.7.2 The point-to-point intercom system should provide a good frequency response from 200 to 3300 Hz.

3.8.7.3 Gain should be adjustable at each intercom unit, but adjustability should be limited to preclude reducing volume below an audible level.

CHECKLIST

COMMUNICATION EQUIPMENT

GENERAL OPERATIONS CONSIDERATIONS

		Yes	No	Comment Number
1.	Are operating instructions provided for the communication system, including suggested alternatives if the system becomes inoperable?	[ ]	[ ]	[ ]
2.	Is a periodic maintenance program for the system established to ensure that it is normally operative and effective under changes in ambient noise levels?	[ ]	[ ]	[ ]
3.	Have priority procedures been established for the transmission of emergency messages from the control room by any of the communication systems?	[ ]	[ ]	[ ]
4.	Have procedures been established for handling communications during an emergency?	[ ]	[ ]	[ ]
5.	Are emergency procedures known by all operators?	[ ]	[ ]	[ ]
6.	Do the procedures for the sound-powered telephone system dictate the need for switching?	[ ]	[ ]	[ ]
7.	Are complete sets of cords provided at each panel if cord-type patching is used for sound-powered phones?	[ ]	[ ]	[ ]

		Yes	No	Comment Number
8.	Is walkie-talkie use prohibited in areas close to low level analog or digital equipment?	[ ]	[ ]	[ ]
9.	Are there procedures for walkie-talkie communication when there are more than two parties on a channel at separate locations?	[ ]	[ ]	[ ]
10.	Are replacement walkie-talkie batteries stored in an accessible, well-marked space?	[ ]	[ ]	[ ]
11.	Is the stock of batteries sufficient to support long periods of continuous operation in case of an emergency?	[ ]	[ ]	[ ]
12.	Have procedures been established for the use of the fixed-base UHF system?	[ ]	[ ]	[ ]
13.	Have operators been familiarized with the proper way to speak on the announcing system?	[ ]	[ ]	[ ]
14.	Are emergency face masks equipped with diaphragms that are designed to transmit speech?	[ ]	[ ]	[ ]
15.	Are the diaphragms able to separate voice from exhaust valve action?	[ ]	[ ]	[ ]
16.	If not equipped with diaphragms, do the masks contain an electronic speech system with an internal microphone and an external speaker?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
17. Are there provisions to ensure that there are backup internal and external communications during an emergency?	[ ]	[ ]	[ ]
18. Is communication equipment usable by personnel wearing protective gear without impeding their tasks?	[ ]	[ ]	[ ]

CHECKLIST

COMMUNICATION EQUIPMENT

CONVENTIONALLY POWERED TELEPHONE SYSTEM

	Yes	No	Comment Number
1. Are the communication devices easily accessible and unobstructed?	[ ]	[ ]	[ ]
2. Are communication devices labeled and color-coded?	[ ]	[ ]	[ ]
3. Does conventionally powered telephone system provide a good frequency response?	[ ]	[ ]	[ ]
4. Are size and shape of handset compatible with operator's hand size and mouth-ear distance?	[ ]	[ ]	[ ]
5. Does handset maintain firm ear contact by receiver while transmitter is positioned to receive voice waves directly from mouth?	[ ]	[ ]	[ ]
6. Is handset cord non-kinking or self-retracting?	[ ]	[ ]	[ ]
7. Is handset cord of sufficient length to permit reasonable operator mobility?	[ ]	[ ]	[ ]
8. Is handset cord positioned so as to avoid entangling critical controls or endangering passing traffic?	[ ]	[ ]	[ ]

		Yes	No	Comment Number
9.	Are vertically mounted handset cradles designed and located to prevent the handset from being knocked out of the cradle by passing traffic?	[ ]	[ ]	[ ]
10.	Where multiple telephones are located close together, are the phones coded to indicate circuit or function?	[ ]	[ ]	[ ]
11.	If a press-to-talk button is used, is the button convenient for both left- and right-hand operation?	[ ]	[ ]	[ ]
12.	For the conventionally powered telephone system, is switching designed to minimize delay in making desired connections under both normal and emergency conditions?	[ ]	[ ]	[ ]
13.	Is switching also designed to give the control room automatic priority of access to the switching system?	[ ]	[ ]	[ ]
14.	Is loudness of ringing of the telephone adjustable at each individual phone?	[ ]	[ ]	[ ]
15.	When transmitters within the conventionally powered telephone system are used as a microphone input to the announcing system, are the transmitters compatible with the rest of the announcing system?	[ ]	[ ]	[ ]

CHECKLIST

COMMUNICATION EQUIPMENT

SOUND-POWERED TELEPHONE SYSTEM

		Yes	No	Comment Number
1.	Does the sound-powered telephone system provide a good frequency response?	[ ]	[ ]	[ ]
2.	Does earphone cushioning of headsets for the sound-powered telephone system provide comfort for extended periods of wear?	[ ]	[ ]	[ ]
3.	Does the supporting structure of headset earpieces impose discomforts of weight, concentrated pressures, or metal contact with the skin?	[ ]	[ ]	[ ]
4.	Is the headset earpiece held firmly in place, yet easy to remove?	[ ]	[ ]	[ ]
5.	Do headsets provide hands-free operation?	[ ]	[ ]	[ ]
6.	Are binaural headsets available for use by control room personnel when they are required to leave the control room for plant areas with high ambient noise?	[ ]	[ ]	[ ]
7.	Do headsets attenuate the ambient noise level to less than 85 dB(A)?	[ ]	[ ]	[ ]
8.	Are well-marked and accessible places provided for headset storage?	[ ]	[ ]	[ ]

		Yes	No	Comment Number
9.	Are the sound-powered telephones required to ring?	[ ]	[ ]	[ ]
10.	If ringing is not installed, can the user directly switch the sound-powered transmitter to the page system so that the desired party can be called to the line?	[ ]	[ ]	[ ]
11.	Are plug-in jacks for the sound-powered telephone system provided in the control room close to the work stations?	[ ]	[ ]	[ ]
12.	Do the jacks for the sound-powered telephone system accommodate plugs of conventionally powered phones?	[ ]	[ ]	[ ]
13.	Are patch panels for the sound-powered phones marked and located in accessible areas?	[ ]	[ ]	[ ]

CHECKLIST

COMMUNICATION EQUIPMENT

WALKIE-TALKIE RADIO TRANSCEIVERS

		Yes	No	Comment Number
1.	Do walkie-talkies provide a good frequency response?	[ ]	[ ]	[ ]
2.	Do walkie-talkies provide a sufficient range and gain to develop the necessary signal level at the headphone or loudspeaker of the walkie-talkie?	[ ]	[ ]	[ ]
3.	Was the radio frequency chosen to provide a broad area of walkie-talkie communication to the control room?	[ ]	[ ]	[ ]
4.	Are walkie-talkies small, light, and easy to carry, with the microphone integrated into the transceiver package?	[ ]	[ ]	[ ]

CHECKLIST

COMMUNICATION EQUIPMENT

FIXED-BASE UHF TRANSCEIVERS

	Yes	No	Comment Number
1. Do the fixed-base UHF transceivers provide a good frequency response?	[ ]	[ ]	[ ]
2. Do the fixed-base UHF transceivers provide sufficient range and gain to develop the necessary signal level at the loudspeaker of the transceiver?	[ ]	[ ]	[ ]
3. For the fixed-base UHF system is the gain adjustable and limited so that even at its lowest setting an audible signal is still present?	[ ]	[ ]	[ ]

CHECKLIST

COMMUNICATION EQUIPMENT

ANNOUNCING SYSTEM

		Yes	No	Comment Number
1.	Does the announcing system provide a good frequency response?	[ ]	[ ]	[ ]
2.	Is there a requirement for paging only certain selected areas instead of the entire plant?	[ ]	[ ]	[ ]
3.	Are microphones for the announcing system protected against breath blast and moisture condensation?	[ ]	[ ]	[ ]
4.	Is frequency response of the microphone compatible with that of the rest of the announcing system?	[ ]	[ ]	[ ]
5.	Is the microphone highly sensitive to speech signals?	[ ]	[ ]	[ ]
6.	If the powered telephone system is used to provide microphone input to the announcing system, does the phone system contain transmitters of quality compatible with that of the announcing system?	[ ]	[ ]	[ ]
7.	Is microphone input to the announcing system provided in the control room?	[ ]	[ ]	[ ]

		Yes	No	Comment Number
8.	Does the microphone permit 50 dB variations in signal input?	[ ]	[ ]	[ ]
9.	Are loudspeakers for the announcing system provided in the control room and other areas where control room personnel might be?	[ ]	[ ]	[ ]
10.	Are speakers placed to yield an intelligible level of signal throughout each area?	[ ]	[ ]	[ ]
11.	Are speakers placed to avoid "dead spots"?	[ ]	[ ]	[ ]
12.	If speaker reverberation is a problem, were many low power speakers considered rather than a few powerful speakers?	[ ]	[ ]	[ ]
13.	Is speaker volume adjustable?	[ ]	[ ]	[ ]
14.	Do the speakers located in the control room have individual volume controls?	[ ]	[ ]	[ ]
15.	Is audio gain control of the loudspeakers limited to preclude reducing volume below an audible level?	[ ]	[ ]	[ ]
16.	Do control room inputs to the announcing system have priority over any other input?	[ ]	[ ]	[ ]

CHECKLIST

COMMUNICATION EQUIPMENT

POINT-TO-POINT INTERCOM SYSTEM

		Yes	No	Comment Number
1.	Does the point-to-point intercom system provide a good frequency response?	[ ]	[ ]	[ ]
2.	Does the intercom system connect the control room with other important plant areas?	[ ]	[ ]	[ ]
3.	Is the gain adjustable at each intercom unit?	[ ]	[ ]	[ ]
4.	Is the gain of each intercom unit limited to preclude reducing the volume below an audible level?	[ ]	[ ]	[ ]

4.0 COMPUTER-DRIVEN INSTRUMENTATION

4.0.1 The following process computers are presently installed in the control room at Turkey Point Units 3 and 4: SPDS/SAS, QSPDS, and DDPS.

4.0.2 The SPDS/SAS (Safety Parameter Display System/Safety Assessment System) is strictly for data acquisition and display. This includes High Level Displays, Trends, Mimics, and Alarm Tables. The system consists of CRTs, keyboards, plotters, and printers. The SPDS/SAS was installed to meet the intent of NUREG 0696. There are also outputs to the Technical Support Center and the Emergency Operating Facility.

4.0.3 The QSPDS (Qualified Safety Parameter Display System) includes inputs from the Core Exit Thermocouples, RCS Pressure, Hot and Cold Leg Temperatures and Reactor Vessel Level. The system consists of plasma displays and keyboards. The QSPDS is fully qualified and redundant.

4.0.4 The DDPS (Digital Data Processing System) includes the Sequence of Events recorder and flux mapping and performs various calculations. The system consists of CRTs, printers, and keyboards.

4.0.5 Access to the process computer software and database from the control room should be closely controlled.

4.0.6 Only properly authorized personnel should make changes by entry, deletion, or alteration.

4.0.7 At least one copy of the current operating software should be stored in a secure remote location.

4.0.8 When characters, words, or phrases are to be inserted, such items should first be collected and displayed on a buffer area of the screen, and then collectively inserted by one operator command.

4.0.9 Before any operator requests are processed that would result in permanent changes to existing data, the computer system should require operator acknowledgement.

4.0.10 Computer dialogue should be based on an operator's point of view, not the programmer's.

4.0.11 Computer dialogue should be logical and used in a consistent manner.

4.0.12 Computer dialogue should reflect the vocabulary and syntax of the expected user population.

4.0.13 Input words (keywords) should approximate real words.

4.0.14 Computer dialogue should require an explicit command in order to terminate an interaction.

4.0.15 Computer input words which must be typed should not exceed seven characters.

4.0.16 Abbreviations should be used whenever possible to minimize operator input requirements.

4.0.17 If the operator is using a synonym or abbreviation for a system command name, the computer system should use the same synonym or abbreviation when referring to that command in messages, prompts, etc. to the operator.

4.0.18 The use of abbreviations or contractions for output text should be avoided.

4.0.19 Operator inputs, responses, or actions which could significantly degrade the computer system or plant performance should not be dependent on a single keystroke.

4.0.20 The computer system should contain prompting and structuring features by which an operator can request additional information or corrected information when an error is detected.

4.0.21 The computer system should display the mode designation and the file(s) being processed.

4.0.22 The computer systems should permit correction of individual errors without requiring re-entry of correct data.

4.0.23 The computer system should contain a sequential file of operator entries, available upon operator request.

4.0.24 Keyboards that combine alphabetic and numeric functions in a single keyboard should conform to the standard "QWERTY" arrangement (see Exhibit 4.0-1).

4.0.25 The configuration of the keyboard used to enter solely numeric data should be a 3 x 3 + 1 matrix, either "telephone" or "calculator" style (see Exhibit 4.0-2).

4.0.26 If there is more than one computer keyboard in the control room, the alphanumeric and/or numeric-only key configuration should be the same.

4.0.27 The key dimensions and the separation should be as illustrated in Exhibit 4.0-3.

4.0.28 The key displacement and the resistance should be as shown in Exhibit 4.0-4.

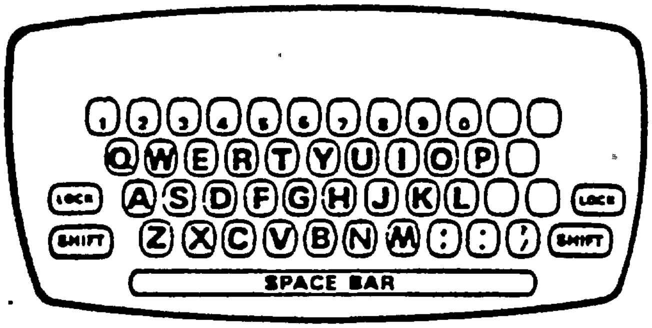


EXHIBIT 4.0-1: "QWERTY" Keyboard Arrangement

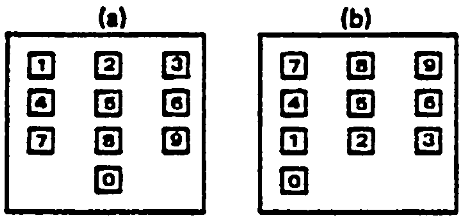
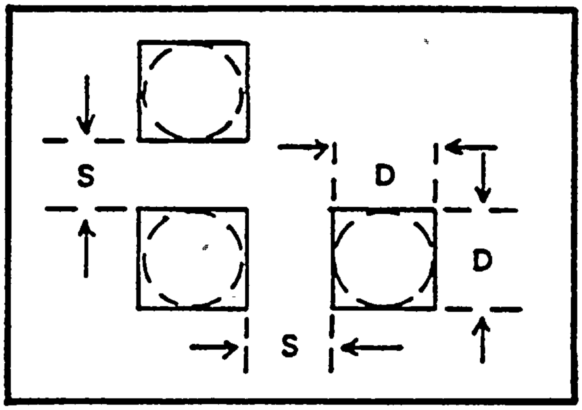


EXHIBIT 4.0-2: Acceptable Numeric-Only Keyboard Arrangements



	Key Dimension (D) (inches)	Key Separation (S) (inches)
Minimum	0.385	0.25
Maximum	0.75	
Preferred	0.5	0.25

EXHIBIT 4.0-3: Key Dimensions and Separation

Displacement (inches)	Numeric	Alpha-numeric
Minimum	0.03	0.05
Maximum	0.19	0.25

Resistance (ounces)	Numeric	Alpha-numeric
Minimum	3.5	0.9
Maximum	14.0	5.3

EXHIBIT 4.0-4: Key Displacement and Resistance

4.0.29 To provide positive key actuation feedback to the operator, a definite indication should be provided (e.g., snap, feel, audible, click, release of resistance).

4.0.30 Keyboards should be sloped between 15 degrees and 25 degrees from horizontal, with 16 to 17 degrees being the optimum slope.

4.0.31 Data being entered via keyboards should be displayed as it is keyed.

4.0.32 Control room keyboards should contain only those keys which are used by the operator.

4.0.33 Design of function controls on the computer should conform to appropriate guidelines.

4.0.34 Terms, nomenclature, and abbreviations used on function controls should be the same as or consistent with those of the computer function which is selected or displayed.

4.0.35 A positive indication should be provided at the master control location to identify those displays under local or master control.

4.0.36 A positive indication should be provided at the individual CRT to indicate whether the display is under master or local control.

4.0.37 When dedicated controls are used to initiate/activate functions, the keys should be grouped together.

4.0.38 Function controls should be easily distinguished from other types of keys on the computer console.

4.0.39 Each function control should be clearly labeled to indicate its function to the operator.

4.0.40 If multiple computer consoles exist in the control room, the design and layout of function controls should be the same for all consoles.

4.0.41 When function keys are included with an alphanumeric keyboard, the function keyboards should be physically separated.

4.0.42 Control devices (e.g., light pens, RAND tablets, digitizers, etc.) should be operable from the location where the operator is most likely to need to interact with the computer.

4.0.43 Control devices should provide rapid positioning of cursors or selection of choices.

4.0.44 Device or method accuracy should be commensurate with the functions to be served.

4.0.45 Control design should allow the operator freedom of movement to perform other duties.

4.0.46 The computer system should provide the correct response to each type of query within the recommended response time listed in Exhibit 4.0-5.

4.0.47 When response time for any query exceeds 3 seconds, a delay message should appear to maintain the operator's attention and to confirm normal computer operation.

4.0.48 A complete set of computer system operating procedures and contingency procedures should be available in the control room.

4.0.49 Procedures should be prepared from the point of view of the control room operator.

4.0.50 Procedures should be in hard-copy form as a minimum.

QUERY TYPE	"Maximum" Response Time
Control activation (for example, keyboard entry).	0.1 SECOND
System activation (system initialization).	3.0
Request for given service:	
simple	2
complex	5
loading and restart	15 - 60
Error feedback (following completion of input).	2 - 4
Response to ID.	2
Information on next procedure.	< 5
Response to simple inquiry from list.	2
Response to simple status inquiry.	2
Response to complex inquiry in table form.	2 - 4
Request for next page.	0.5 -1
Response to "execute problem."	< 15
Light pen entries.	1.0
Drawing with light pens.	0.1
Response to complex inquiry in graphic form.	2 - 10
Response to dynamic modeling.	-
Response to graphic manipulation.	2
Response to user intervention in automatic process.	4

EXHIBIT 4.0-5: Computer Response Times

4.0.51 Operating procedures should describe:

- o The overall computer system.

- o The computer system components with which the operator can interface.

- o The specific procedures necessary to accomplish all of the operator-computer interface functions.

4.0.52 Contingency procedures should describe:

- o Indications available to the operator which identify failure or malfunctioning of the computer systems.

- o Necessary actions to be performed by the operator if the computer fails or malfunctions.

4.0.53 Specific codes or addresses, by which data displays can be called up by an operator, should be cross-referenced by alphanumeric or numeric code, program name, system/subsystem identification, and functional group identification.

4.0.54 Cross-indices should be available in the control room in hard-copy form as a minimum.

4.0.55 Alphanumeric and graphic characters should be easily readable on the CRT by the operator under all control room lighting conditions.

4.0.56 CRT screens should be installed to minimize reflected glare at normal operator viewing angles.

4.0.57 Ambient illumination should contribute no more than 25 percent to screen luminance through diffuse reflection and phosphor excitation.

4.0.58 When ambient illumination in the vicinity of CRT is in the medium to high range, the CRT should use dark characters and symbols on a light background.

4.0.59 Contrast between light characters and a dark screen background should be 15:1 minimum and 20:1 preferred.

4.0.60 Contrast between dark characters and a light screen background should be 1:15 minimum and 1:20 preferred.

4.0.61 The cumulative effects of all geometric distortion should not displace any point within the viewable area of the screen from its correct position by more than 5 percent of picture height.

4.0.62 CRTs for displaying simple alphanumeric text should have a minimum of 20 resolution elements per inch.

4.0.63 CRTs for displaying complex symbols and graphic detail should have a minimum of 100 resolution elements per inch.

4.0.64 Complex symbols which must be distinguished from other complex shapes should have a minimum of ten resolution elements for the longest dimension of the symbol.

4.0.65 Alphanumeric characters should have a minimum of ten resolution elements per character height.

4.0.66 The regeneration rate for CRT display should be above the critical frequency at fusion so that the occurrence of disturbing flicker is not perceptible.

4.0.67 Parameters such as brightness, contrast, and color should be adjustable by the control room operator.

4.0.68 Adjustment controls should conform to appropriate guidelines.

4.0.69 The visual angles of complex symbols should subtend not less than 20 minutes of arc at the required viewing distance.

4.0.70 The height of alphanumeric characters should have a visual angle of not less than 12 minutes of arc of the required viewing distance.

4.0.71 Alphanumeric characters should be upper case letters with a width-to-height ratio of between 3:5 and 1:1 and stroke-width-to-character-height ratio of between 1:5 and 1:10.

4.0.72 Graphic lines should contain a minimum of 50 resolution elements per inch.

4.0.73 Horizontal separation between characters or symbols should be between 10 percent and 65 percent of character or symbol height.

4.0.74 Separation should be not less than 25 percent of character or symbol height when any of the following degraded conditions exist:

- When character or symbol width is less than 85 percent of height.
- When character or symbol luminance is less than 12 ft-L.
- When luminance contrast is less than 88 percent.
- When CRT screen location is greater than 35 degrees to the left or right of the operator's straight-ahead line of sight.
- When the visual angle subtended by symbol height is less than 15 minutes of arc.
- When the visual angle subtended by character height is less than 12 minutes of arc.

4.0.75 Simple character fonts should be use.

4.0.76 When dot-matrix characters are used, a 7 x 9 dot matrix should be used in preference to a 5 x 7 dot matrix.

4.0.77 Character styles such as Lincoln/Mitre or Leroy should be used.

4.0.78 Viewing distance from operator to CRT should be greater than 18 inches.

4.0.79 The minimum angle between the operator's line-of-sight as measured from the operator's normal work station and the plane of the display screen should be 45 degrees for a seated observer and 30 degrees for a standing observer.

4.0.80 All data and messages on the CRT screen should be within the unobstructed view of an operator at the normal work station.

4.0.81 Data should be presented to the operator in a readily usable format. There should be no requirement for transposing, computing, interpolating, or mentally translating displayed data into other units or numerical bases.

4.0.82 Illustrations should be used whenever possible to supplement or explain text.

4.0.83 When five or more digits and/or non-text alphanumerics are displayed, and no natural organization exists, characters should be grouped in blocks of three to four characters each.

4.0.84 Groups should be separated by a minimum of one blank character space.

4.0.85 Elements in a data field should be displayed in a logical order.

4.0.86 The manner of presentation of identical data should be based on the uses to which the data will be put by the operator.

4.0.87 Identical data in different presentations should be displayed in a consistent, standardized manner.

4.0.88 Numbers should be used as designators when listing selectable items.

4.0.89 Numerical designators should start with the number "1," not zero.

4.0.90 If the use of numbers as designators would create confusion, alphabetic characters should be used.

4.0.91 Alphabetic designators should start with the letter "A".

4.0.92 Lists should be vertically aligned and left justified. Indentation should be used for subclassifications.

4.0.93 Quantitative data which must be scanned and compared should be presented in either tabular or graphic form.

4.0.94 The use of hyphenation should be minimized.

4.0.95 When presented in tabular form, alphanumeric data should be left justified and numeric data should be right justified with decimal points aligned.

4.0.96 Periods should be placed after item selection designators and at the end of sentences.

4.0.97 The following standardized fields should be used:

- Telephone Number: (914) 555-1212
- Time: HH:MM:SS, HH:MM, MM:SS(.S)
- Date: MM:DD:YY

4.0.98 Each individual data group should have a descriptive label. Label should reflect some unique characteristic of the content of the data group.

4.0.99 Labels should be placed in a consistent manner either above or to the left of the data group they describe.

4.0.100 Labels should be oriented horizontally.

4.0.101 Labels should be highlighted or otherwise accentuated to facilitate operator scanning and recognition. Highlighted labels should be easily distinguished from highlighting used for emergency or critical messages.

4.0.102 When presenting a list of operator options, the option label should reflect the question or choices being posed to the operator.

4.0.103 Displayed data should be organized in a logical, consistent manner.

4.0.104 Displayed data should reflect some obvious and inherent quality of the data groups (e.g., hierarchical, sequential, or mimic relationship).

4.0.105 Information that requires immediate attention should be located in the upper right quadrant of CRT. Information with less immediacy should be located in the upper left, lower left, and lower right quadrants - in order of usual scanning patterns.

4.0.106 Physical location of specific data groups on the screen should be consistent.

4.0.107 Organization and separation of information subgroups should be made apparent to the operator through the use of blank spaces, lines, or some other form of visible demarcation.

4.0.108 List of options should be organized with high probability items presented first.

4.0.109 Non-option lists of equal probability options should be presented in alphabetic or numerical order.

4.0.110 Paragraphs in continuous text should be separated by at least one blank line.

4.0.111 Selection designators in menus should be separated from text by at least one blank space.

4.0.112 When data are contained on multiple pages, each page should display both page number and total number of pages.

4.0.113 Items contained in a numbered list and described on continuation pages should be numbered relative to the first number on the first page of the list.

4.0.114 When directions to the operator accompany a list of options, such directions should precede the list.

4.0.115 Urgent messages should always be displayed in the same location and highlighted to attract the operator's attention.

4.0.116 In systems in which selection is made by use of a cursor, formats should be organized to minimize positioning movements of the cursor.

4.0.117 The amount of information-bearing activated screen area should not exceed 25 percent of the total screen area. This does not include demarcation lines.

4.0.118 CRT displayed trend plot scales should be consistent with the intended functional use of the data.

4.0.119 Messages should be concise and provide the operator with the information necessary to complete a specific action or decision sequence.

4.0.120 Information contained in messages should be necessary, complete, and readily usable.

4.0.121 Prompts should be displayed whenever the operator may need directions or guidance to initiate or complete an action or sequence of actions.

4.0.122 Prompts should contain clear and specific instructions which are relevant to the action to be taken. Instructions should be placed in the sequence to be used by operator.

4.0.123 Whenever an operator error or invalid input is detected, an error message should be displayed.

4.0.124 Error messages should contain instructions to the operator regarding required corrective action.

4.0.125 Capability should be provided for operator correction of individual errors without affecting valid entries.

4.0.126 Feedback messages should be provided to the operator to indicate changes in the status of system functioning.

4.0.127 When an option is selected as an input to a system, the subject items should be highlighted, or otherwise positively identified, to indicate acknowledgement by the system.

4.0.128 When system response is delayed, periodic feedback should be provided to the operator to indicate normal system operation and the reason for the delay.

4.0.129 Positive indication should be presented to the operator when a process or sequence is completed by the system.

4.0.130 Highlighting should be used to attract the operator's attention to any displayed data item or message which is important to decision-making or action requirements.

4.0.131 Highlighting methods should have the same meaning in all applications.

4.0.132 Highlighting methods associated with emergency conditions should not be used in association with normal conditions.

4.0.133 When contrast enhancement (i.e., increased illumination intensity level) is used for highlighting, not more than three brightness levels should be used in a single presentation (two is preferred).

4.0.134 Blinking of a symbol or message for purposes of highlighting should be reserved for emergency conditions.

4.0.135 When blinking is used, a maximum of two blink rates should be used.

4.0.136 When a single blink rate is used, the rate should be two to three blinks per second with a minimum of 50 msec "on" time between blinks.

4.0.137 When two blink rates are used, the fast blink should be four per second and the slow blink should be one per second.

4.0.138 When two blink rates are used, the "on-off" ratio should be about 50 percent and the higher rate should apply to the most critical information.

4.0.139 Image reversal should be used primarily for highlighting in dense data fields.

4.0.140 Graphic coding methods should be used to present standard qualitative information to the operator or to draw the operator's attention to a particular portion of the display.

4.0.141 Graphic codes should have the same meaning in all applications.

4.0.142 When geometric shape (symbol) coding is used, the basic symbols should vary widely in shape.

4.0.143 The number of basic symbols used for coding should be kept small; the upper limit under optimum display conditions should be 20 and under adverse display conditions it should be 6.

4.0.144 When needed, other highlighting and graphic techniques should be used to display different states or qualities of a basic symbol.

4.0.145 Colors used on the CRT to convey information should be consistent in use and meaning with all other color codes in the control room.

4.0.146 Once colors are assigned a specific use or meaning, no other color should be used for the same purpose.

4.0.147 Exhibit 4.0-6 provides general guidelines for CRT color selection.

4.0.148 The following specific meaning for selected colors should apply when these colors are used in CRT displays:

- o Red - Unsafe condition, immediate operator action required, or critical parameter value out of tolerance.

- o Green - Safe condition, no operator action required, or parameter value is within tolerance.

Red—Good attention-getting color. Associated with danger.

Yellow (amber)—Good attention getting color. Associated with caution.

Green—A non-attention-getting color; easy on the eyes. Associated with satisfactory conditions.

Black—Normally used as the background color, i.e., the color of blank character spaces. Also used as the action character when reverse field coding is employed.

White—A non-attention-getting color. It should be used for standard alphanumeric text or tables where the information is contained in the characters and not the color. Might also be used for labels, coordinate axes, dividing lines, demarcation brackets, etc.

Cyan (light blue)—(Same as white)—Might be used in conjunction with white to provide some amount of noncritical discrimination (e.g., use cyan for tabular column headings and demarcation lines; use white for alphanumeric data).

Blue (dark)—Poor contrast with dark background. Not recommended for attention-getting purposes or for information-bearing data. Use for labels and other advisory type messages.

Magenta—A harsh color to the eye. Should be used sparingly, and for attention-getting purposes.

Orange—Good attention-getting color. Care must be taken that hue is selected to be readily differentiable from red, yellow, and white.

EXHIBIT 4.0-6: Guidelines for CRT Color Selection

- o Yellow/Amber - Hazard, potentially unsafe, caution, attention required, marginal parameter value exists.

4.0.149 Whenever possible, red and green colors should not be used in combination. Use of red characters/symbols on a green background should especially be avoided.

4.0.150 Page design and content planning should minimize requirements for operator memory.

4.0.151 All data relevant to a specific operator entry should be displayed on a single page.

4.0.152 When pages are organized in a hierarchical fashion, containing a number of different paths through the series, a visual audit trail of the choices should be available upon operator request.

4.0.153 When the operator is required to scroll or pan on a large logical frame, location references should be provided in the viewable portion of the frame.

4.0.154 Sectional coordinates should be used when large schematics must be panned or magnified.

4.0.155 The operator should have some capability for controlling the amount, format, and complexity of information being displayed by the system.

4.0.156 If the message is a variable option list, common elements should maintain the physical relationship to other recurring elements.

4.0.157 Printers should be part of the process computer system and be located in the primary operating area.

4.0.158 Control room printers should provide the capability to record alarm data, trend data, and plant status data.

4.0.159 The system should be designed to provide a hard copy of any page appearing on the CRT of the operator's request.

4.0.160 If a copy will be printed remote to the operator, a print confirmation or denial message should be displayed.

4.0.161 Printer operation should not alter screen content.

4.0.162 Printed information should be presented in a directly usable form with minimal requirements for decoding, transposing, and interpolating.

4.0.163 Printers used for recording trend data, computer alarms, and critical status information should have a high speed printing capability of at least 300 lines per minute.

4.0.164 Hard finish matte paper should be used to avoid smudged copy and glare.

4.0.165 There should be a positive indication of the remaining supply of recording materials.

4.0.166 Instructions for reloading paper, ribbon, ink, etc. should appear on an instruction plate attached to the printer.

4.0.167 When the printer is down, data and information which would normally be printed must not be lost.

4.0.168 A takeup device for printed materials should be provided which requires little or no operator attention and which has a capacity at least equal to the feed supply.

4.0.169 The following features should be provided to enhance operator accessibility of printed material:

- o Provisions should be made so that the operator can always read the most recently printed line.
- o Printed material should have an adequate contrast ratio to ensure easy operator reading.
- o It should be easy to annotate the print copy while it is still in the machine.
- o The recorded material should not be obscured, masked, or otherwise hidden in a manner which prevents direct reading of material.

4.0.170 A printer should be provided for recording alarm messages. Alarm messages should be recorded in the sequence of their occurrence.

4.0.171 All annunciator alarms should be recorded.

4.0.172 Provisions should be included to provide, upon operator request, printouts by alarm group (e.g., system, subsystem, component).

4.0.173 Alarm messages should be readily distinguishable from other messages and provide rapid identification of the nature of the alarm.

4.0.174 Wording in the alarm messages should clearly relate to the specific annunciator tile that is illuminated, contain at least that information (i.e., identical wording) presented in the illuminated annunciator tile, and provide additional specific data.

4.0.175 If the general shape of the function is important in making decisions, a graph should be used.

4.0.176 If interpolation is necessary, line graphs are preferable to bar graphs and tables.

4.0.177 Graphs should be constructed so that numbered grids are bolder than unnumbered grids.

4.0.178 If 10-grid intervals are used, the fifth intermediate grid should be less bold than the numbered grid, but bolder than the unnumbered grids.

4.0.179 Tables should be simple, concise, and readable.

4.0.180 When table columns are long, numbers should be separated into groups by providing a space between groups of five.

4.0.181 When columns are not separated by vertical lines, the columns should be separated by at least two character widths.

CHECKLIST

COMPUTER DRIVEN INSTRUMENTATION

		Yes	No	Comment Number
1.	Is access to computer software and database closely controlled?	[ ]	[ ]	[ ]
2.	Is at least one copy of current software stored in a secure remote location?	[ ]	[ ]	[ ]
3.	When characters, words, or phrases are to be inserted, are they first displayed on the screen and then collectively inserted by operator command?	[ ]	[ ]	[ ]
4.	Before operator requests are processed, does the computer system require operator acknowledgement?	[ ]	[ ]	[ ]
5.	Is computer dialogue based on the operator's point of view?	[ ]	[ ]	[ ]
6.	Is computer dialogue logical and used in a consistent manner?	[ ]	[ ]	[ ]
7.	Does computer dialogue reflect the vocabulary and syntax of the expected user population?	[ ]	[ ]	[ ]
8.	Do input words approximate real words?	[ ]	[ ]	[ ]
9.	Does computer dialogue require an explicit command in order to terminate an interaction?	[ ]	[ ]	[ ]

		Yes	No	Comment Number
10.	Do computer input words exceed 7 characters?	[ ]	[ ]	[ ]
11.	Are abbreviations used to minimize operator input requirements?	[ ]	[ ]	[ ]
12.	Are synonyms and abbreviations used by the operator also used by the computer for messages and prompts to the operator?	[ ]	[ ]	[ ]
13.	Are abbreviations or contractions for output text avoided?	[ ]	[ ]	[ ]
14.	Are operator inputs that could significantly degrade the computer system with a single key stroke avoided?	[ ]	[ ]	[ ]
15.	Does the computer prompt the operator when an error is detected?	[ ]	[ ]	[ ]
16.	Does the computer display the mode designation and file(s) being processed?	[ ]	[ ]	[ ]
17.	Does the computer allow correction of individual errors without re-entry of correct data?	[ ]	[ ]	[ ]
18.	Does the computer contain a sequential file of operator entries, available upon operator request?	[ ]	[ ]	[ ]
19.	Do keyboards that combine alphabetic and numeric functions conform to the standard "QWERTY" arrangement shown in Exhibit 4.0-1?	[ ]	[ ]	[ ]
20.	Are keyboards used to enter solely numeric data arranged in a 3 x 3 + 1 matrix, in either style shown in Exhibit 4.0-2?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
21. Do all keyboards located in the control room, alphanumeric and/or numeric only, contain the same keyboard configuration?	[ ]	[ ]	[ ]
22. Are key dimensions and separation as shown in Exhibit 4.0-3?	[ ]	[ ]	[ ]
23. Are key displacement and resistance as shown in Exhibit 4.0-4?	[ ]	[ ]	[ ]
24. Is there a definite indication to the operator of positive key actuation?	[ ]	[ ]	[ ]
25. Are keyboards sloped between 15 degrees and 25 degrees?	[ ]	[ ]	[ ]
26. Is data displayed as it is being entered?	[ ]	[ ]	[ ]
27. Do control room keyboards contain only keys used by the operator?	[ ]	[ ]	[ ]
28. Does the design of function controls on the computer conform to appropriate guidelines?	[ ]	[ ]	[ ]
29. Are terms, nomenclature, and abbreviations used on function controls the same as those of the computer function which is selected or displayed?	[ ]	[ ]	[ ]
30. Is positive indication provided at the master control location to identify those displays under local or master control?	[ ]	[ ]	[ ]
31. Is positive indication provided at the individual CRT to indicate whether the display is under master or local control?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
32. Are dedicated controls used to initiate functions grouped together?	[ ]	[ ]	[ ]
33. Are function controls easily distinguished from other types of keys on the computer console?	[ ]	[ ]	[ ]
34. Is each function control key clearly labeled to identify its function?	[ ]	[ ]	[ ]
35. If multiple computer consoles exist in the control room, is the design and layout of function controls the same for all consoles?	[ ]	[ ]	[ ]
36. If function keys are included with the alphanumeric keyboard, are function keys physically separated?	[ ]	[ ]	[ ]
37. Are control devices operable from the location where the operator is most likely to need to interact with the computer?	[ ]	[ ]	[ ]
38. Do control devices provide rapid positioning of cursor or selection of choices?	[ ]	[ ]	[ ]
39. Are device or method accuracy commensurate with the functions to be served?	[ ]	[ ]	[ ]
40. Does the control design allow the operator freedom of movement to perform other duties?	[ ]	[ ]	[ ]
41. Do computer response times conform to Exhibit 4.0-5?	[ ]	[ ]	[ ]

		Yes	No	Comment Number
42.	When response time exceeds 3 seconds, does a message appear to confirm normal computer operation?	[ ]	[ ]	[ ]
43.	Is a complete set of computer system operating procedures and contingency procedures available in the control room?	[ ]	[ ]	[ ]
44.	Are procedures prepared from the operator's point of view?	[ ]	[ ]	[ ]
45.	Are procedures available in hard copy?	[ ]	[ ]	[ ]
46.	Do operating procedures describe the overall computer system?	[ ]	[ ]	[ ]
47.	Do operating procedures describe the computer system components with which the operator can interface?	[ ]	[ ]	[ ]
48.	Do operating procedures describe the necessary procedures to accomplish all of the operator-computer interface functions?	[ ]	[ ]	[ ]
49.	Do contingency procedures describe indications available to the operator which identify failure or malfunctioning of the computer system?	[ ]	[ ]	[ ]
50.	Do contingency procedures describe necessary actions to be performed by the operator if the computer fails or malfunctions?	[ ]	[ ]	[ ]

		Yes	No	Comment Number
51.	Are specific codes or addresses cross-indexed by alphanumeric or numeric code, program name, system/subsystem identification, and functional group identification?	[ ]	[ ]	[ ]
52.	Are cross-indices available in the control room in hard copy?	[ ]	[ ]	[ ]
53.	Are CRTs readable under all control room lighting conditions?	[ ]	[ ]	[ ]
54.	Are CRT screens installed to minimize glare?	[ ]	[ ]	[ ]
55.	Does ambient illumination contribute more than 25 percent to screen luminance?	[ ]	[ ]	[ ]
56.	If CRT is located in an area where ambient illumination is in the medium to high range, does CRT use dark characters on a light background?	[ ]	[ ]	[ ]
57.	Is the contrast between light characters and a dark screen at least 15:1?	[ ]	[ ]	[ ]
58.	Is the contrast between dark characters and a light screen at least 1:15?	[ ]	[ ]	[ ]
59.	Does geometric distortion displace any point of the screen more than 5 percent of picture height?	[ ]	[ ]	[ ]
60.	Do CRTs for displaying simple alphanumeric text have a minimum of 20 resolution elements per inch?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
61. Do CRTs for displaying complex symbols and graphic details have a minimum of 100 resolution elements per inch?	[ ]	[ ]	[ ]
62. Do complex symbols have a minimum of ten resolution elements for the longest dimension of the symbol?	[ ]	[ ]	[ ]
63. Do alphanumeric characters have a minimum of ten resolution elements per character height?	[ ]	[ ]	[ ]
64. Is the regeneration rate for CRT display above the critical frequency at fusion?	[ ]	[ ]	[ ]
65. Are parameters such as brightness, contrast, and color adjustable by operator?	[ ]	[ ]	[ ]
66. Do adjustment controls conform to appropriate guidelines?	[ ]	[ ]	[ ]
67. Do visual angles of complex symbols subtend less than 20 minutes of arc at the required viewing distance?	[ ]	[ ]	[ ]
68. Does the height of alphanumeric characters have a visual angle less than 12 minutes of arc at the required viewing angle?	[ ]	[ ]	[ ]
69. Are alphanumeric characters upper case?	[ ]	[ ]	[ ]
70. Do alphanumeric characters have a width-to-height ratio of between 3:5 and 1:1?	[ ]	[ ]	[ ]
71. Do alphanumeric characters have a stroke-width-to-character-height of between 1:5 and 1:10?	[ ]	[ ]	[ ]

		Yes	No	Comment Number
72.	Do graphic lines contain a minimum of 50 resolution elements per inch?	[ ]	[ ]	[ ]
73.	Is the horizontal separation between characters between 10 percent and 65 percent of character height?	[ ]	[ ]	[ ]
74.	Is the separation less than 25 percent of character or symbol height?	[ ]	[ ]	[ ]
75.	Is a simple character font used?	[ ]	[ ]	[ ]
76.	If a dot matrix is used, was a 7 x 9 dot matrix used?	[ ]	[ ]	[ ]
77.	Is Leroy or Lincoln/Mitre character style used?	[ ]	[ ]	[ ]
78.	Is the viewing distance from CRT to operator greater than 18 inches?	[ ]	[ ]	[ ]
79.	Is the angle between the operator's line-of-sight and the plane of the display screen greater than 45 degrees for a seated observer and 30 degrees for a standing observer?	[ ]	[ ]	[ ]
80.	Are data and messages on the CRT screen within the unobstructed view of an operator at the normal work station?	[ ]	[ ]	[ ]
81.	Are data presented to the operator in a readily usable format?	[ ]	[ ]	[ ]
82.	Are illustrations used whenever possible to supplement or explain text?	[ ]	[ ]	[ ]

		Yes	No	Comment Number
83.	When five or more digits and/or non-text alphanumerics are displayed and no natural organization exists, are characters grouped in blocks of three to four characters each?	[ ]	[ ]	[ ]
84.	Are groups separated by a minimum of one blank character space?	[ ]	[ ]	[ ]
85.	Are elements in a data field displayed in a logical order?	[ ]	[ ]	[ ]
86.	Are identical data presented based on the uses to which the data will be used by operator?	[ ]	[ ]	[ ]
87.	Are identical data displayed in a consistent manner for different presentations?	[ ]	[ ]	[ ]
88.	Are numbers used as designators when listing selectable items?	[ ]	[ ]	[ ]
89.	Do numerical designators start with the number "1"?	[ ]	[ ]	[ ]
90.	If number designators would cause confusion, are alphabetic characters used?	[ ]	[ ]	[ ]
91.	Do alphabetic designators start with the letter "A"?	[ ]	[ ]	[ ]
92.	Are lists vertically aligned and left justified?	[ ]	[ ]	[ ]
93.	Are subclassifications indented?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
94. Are quantitative data which must be scanned and compared presented in either tabular or graphic form?	[ ]	[ ]	[ ]
95. Is the use of hyphenation minimized?	[ ]	[ ]	[ ]
96. When presented in tabular form, are alpha-numeric data left justified?	[ ]	[ ]	[ ]
97. When presented in tabular form, are numeric data right justified with decimal points aligned?	[ ]	[ ]	[ ]
98. Are periods placed after item selection designators and at the end of sentences?	[ ]	[ ]	[ ]
99. Are telephone numbers displayed in the following format: (914) 555-1212?	[ ]	[ ]	[ ]
100. Is time displayed in one of the following formats: HH:MM:SS, HH:MM, MM:SS(.S)?	[ ]	[ ]	[ ]
101. Is the date displayed in the following format: MM:DD:YY?	[ ]	[ ]	[ ]
102. Do individual data groups have a descriptive label?	[ ]	[ ]	[ ]
103. Do labels reflect some unique characteristic of the content of its data group?	[ ]	[ ]	[ ]
104. Are labels placed in a consistent manner, either above or to the left of the data group they describe?	[ ]	[ ]	[ ]
105. Are labels oriented horizontally?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
106. Are labels highlighted to facilitate operator scanning and recognition?	[ ]	[ ]	[ ]
107. Are highlighted labels easily distinguished from highlighting used for emergency or critical messages?	[ ]	[ ]	[ ]
108. When presenting a list of operator options, does the option label reflect the question or choices being posed to the operator?	[ ]	[ ]	[ ]
109. Are the displayed data organized in a logical, consistent manner?	[ ]	[ ]	[ ]
110. Do the displayed data reflect some obvious and inherent quality of the data groups?	[ ]	[ ]	[ ]
111. Is information that requires immediate attention located in the upper right quadrant of CRT?	[ ]	[ ]	[ ]
112. Is the physical location of specific data groups on the screen consistent?	[ ]	[ ]	[ ]
113. Are information subgroups organized and separated by some form of demarcation?	[ ]	[ ]	[ ]
114. Are high priority items listed first in option lists?	[ ]	[ ]	[ ]
115. Are non-option lists of equal probability options listed in alphabetic or numeric order?	[ ]	[ ]	[ ]
116. Are paragraphs in continuous text separated by a blank line?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
117. Are selection designators in menus separated from text by at least one blank space?	[ ]	[ ]	[ ]
118. When data are contained on multiple pages, does each page display both the page number and total number of pages?	[ ]	[ ]	[ ]
119. Are items contained in a numbered list and described on continuation pages numbered relative to the first number on the first page of the list?	[ ]	[ ]	[ ]
120. Do the directions to the operator accompanying a list precede the list?	[ ]	[ ]	[ ]
121. Are urgent messages always displayed in the same location?	[ ]	[ ]	[ ]
122. Are urgent messages highlighted?	[ ]	[ ]	[ ]
123. When selection is made by a cursor, are formats organized to minimize positioning movements of the cursor?	[ ]	[ ]	[ ]
124. Does the amount of information-bearing activated screen area exceed 25 percent of the total screen area?	[ ]	[ ]	[ ]
125. Are CRT displayed trend plot scales consistent with the intended functional use of the data?	[ ]	[ ]	[ ]
126. Are messages concise and do they provide the operator with the information necessary to complete a specific action or decision sequence?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
127. Is information contained in messages complete and readily usable?	[ ]	[ ]	[ ]
128. Are prompts displayed whenever the operator needs direction or guidance to initiate or complete an action or sequence of actions?	[ ]	[ ]	[ ]
129. Do prompts contain clear and specific instructions?	[ ]	[ ]	[ ]
130. Are instructions placed in the sequence to be used by the operator?	[ ]	[ ]	[ ]
131. When an operator error or invalid input is deleted, is an error message displayed?	[ ]	[ ]	[ ]
132. Do error messages contain instructions regarding required corrective action?	[ ]	[ ]	[ ]
133. Can the operator correct individual errors without affecting valid entries?	[ ]	[ ]	[ ]
134. Are feedback messages provided to indicate changes in the status of system functioning?	[ ]	[ ]	[ ]
135. When an option is selected as an input to a system, is the subject item highlighted to indicate acknowledgement by the system?	[ ]	[ ]	[ ]
136. When system response is delayed, is periodic feedback provided to indicate normal system operation and the reason for delay?	[ ]	[ ]	[ ]
137. Is positive indication presented to the operator when a process or sequence is completed by the system?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
138. Is highlighting used for messages or data which are important to decisionmaking or action requirements?	[ ]	[ ]	[ ]
139. Do highlighting methods have the same meaning in all applications?	[ ]	[ ]	[ ]
140. Are highlighting methods associated with emergency conditions also used in association with normal conditions?	[ ]	[ ]	[ ]
141. When contrast enhancement is used for highlighting, are there more than three brightness levels?	[ ]	[ ]	[ ]
142. Is blinking of symbols or messages reserved for emergency conditions?	[ ]	[ ]	[ ]
143. Are more than two blink rates used?	[ ]	[ ]	[ ]
144. If a single blink rate is used, is the blink rate approximately two to three blinks per second with a minimum of 50 msec "on" time?	[ ]	[ ]	[ ]
145. If two blink rates are used, is the fast blink rate approximately four per second and the slow blink rate one per second?	[ ]	[ ]	[ ]
146. If two blink rates are used, is the "on-off" ratio about 50 percent?	[ ]	[ ]	[ ]
147. If two blink rates are used, does the higher rate apply to the most critical information?	[ ]	[ ]	[ ]
148. Is image reversal used primarily for highlighting in dense data fields?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
149. Is graphic coding used to present standard qualitative information to the operator or to draw the operator's attention to a particular portion of the display?	[ ]	[ ]	[ ]
150. Do graphic codes have the same meaning in all applications?	[ ]	[ ]	[ ]
151. Do geometric symbols vary widely in shape?	[ ]	[ ]	[ ]
152. Are there 20 or fewer geometric symbols under optimum display conditions?	[ ]	[ ]	[ ]
153. Are there six or fewer geometric symbols under adverse display conditions?	[ ]	[ ]	[ ]
154. When needed, are other highlighting and graphic techniques used to display different states or qualities of a basic symbol?	[ ]	[ ]	[ ]
155. Are colors used on the CRT to convey information consistent in use and meaning with all other color codes in the control room?	[ ]	[ ]	[ ]
156. Is only one color assigned a specific use or meaning?	[ ]	[ ]	[ ]
157. On CRT displays, is red used to indicate an unsafe condition, operator action required, or critical parameter value out of tolerance?	[ ]	[ ]	[ ]
158. On CRT displays, is green used to indicate a safe condition, no operator action required, or parameter value within tolerance?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
159. On CRT displays, is yellow/amber used to indicate a hazard, potentially unsafe, caution, attention required, or marginal parameter value exists?	[ ]	[ ]	[ ]
160. Are red and green used in combination on the CRT displays?	[ ]	[ ]	[ ]
161. Are page design and content planned to minimize requirements for operator memory?	[ ]	[ ]	[ ]
162. Are all data relevant to a specific operator entry displayed on a single page?	[ ]	[ ]	[ ]
163. When pages are organized in a hierarchical fashion, containing a number of different paths through the series, is a visual audit trail of the choices available upon operator request?	[ ]	[ ]	[ ]
164. When an operator is required to scroll or pan on a large logical frame, are location references provided in the viewable portion of the frame?	[ ]	[ ]	[ ]
165. Are sectional coordinates used when large schematics must be panned or magnified?	[ ]	[ ]	[ ]
166. Does the operator have some capacity for controlling the amount, format, and complexity of information being displayed by the system?	[ ]	[ ]	[ ]
167. If a message is a variable option list, do common elements maintain the physical relationship to other recurring elements?	[ ]	[ ]	[ ]

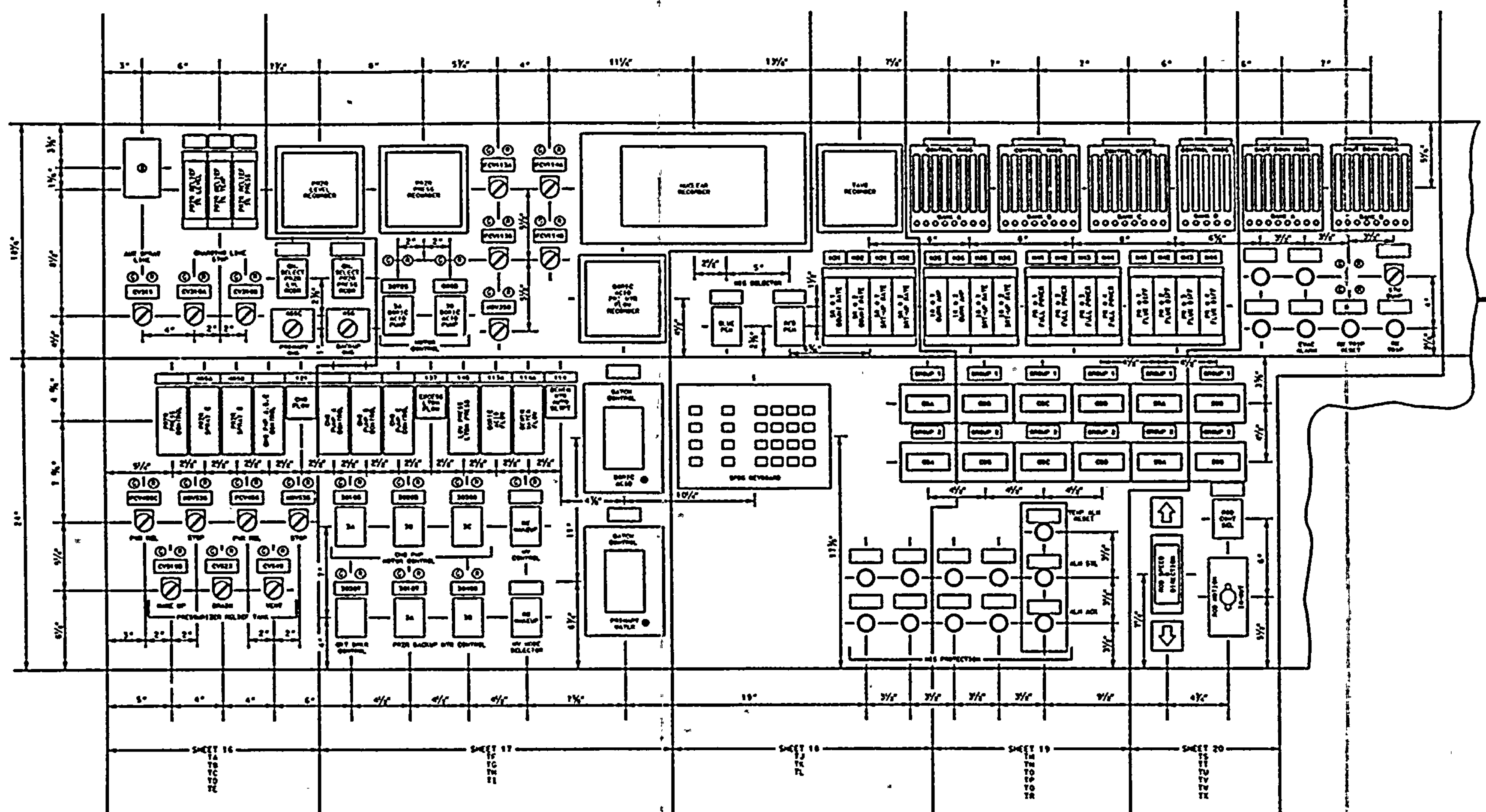
	Yes	No	Comment Number
168. Are printers part of the process computer system and located in the control room?	[ ]	[ ]	[ ]
169. Do control room printers provide the capability to record alarm data, trend data, and plant status data?	[ ]	[ ]	[ ]
170. Is the system designed to provide a hard copy of any page appearing on the CRT at the operator's request?	[ ]	[ ]	[ ]
171. Does printer operation alter screen content?	[ ]	[ ]	[ ]
172. Is printer information presented in a directly usable form with minimal requirements for decoding, transposing, and interpolating?	[ ]	[ ]	[ ]
173. Do printers used for recording trend data, computer alarms, and critical status information have a high speed printing capability of at least 300 lines per minute?	[ ]	[ ]	[ ]
174. Is hard finish matte paper used to avoid smudged copy and glare?	[ ]	[ ]	[ ]
175. Is there a positive indication of the remaining supply of recording materials?	[ ]	[ ]	[ ]
176. Do instructions for reloading paper, ribbon, ink, etc. appear on an instruction plate attached to the printer?	[ ]	[ ]	[ ]
177. When the printer is down, are data and information normally printed lost?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
178. Is a takeup device for printed material provided that requires little attention and which has a capacity at least equal to the feed supply?	[ ]	[ ]	[ ]
179. Are provisions made so the operator can always read the most recently printed line of printer?	[ ]	[ ]	[ ]
180. Does printed material have an adequate contrast ratio to ensure easy operator reading?	[ ]	[ ]	[ ]
181. Is it easy to annotate the print copy while it is still in the machine?	[ ]	[ ]	[ ]
182. Is a printer provided to record alarm messages?	[ ]	[ ]	[ ]
183. Are alarm messages recorded in the sequence of their occurrence?	[ ]	[ ]	[ ]
184. Are all annunciator alarms recorded?	[ ]	[ ]	[ ]
185. Are provisions included to provide printouts by alarm group?	[ ]	[ ]	[ ]
186. Are alarm messages readily distinguishable from other messages?	[ ]	[ ]	[ ]
187. Do alarm messages provide rapid identification of the nature of the alarm?	[ ]	[ ]	[ ]
188. Does wording in alarm messages clearly relate to the specific annunciator tile that is illuminated (i.e., at least the identical wording)?	[ ]	[ ]	[ ]

	Yes	No	Comment Number
189. If the general shape of the function is important in making decisions, is a graph used?	[ ]	[ ]	[ ]
190. If interpolation is necessary, is a line graph used?	[ ]	[ ]	[ ]
191. Are graphs constructed so that numbered grids are bolder than unnumbered grids?	[ ]	[ ]	[ ]
192. If 10-grid intervals are used, is the fifth intermediate grid less bold than the numbered grid, but bolder than the unnumbered grids?	[ ]	[ ]	[ ]
193. Are tables simple; concise, and readable?	[ ]	[ ]	[ ]
194. When table columns are long, are numbers separated into groups by providing a space between groups of five?	[ ]	[ ]	[ ]
195. When columns are not separated by vertical lines, are columns separated by at least two character widths?	[ ]	[ ]	[ ]
196. If a copy will be printed remote to the operator, is a print confirmation or denial message displayed?	[ ]	[ ]	[ ]

NOTES:

1. THIS DRAWING WAS MADE FROM 5610-4001-28.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.



CONTINUED ON DRAWING 5610-J507

FRONT VIEW
SECTION 3C01

TI
APERTURE
CARD

Also Available On
Aperture Card

8604080305-01

COORDINATION SIGN-OFF

ISSUED FOR USE

BECHTEL
GAITHERSBURG, MARYLAND

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS
UNIT NO. 3 1970-760 MW INSTALLATION
UNIT NO. 4 1971-760 MW INSTALLATION

CONTROL CONSOLE
FRONT VIEW
SECTION 3C01

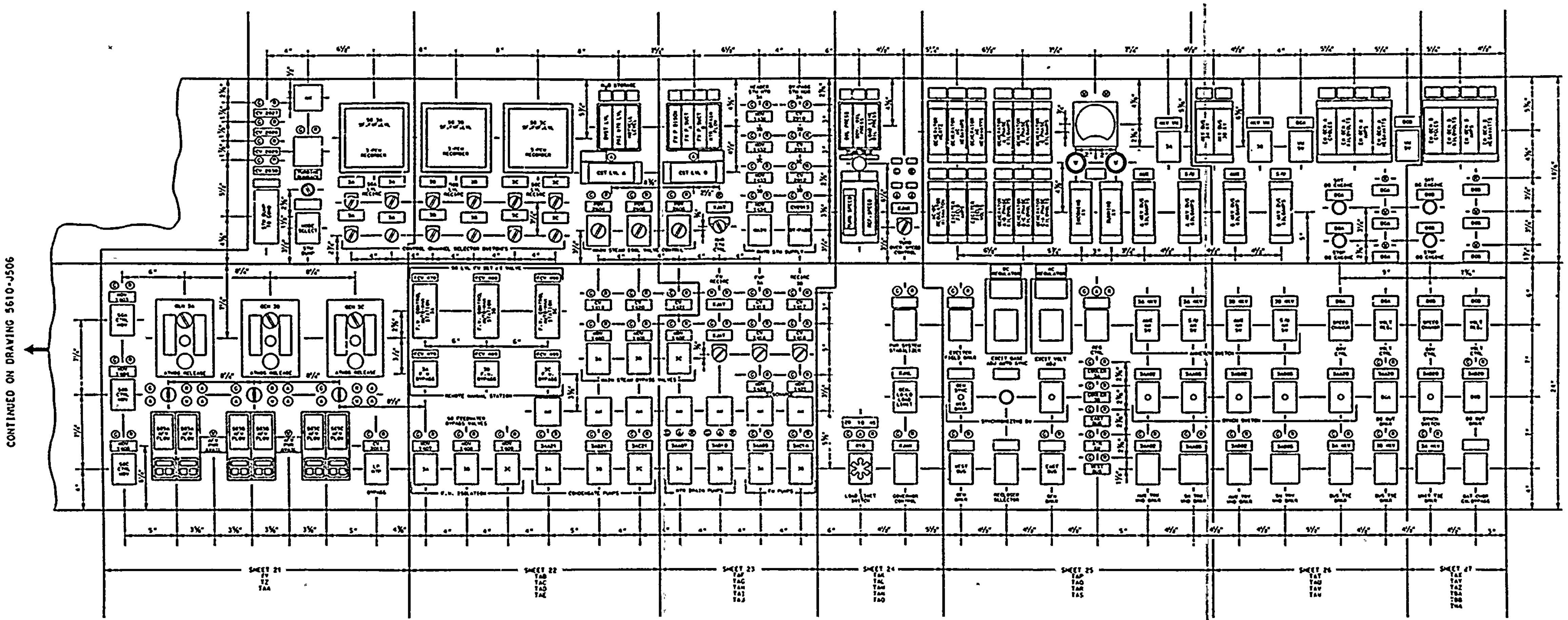
CADD

DRAWING NO. 5610-J506 0

FILE NUMBER: 5177-257

NOTES:

1. THIS DRAWING WAS MADE FROM 5610-M301-20.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.



FRONT VIEW
SECTION 3C02

8604080305-02

TI APERTURE CARD

Also Available On Aperture Card

ISSUED FOR USE

COORDINATION SIGN OFF

BECHTEL
GAITHERSBURG, MARYLAND

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS

CONTROL CONSOLE
FRONT VIEW
SECTION 3C02

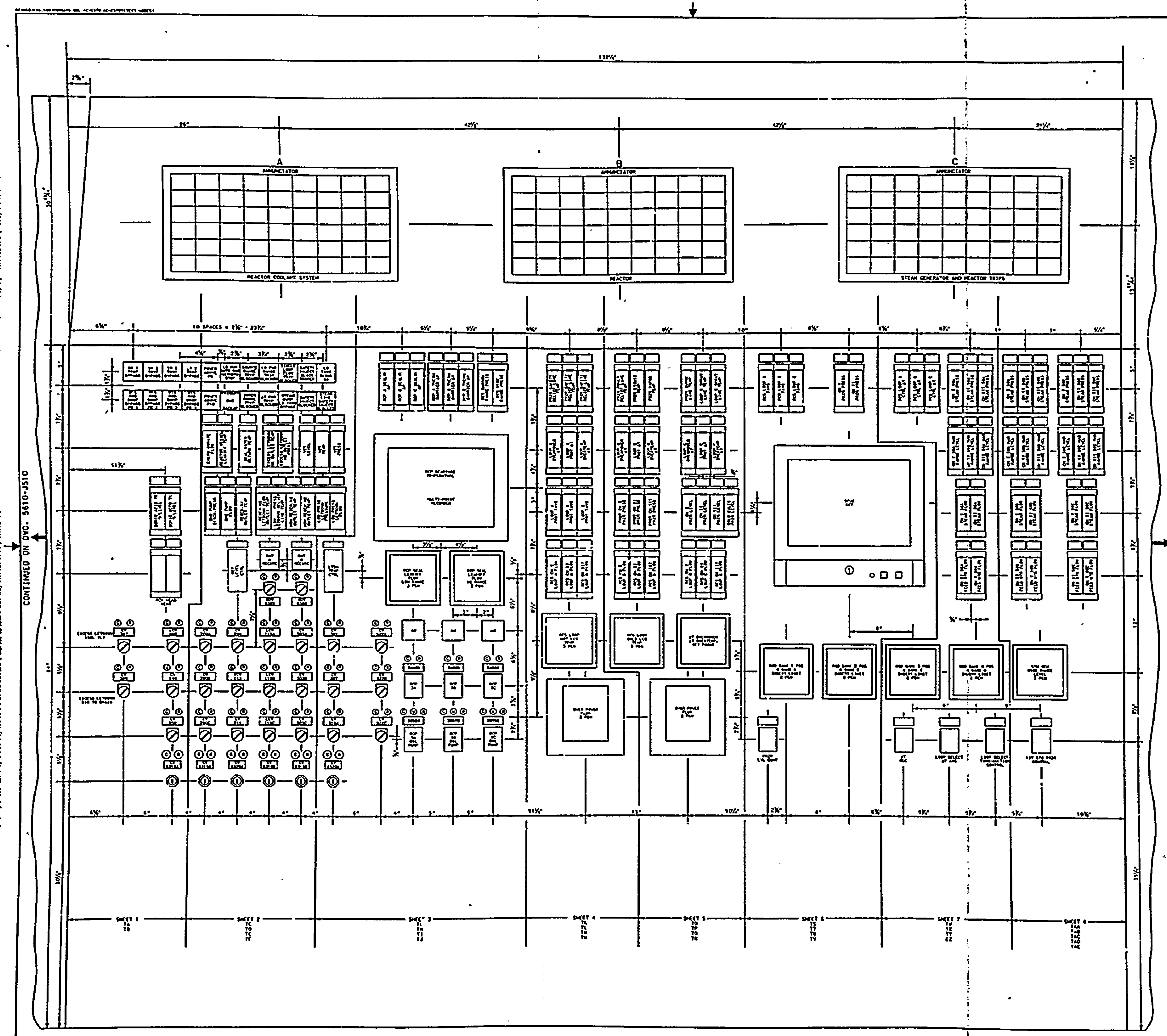
5610 - J507 | 0

FILE NUMBER: 5177 - 257

PLOT SCALE

NOTES:

1. THIS DRAWING WAS MADE FROM 5610-M-301-13.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.



FRONT VIEW-SECTION 3C03

TI APERTURE CARD

Also Available On Aperture Card

8604080305-03

ISSUED FOR USE

BECHTEL
GAITHERSBURG, MARYLAND

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS

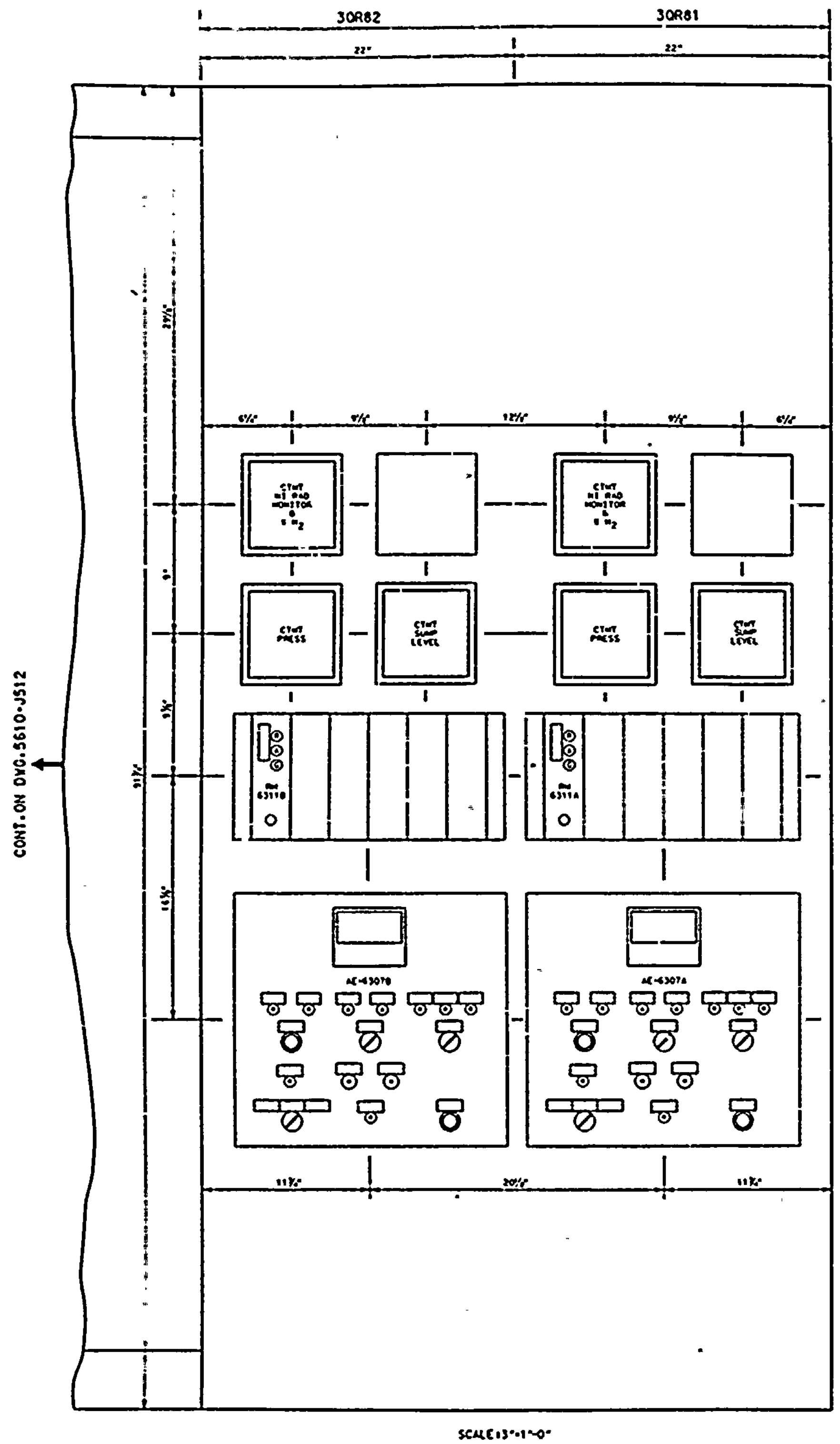
VERTICAL PANEL "A"
FRONT VIEW
SECTION 3C03

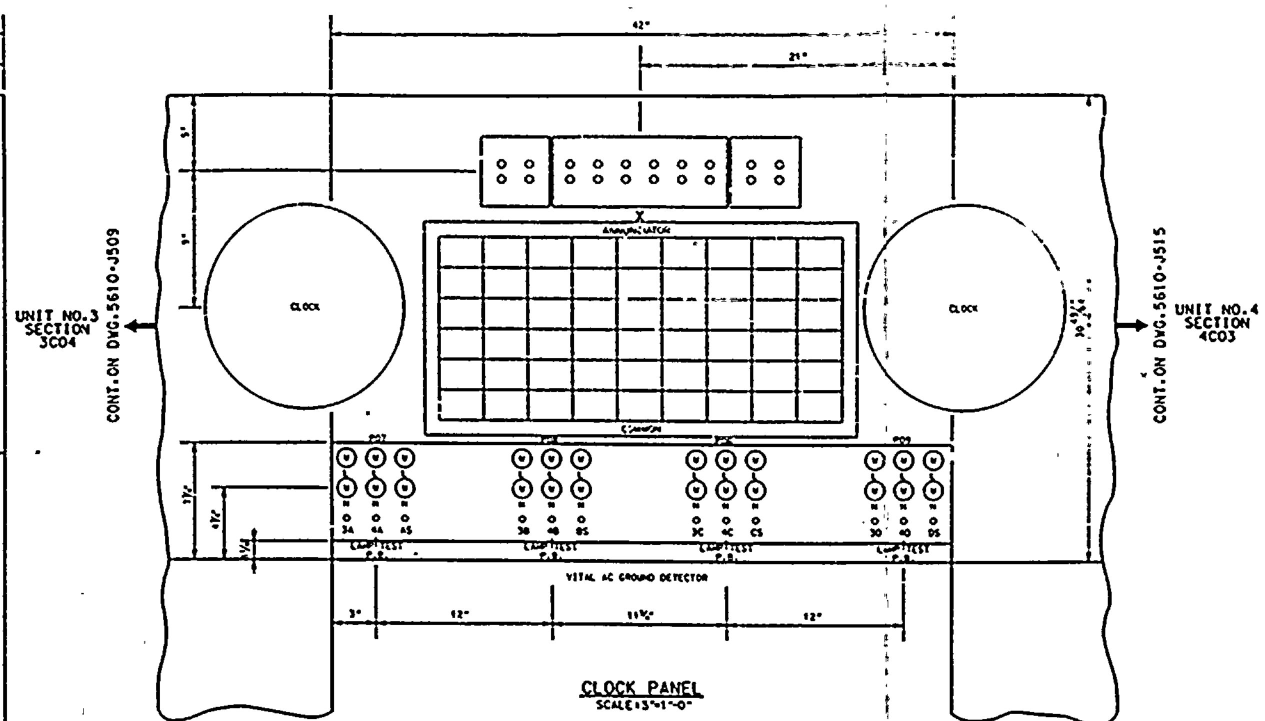
5610-J508 SH.1 OF 2 | 0

FILE NUMBER: 5177-257

NOTES:

1. THIS DRAWING IS NUCLEAR SAFETY RELATED.
2. ALL DIMENSIONS ARE IN INCHES.





CLOCK PANEL

SCALE: 3"=1'-0"

TI APERTURE CARD

Also Available On Aperture Card

8604080305-04

COORDINATION SIGN OFF

0		ISSUED FOR USE

BECHTEL

GAITHERSBURG, MARYLAND

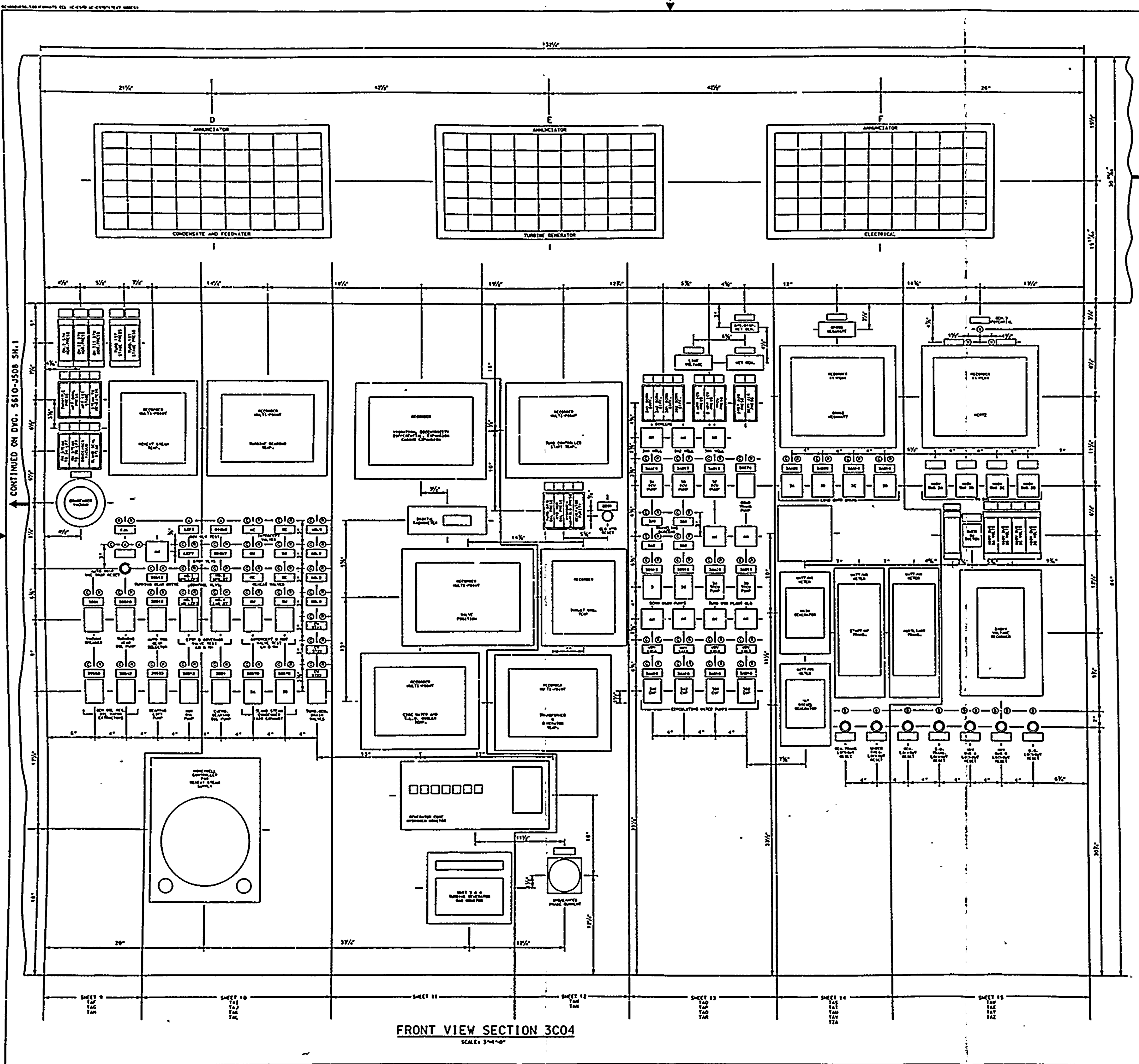
FLORIDA POWER & LIGHT COMPANY

TURKEY POINT NUCLEAR UNITS

30R81, 30R82 AND CLOCK PANEL FRONT VIEW

DRAWING NO. 5610-J508 SH.2 — 0

FILE NUMBER: 5177-257



NOTES:

1. THIS DRAWING WAS MADE FROM 5610-J301-12.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.

TI APERTURE CARD

Also Available On Aperture Card

8604080305-05

COORDINATION SIGN OFF

ISSUED FOR USE

BECHTEL
GAITHERSBURG, MARYLAND

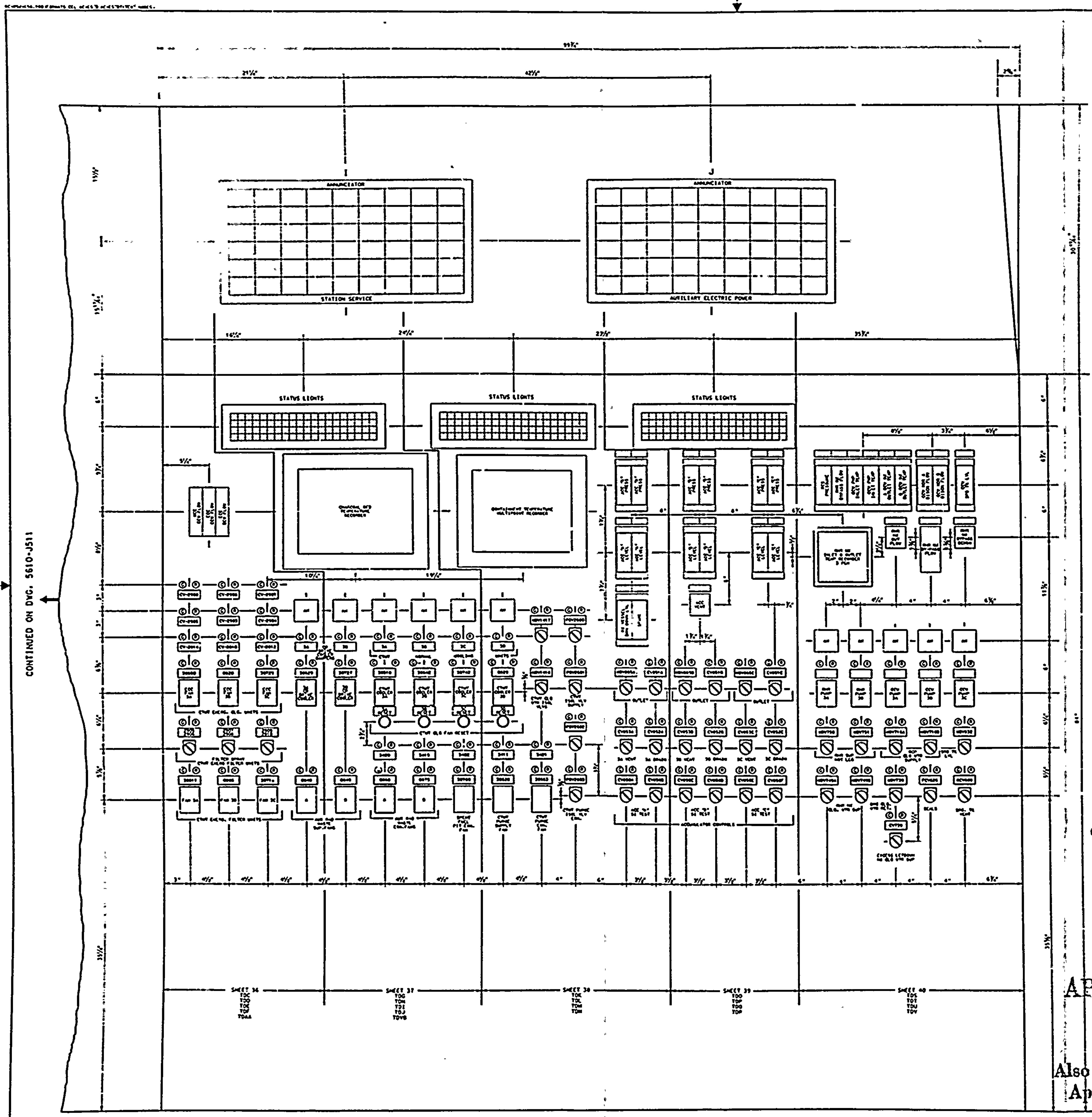
FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS
UNIT NO. 3 1970-760 MW INSTALLATION
UNIT NO. 4 1971-760 MW INSTALLATION

VERTICAL PANEL "A"
FRONT VIEW
SECTION 3C04

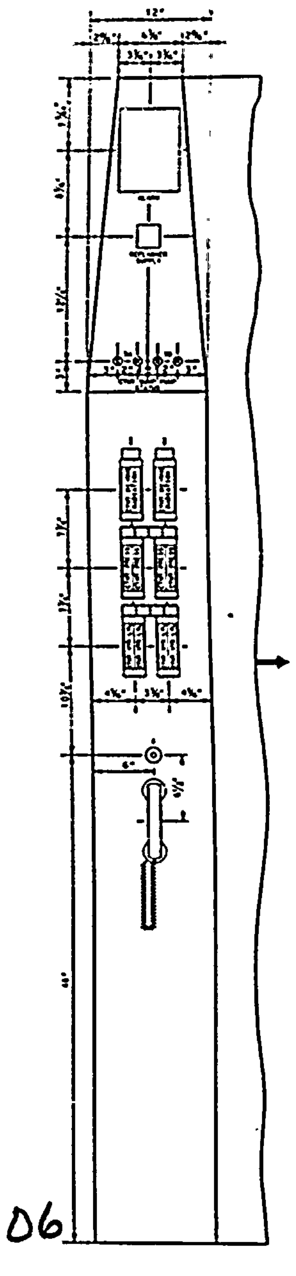
CADD

DRAWING NO. 5610-J509 | 0

FILE NUMBER: 5177-257



FRONT VIEW-SECTION 3C05



VERTICAL PANEL 'C'

SCALE: 2"=1'-0"

COORDINATION SIGN OFF

8604080305-06

TI APERTURE CARD

Also Available On Aperture Card

0	9/84	ISSUED FOR USE	

BECHTEL
GAITHERSBURG, MARYLAND

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS
UNIT NO. 3 1970-760 MW INSTALLATION
UNIT NO. 4 1971-760 MW INSTALLATION

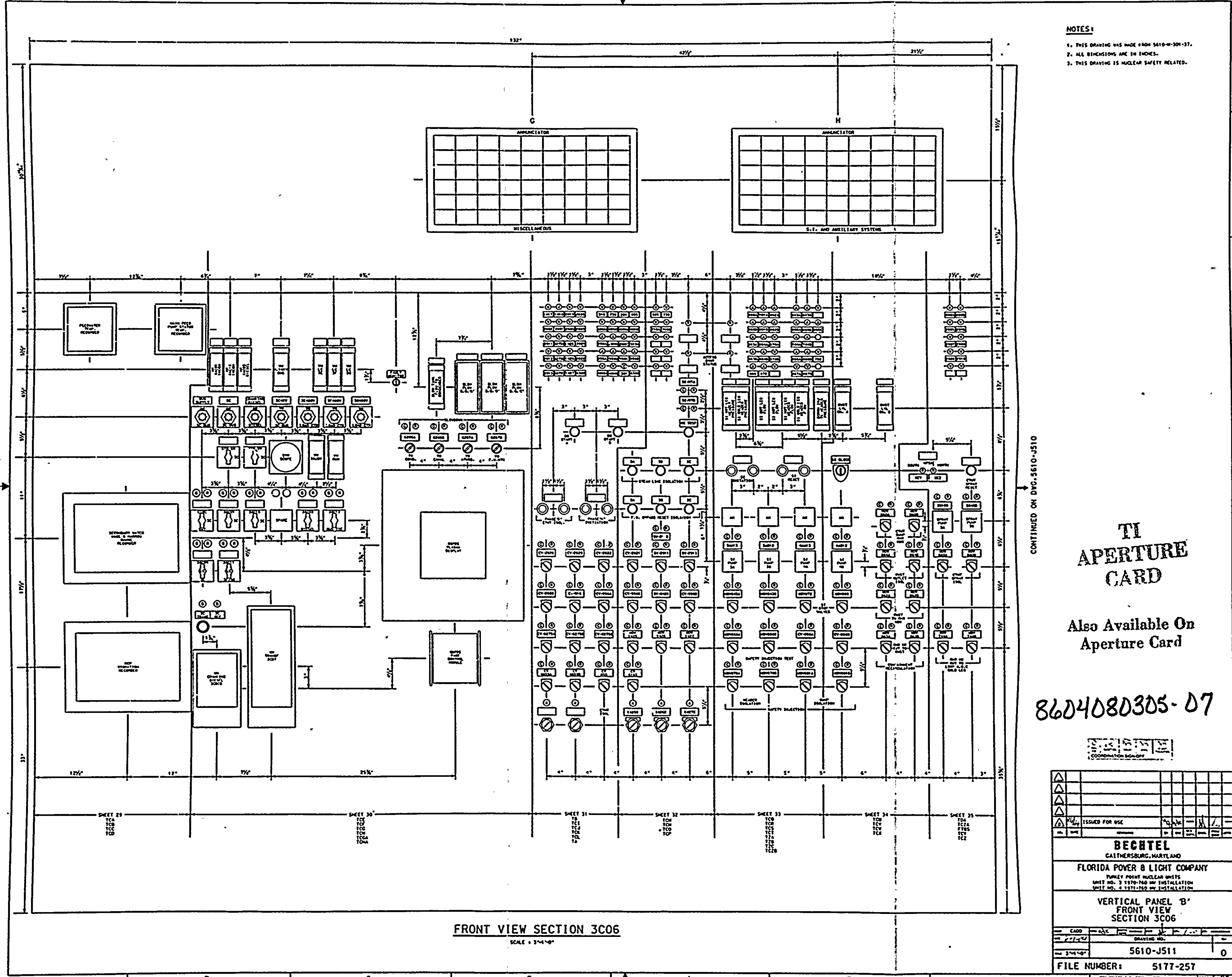
VERTICAL PANELS 'B' & 'C'
FRONT VIEW
SECTION 3C05

CADD

AS NOTED

DRAWING NO. 5610-J510 — 0

FILE NUMBER: 5177-257



FRONT VIEW SECTION 3C06

NOTES:

1. THIS DRAWING WAS MADE FROM 5610-M-301-37.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.

TI APERTURE CARD

Also Available On Aperture Card

8604080305-07

0		ISSUED FOR USE

BECHTEL
GAITHERSBURG, MARYLAND

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS
UNIT NO. 3 1970-760 MW INSTALLATION
UNIT NO. 4 1971-760 MW INSTALLATION

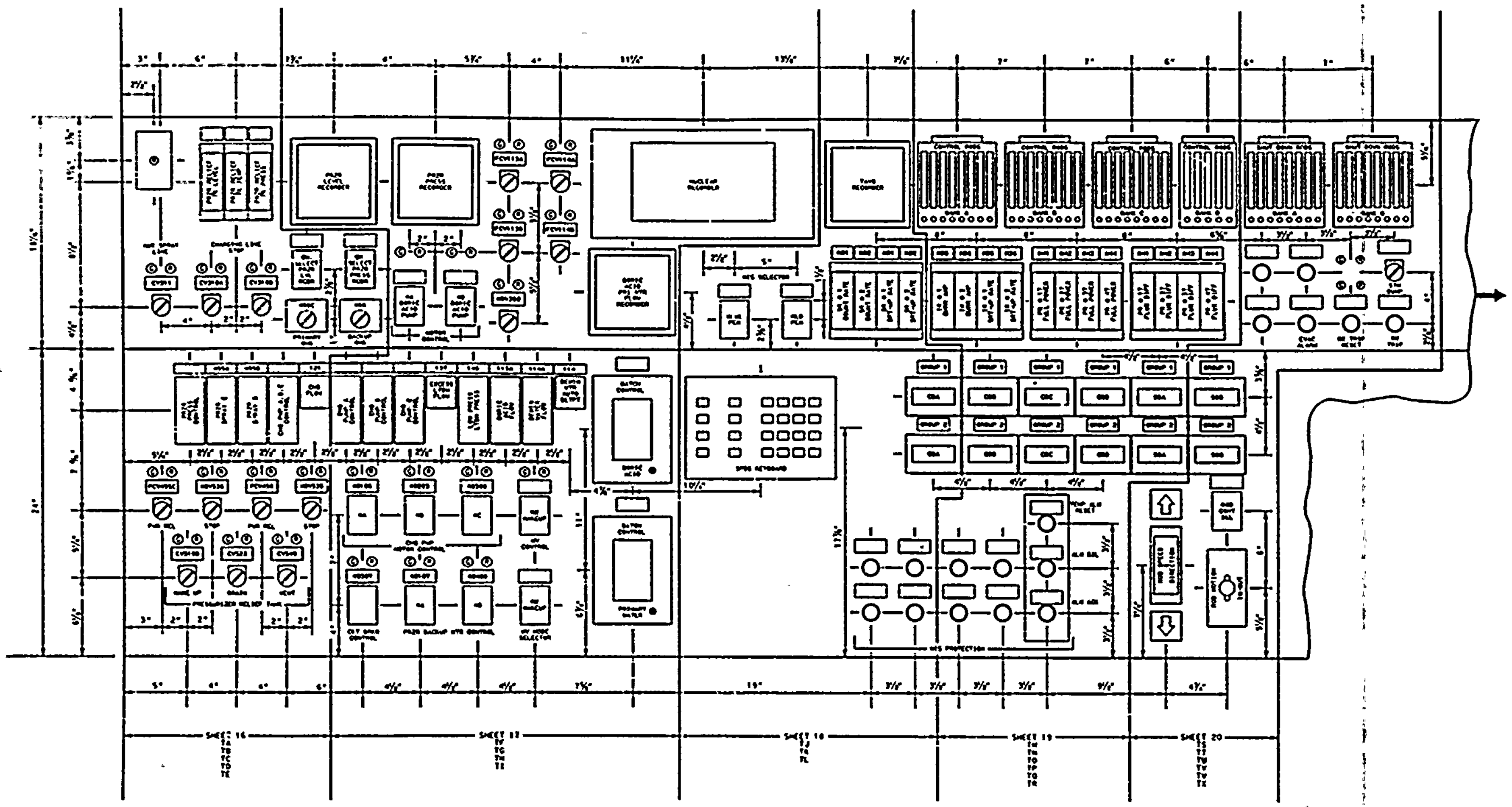
VERTICAL PANEL 'B'
FRONT VIEW
SECTION 3C06

DRAWING NO. 5610-J511 0

FILE NUMBER: 5177-257

NOTES:

1. THIS DRAWING WAS MADE FROM 5610-H001-23.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.



CONTINUED ON DRAWING 5610-J514

FRONT VIEW
SECTION 4C01

TI APERTURE CARD

Also Available On Aperture Card

8604080305-08

ISSUED FOR USE

BECHTEL
GAITHERSBURG, MARYLAND

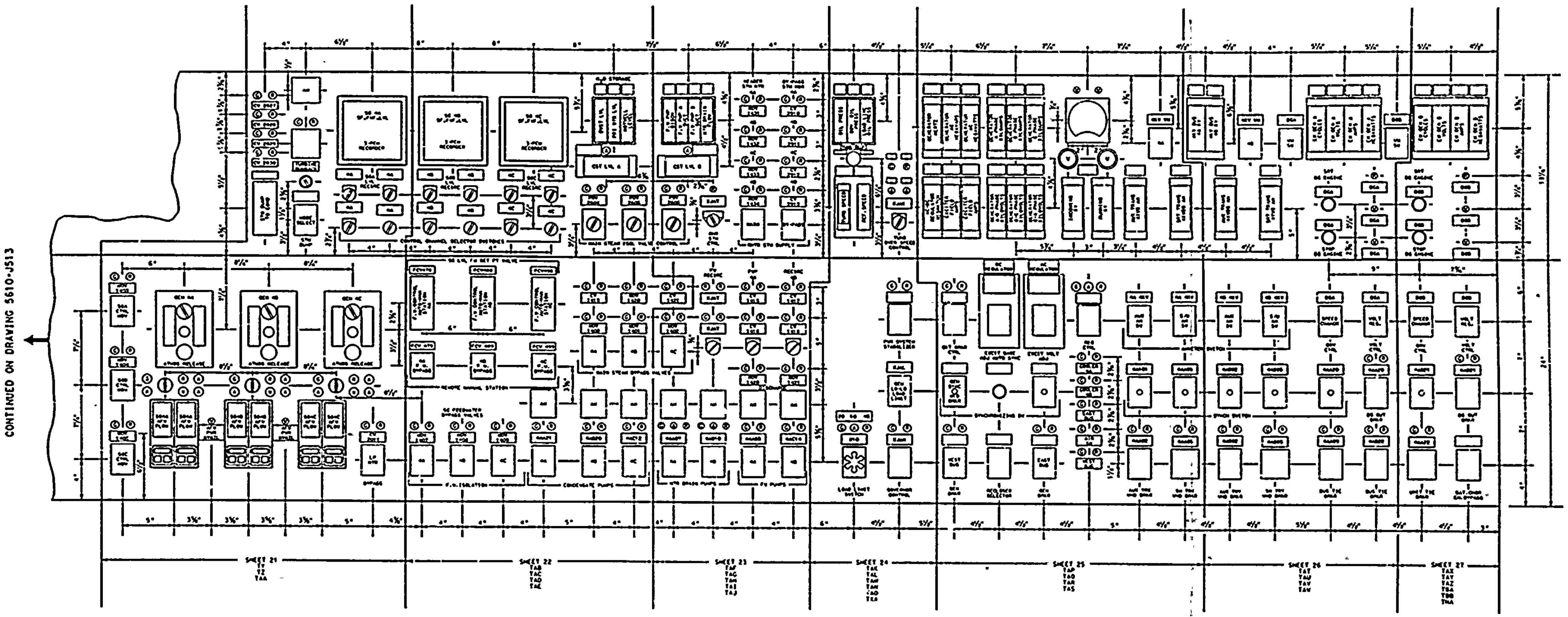
FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS
UNIT NO. 3 1970-760 MW INSTALLATION
UNIT NO. 4 1971-760 MW INSTALLATION

CONTROL CONSOLE
FRONT VIEW
SECTION 4C01

5610-J513 | 0

FILE NUMBER: 5177-257

NOTES:
1. THIS DRAWING WAS MADE FROM 5610-M301-23.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.



FRONT VIEW
SECTION 4C02
SCALE: 3" = 1'-0"

8604080305-09

TI
APERTURE
CARD

Also Available On
Aperture Card

COORDINATION SIGN OFF

0		ISSUED FOR USE						

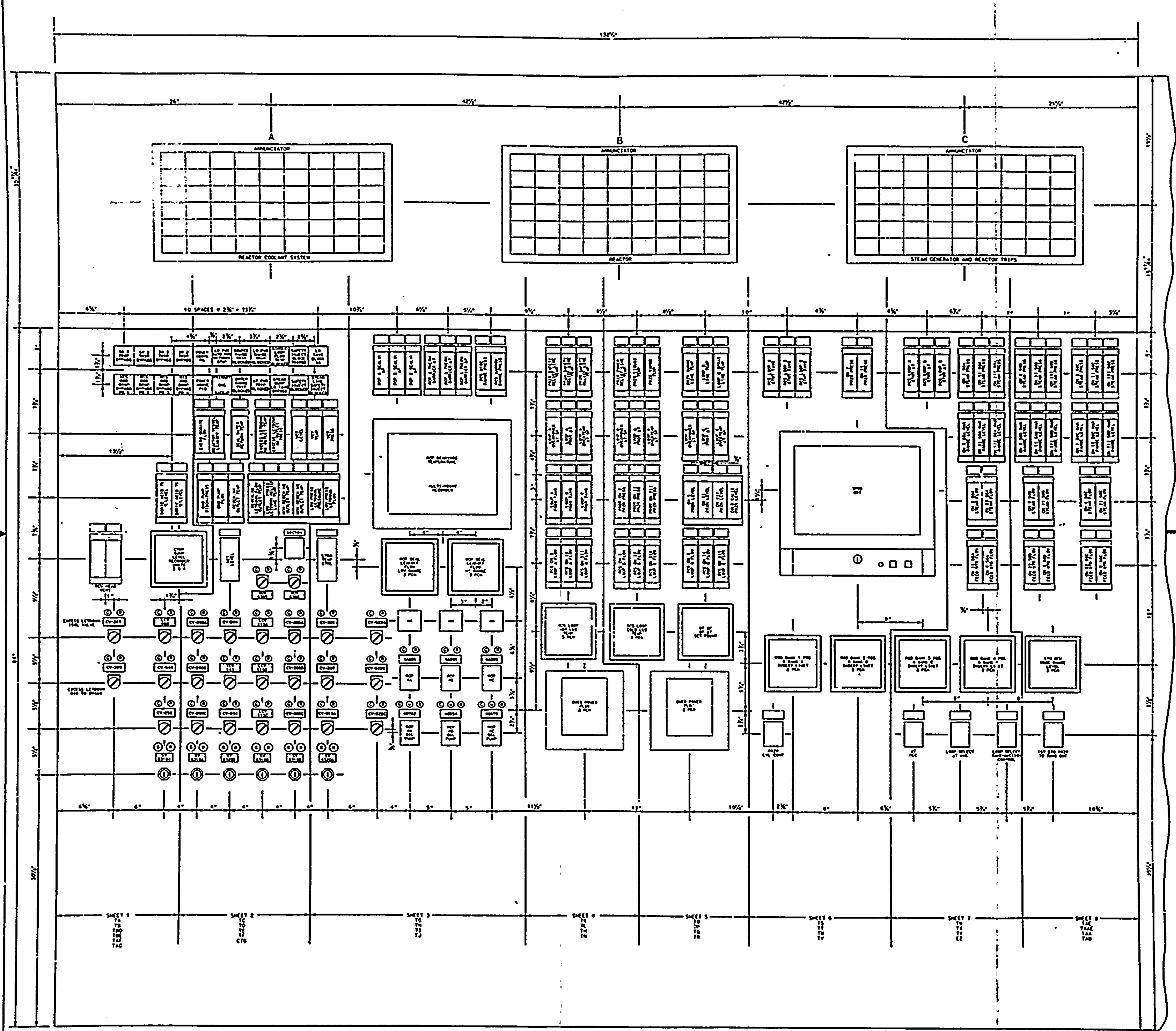
BECHTEL
GAITHERSBURG, MARYLAND

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS
UNIT NO. 3 1970-760 MW INSTALLATION
UNIT NO. 4 1971-760 MW INSTALLATION

CONTROL CONSOLE
FRONT VIEW
SECTION 4C02

CADD
DRAWING NO. 5610 - J514 — 0

FILE NUMBER: 5177 - 257



FRONT VIEW-SECTION 4C03

NOTES:

1. THIS DRAWING WAS MADE FROM 5610-M-301-26.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.

TI APERTURE CARD

Also Available On Aperture Card

8604080305-10

COORDINATION SIGN OFF

ISSUED FOR USE

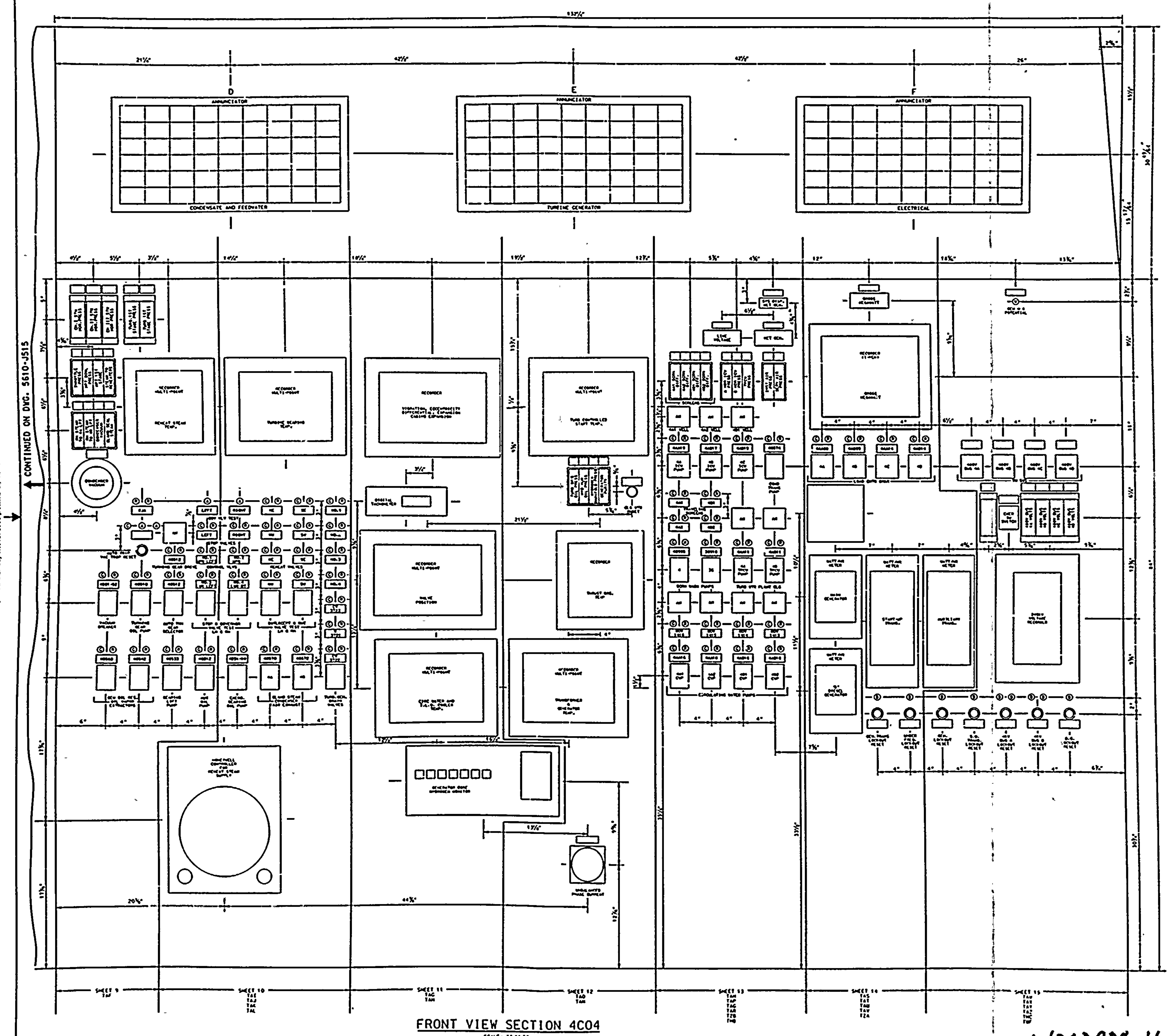
BECHTEL
GAITHERSBURG, MARYLAND

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS
UNIT NO. 3 1970-760 MW INSTALLATION
UNIT NO. 4 1971-760 MW INSTALLATION

VERTICAL PANEL "A"
FRONT VIEW
SECTION 4C03

DRAWING NO. 5610-J515 | 0

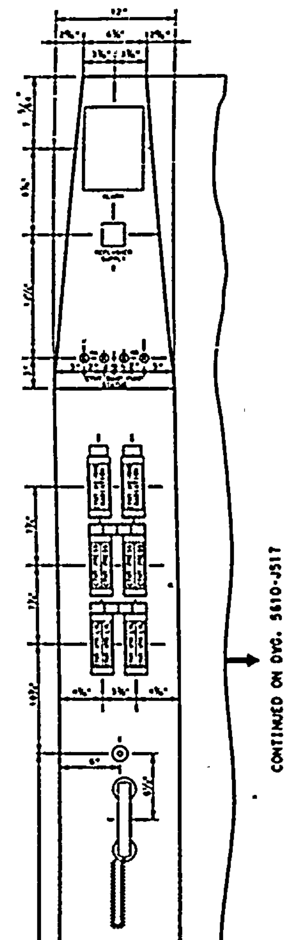
FILE NUMBER: 5177-257



FRONT VIEW SECTION 4C04

NOTES:

1. THIS DRAWING WAS MADE FROM 5610-M301-20.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.



TI APERTURE CARD

Also Available On Aperture Card

COORDINATION SIGN OFF

VERTICAL PANEL 'C'

SCALE: 2"=1'-0"

ISSUED FOR USE

BECHTEL
GAITHERSBURG, MARYLAND

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS
UNIT NO. 3 1970-760 MW INSTALLATION
UNIT NO. 4 1971-760 MW INSTALLATION

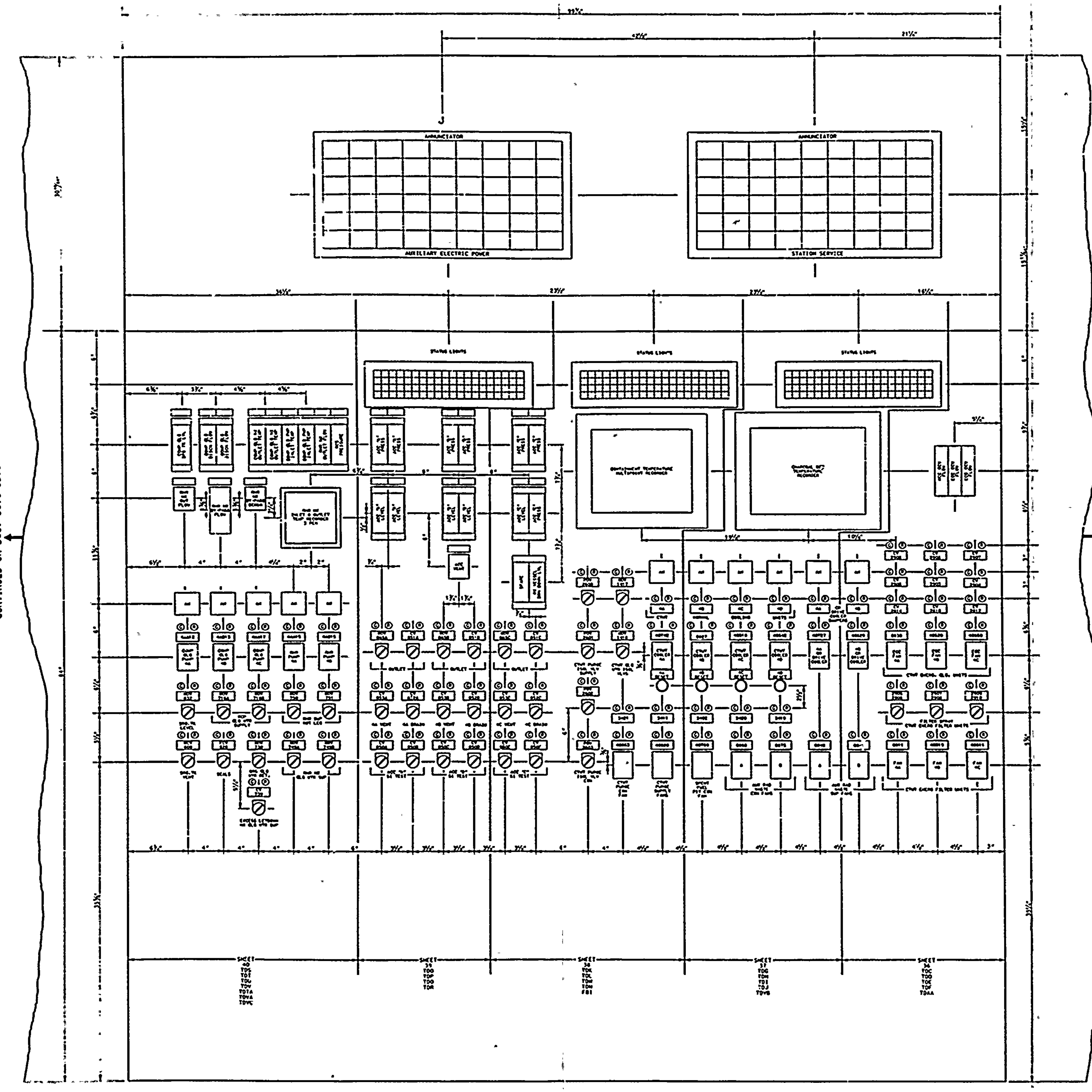
VERTICAL PANELS "A" & "C"
FRONT VIEW
SECTION 4C04

DRAWING NO. 5610-J516 | 0

AS NOTED

FILE NUMBER: 5177-257

8604080305-11



FRONT VIEW-SECTION 4C05

NOTES:

1. THIS DRAWING WAS MADE FROM 5610-M301-20.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.

TI APERTURE CARD

Also Available On Aperture Card

COORDINATION SIGN-OFF

△		ISSUED FOR USE

BECHTEL
GAITHERSBURG, MARYLAND

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS
UNIT NO. 3 1970-760 MW INSTALLATION
UNIT NO. 4 1971-760 MW INSTALLATION

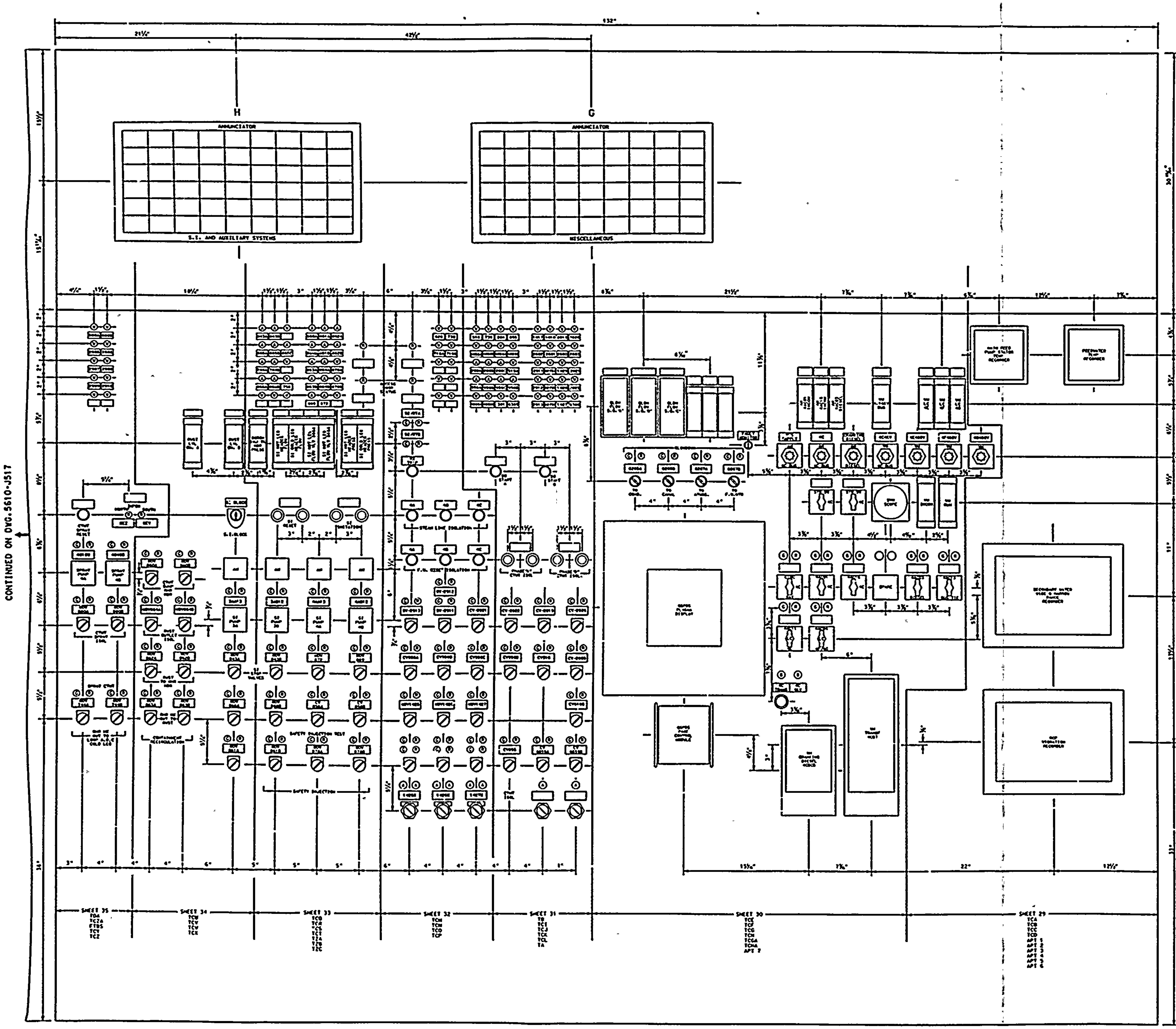
VERTICAL PANEL "B"
FRONT VIEW
SECTION 4C05

CADD

DRAWING NO. 5610-J517 | 0

FILE NUMBER: 5177-257

8604080305-12



FRONT VIEW SECTION 4C06

NOTES:

1. THIS DRAWING WAS MADE FROM 5610-M-309-41.
2. ALL DIMENSIONS ARE IN INCHES.
3. THIS DRAWING IS NUCLEAR SAFETY RELATED.

TI APERTURE CARD

Also Available On Aperture Card

8640803305-13

COORDINATION SIGN OFF

ISSUED FOR USE

BECHTEL
GAITHERSBURG, MARYLAND

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR UNITS
UNIT NO. 3 1970-760 MW INSTALLATION
UNIT NO. 4 1971-760 MW INSTALLATION

VERTICAL PANEL 'B'
FRONT VIEW
SECTION 4C06

CADD

DRAWING NO. 5610-J518 0

FILE NUMBER: 5177-257

[illegible]

UNIT 3

ANNUNCIATOR PANEL A

1	2	3	4	5	6	7	8	9
RC PUMPS THERMAL BARR COOLING WATER HIGH FLOW	BORIC ACID TK A HIGH TEMP	OMS LOW PRESSURE OPERATION	PORV/RELIEF VALVE OPEN	CHARGING PUMP 3A TRIP	CHARGING PUMP 3A MOTOR OVERLOAD	PRESSURIZER RELIEF TANK HI TEMP/HI LVL HI PRES/LO LVL	PRESSURIZER PROTECTION HIGH PRESS	PRESSURIZER LIQUID/VAPOR HIGH TEMP
10	11	12	13	14	15	16	17	18
RC PUMPS THERMAL BARR COOLING WATER HIGH TEMP	BORIC ACID TK A LOW TEMP	OMS HIGH PRESSURE ALERT	INADEQUITE CORE COOLING 5610-E-591 SH. 3A	CHARGING PUMP 3B TRIP	CHARGING PUMP 3B MOTOR OVERLOAD	PRESSURIZER POWER RELIEF LINE HIGH TEMP	PRESSURIZER PROTECTION LOW PRESS	PRESSURIZER CONTROL HIGH/LOW PRESS
19	20	21	22	23	24	25	26	27
RC PUMPS THERMAL BARR COOLING WATER LOW FLOW	BORIC ACID TANK A LO-LO/LOW/HIGH LEVEL	OMS CONTROL ACTUATED	BORIC ACID TANK C LO-LO/LOW/HIGH LEVEL	CHARGING PUMP 3C TRIP	CHARGING PUMP 3C MOTOR OVERLOAD	PRESSURIZER SAFETY VALVE LINE A,B,C HIGH TEMP	PRESSURIZER PROTECTION HIGH LEVEL	PRESSURIZER CONTROL HIGH/LOW LEVEL
28	29	30	31	32	33	34	35	36
RC PUMPS SEAL LEAK-OFF LOW FLOW	BATCHING TANK HIGH TEMP	BATCHING TANK LOW TEMP	BATCHING TANK LOW LEVEL	HIGH PRESSURE LETDOWN LINE HIGH TEMP	REACTOR COOLANT PUMPS SHAFT SEAL WTR LOW ΔP	RC PUMP 3A SEAL WATER BYPASS LOW FLOW	PRESSURIZER PROTECTION LOW-LOW LEVEL	PRESSURIZER LOW LEVEL HEATER OFF AND LETDWN SECURED
37	38	39	40	41	42	43	44	45
RC PUMPS SEAL LEAK-OFF HIGH FLOW	RC MAKE-UP BORIC ACID FLOW DEVIATION	DEMINERALIZED FLOW DIVERTED HIGH TEMP	VOLUME CONTROL TANK HIGH TEMP HIGH/LOW PRESS	LOW PRESSURE LETDOWN LINE HIGH FLOW HIGH PRESS	REACTOR COOLANT PUMPS LABYRINTH SEAL LOW ΔP	RC PUMP 3B SEAL WATER BYPASS LOW FLOW	PRESSURIZER SPRAY LINE LOW TEMP	PRESSURIZER PRESSURE CONTROLLER HIGH OUTPUT
46	47	48	49	50	51	52	53	54
RC PUMPS SHAFT NO. 1 SEAL LEAK-OFF HIGH TEMP	RC MAKE-UP WATER FLOW DEVIATION	REACTOR VESSEL FLANGE LEAK-OFF HIGH TEMP	VOLUME CONTROL TANK HIGH/LOW LEVEL	LOW PRESSURE LETDOWN RELIEF HIGH TEMP	SEAL WATER INJECTION FILTER HIGH ΔP	RC PUMP 3C SEAL WATER BYPASS LOW FLOW	PRESSURIZER SURGE LINE LOW TEMP	RHR LETDOWN ISOLATION

UNIT 3

ANNUNCIATOR PANEL B

1	2	3	4	5	6	7	8	9
REACTOR COOLANT LOOP 3A LOW FLOW	P6 OR P10 NOT SATISFIED	PRESSURIZER HEATER CONTROLLER FAN OFF	SOURCE RANGE HIGH FLUX LEVEL AT SHUTDOWN	INTERM RANGE HIGH FLUX LVL ROD WITHDRAWL STOP	NIS PWR RANGE SINGLE CHANNEL HIGH RANGE ALERT	NIS OR RPI ROD DROP TURB RUNBACK ROD STOP	ROD BANKS A/B/C/D LOW LIMIT	BACKUP NIS TRAIN A/B TROUBLE/HI FLUX LEVEL-SHUTDOWN
10	11	12	13	14	15	16	17	18
REACTOR COOLANT LOOP 3B LOW FLOW	POWER RANGE UPPER DETECTOR HI FLUX DEV OR AUTO DEFEAT	MAKEUP WATER TO BLEND SYSTEM LOW PRESSURE	SOURCE RANGE HIGH SHUTDOWN FLUX ALARM BLOCKED	INTERM RANGE LOSS OF DETECTOR VOLTAGE	NIS PWR RANGE SINGLE CHANNEL LOW RANGE ALERT	SPARE	ROD BANKS A/B/C/D EXTRA LOW LIMIT	AXIAL FLUX TILT
19	20	21	22	23	24	25	26	27
REACTOR COOLANT LOOP 3C LOW FLOW	POWER RANGE LOWER DETECTOR HI FLUX DEV OR AUTO DEFEAT	ROD POSITION DC AUXILIARY POWER ON	SOURCE RANGE LOSS OF DETECTOR VOLTAGE	INTERM RANGE 1 LOSS OF COMPENSATION VOLTAGE	NIS PWR RANGE OVERPOWER ROD WITHDRAWL STOP	ROD DROP RUNBACK OFF-NORMAL	ROD BANK D WITHDRAWL LIMIT	SHUTDOWN RODS OFF TOP/ ROD DEVIATION
28	29	30	31	32	33	34	35	36
REACTOR COOLANT PUMPS 3A,3B,3C TRIP	RC PUMP 3A OIL RESERVOIR HIGH/LOW LEVEL	REACTOR COOLANT SYSTEM HIGH ΔT	T AVG DEVIATION T AVG-T REF	INTERM RANGE 2 LOSS OF COMPENSATION VOLTAGE	NIS PWR RANGE CHANNEL DEVIATION	NUCLEAR INSTR SYSTEM CHANNEL TEST	NUCLEAR INSTR SYSTEM TRIP BYPASS	ROD CONTROL SYSTEM URGENT FAILURE
37	38	39	40	41	42	43	44	45
REACTOR COOLANT PUMPS 3A,3B,3C MOTOR OVERLOAD	RC PUMP 3B OIL RESERVOIR HIGH/LOW LEVEL	OVERPOWER ΔT	REACTOR COOLANT SYSTEM HIGH/LOW T AVG	OVERTEMP ΔT OVERPOWER ΔT AUTO TURB RNBK BLK ROD WITHDW	NIS PWR RANGE LOSS OF DETECTOR VOLTAGE	PROTECTION RACKS IN TEST	ROD CONTROL M-G SETS TRIPPED	ROD CONTROL SYSTEM NON-URGENT FAILURE
46	47	48	49	50	51	52	53	54
UNDERVOLTAGE OR UNDERFREQUENCY 4 KV BUSES	RC PUMP 3C OIL RESERVOIR HIGH/LOW LEVEL	OVERTEMP ΔT	REACTOR COOLANT LOOPS T AVG DEVIATION	REACTOR COOLANT LOOPS ΔT DEVIATION	DEVIATION SYSTEM IN TEST	PROTECTION RACKS TEST PANEL COVER OPEN	ROD CONTROL SYSTEM GROUNDED	ROD POSITION SYSTEM IN TEST

UNIT 3

ANNUNCIATOR PANEL C

1 STEAM GEN A NARROW RANGE LOW/LO-LO LEVEL	2 STEAM GEN A NARROW RANGE HIGH LEVEL	3 STEAM GEN A WIDE RANGE HI/LO LEVEL	4 STEAM GEN A FLOW MISMATCH FEEDWATER > STEAM	5 STEAM GEN A FLOW MISMATCH STEAM > FEEDWATER	6 STEAM GEN A ACTUAL-SET POINT LEVEL DEVIATION	7 STEAM GEN A STEAMLINE HIGH FLOW	8 STEAMLINE LOW PRESSURE	9 REACTOR TRIP BREAKER A OR B TRIPPED
10 STEAM GEN B NARROW RANGE LOW/LO-LO LEVEL	11 STEAM GEN B NARROW RANGE HIGH LEVEL	12 STEAM GEN B WIDE RANGE HI/LO LEVEL	13 STEAM GEN B FLOW MISMATCH FEEDWATER > STEAM	14 STEAM GEN B FLOW MISMATCH STEAM > FEEDWATER	15 STEAM GEN B ACTUAL-SET POINT LEVEL DEVIATION	16 STEAM GEN B STEAMLINE HIGH FLOW	17 STEAMLINE ISOLATION	18 STM GEN SAMPLE HIGH TEMP TO RAD MON RD-19
19 STEAM GEN C NARROW RANGE LOW/LO-LO LEVEL	20 STEAM GEN C NARROW RANGE HIGH LEVEL	21 STEAM GEN C WIDE RANGE HI/LO LEVEL	22 STEAM GEN C FLOW MISMATCH FEEDWATER > STEAM	23 STEAM GEN C FLOW MISMATCH STEAM > FEEDWATER	24 STEAM GEN C ACTUAL-SET POINT LEVEL DEVIATION	25 STEAM GEN C STEAMLINE HIGH FLOW	26 STEAM DUMP	27 STEAMLINE HIGH ΔP
28 STEAM GEN A LO-LO LEVEL REACTOR TRIP	29 MANUAL SAFETY INJECTION REACTOR TRIP	30 PRESSURIZER LOW PRESSURE REACTOR TRIP	31 PRESSURIZER HIGH PRESSURE REACTOR TRIP	32 STEAM GEN A LOW LVL & STM/ FWF MISMATCH REACTOR TRIP	33 SOURCE RANGE HIGH FLUX LEVEL REACTOR TRIP	34 POWER RANGE HI FLUX LEVEL LOW RANGE REACTOR TRIP	35 STEAM GEN A STEAMLINE HI P SAFEGUARDS REACTOR TRIP	36 HI STM FLO w/ LO T AVG OR LO STM PRESS SAFE GUARDS RX TRIP
37 STEAM GEN B LO-LO LEVEL REACTOR TRIP	38 ONE LOOP LOW FLOW/ACB OPEN /LOW FREQ REACTOR TRIP	39 PRESSURIZER HIGH WATER LEVEL REACTOR TRIP	40 TURBINE TRIP REACTOR TRIP	41 STEAM GEN B LOW LVL & STM/ FWF MISMATCH REACTOR TRIP	42 INTERMEDIATE RANGE HI FLUX LEVEL REACTOR TRIP	43 POWER RANGE HI FLUX LEVEL HIGH RANGE REACTOR TRIP	44 STEAM GEN B STEAMLINE HI P SAFEGUARDS REACTOR TRIP	45 CONTAINMENT HIGH PRESS SAFEGUARDS REACTOR TRIP
46 STEAM GEN C LO-LO LEVEL REACTOR TRIP	47 TWO LOOP LOW FLOW/ACB OPEN /LOW FREQ REACTOR TRIP	48 PRESSURIZER LOW PRESSURE SAFEGUARDS REACTOR TRIP	49 UNDERVOLTAGE 4 KV BUSES REACTOR TRIP	50 STEAM GEN C LOW LVL & STM/ FWF MISMATCH REACTOR TRIP	51 OVERTEMP ΔT REACTOR TRIP	52 OVERPOWER ΔT REACTOR TRIP	53 STEAM GEN C STEAMLINE HI P SAFEGUARDS REACTOR TRIP	54 MANUAL REACTOR TRIP

UNIT 3

ANNUNCIATOR PANEL D

1	2	3	4	5	6	7	8	9
HEATER 1A HIGH LEVEL	HEATER 1B HIGH LEVEL	MOISTURE SEPARATOR & REHEATER A HIGH LEVEL	CONDENSATE LOW FLOW	FEEDWATER PUMP 3A & 3B MOTOR OVERLOAD ALARM	FEEDWATER PUMP 3A OR 3B MOTOR OVERLOAD TRIP	FEEDWATER ISOLATION VLV STM GEN 3A MOTOR OVERLOAD	HEATER DRAIN PUMP 3A & 3B MOTOR OVERLOAD ALARM	CONDENSATE PP 3A, 3B & 3C MOTOR OVERLOAD ALARM
10	11	12	13	14	15	16	17	18
HEATER 2A HIGH LEVEL	HEATER 2B HIGH LEVEL	MOISTURE SEPARATOR & REHEATER B HIGH LEVEL	CONDENSATE STORAGE TANK HIGH-LOW LEVEL	FEEDWATER PUMP 3A LOW FLOW	FEEDWATER PUMP 3B LOW FLOW	FEEDWATER ISOLATION VLV STM GEN 3B MOTOR OVERLOAD	HEATER DRAIN PUMP 3A & 3B MOTOR OVERLOAD TRIP	CONDENSATE PP 3A, 3B & 3C MOTOR OVERLOAD TRIP
19	20	21	22	23	24	25	26	27
HEATER 3A HIGH LEVEL	HEATER 3B HIGH LEVEL	MOISTURE SEPARATOR & REHEATER C HIGH LEVEL	STM GEN OR CONDENSATE HIGH CONDUCTIVITY	FEEDWATER PUMP 3A LOW SUCTION PRESSURE	FEEDWATER PUMP 3B LOW SUCTION PRESSURE	FEEDWATER ISOLATION VLV STM GEN 3C MOTOR OVERLOAD	HEATER DRAIN PUMP 3A MOTOR BEARING HIGH TEMP	CONDENSATE PUMP 3A MOTOR BEARING HIGH TEMP
28	29	30	31	32	33	34	35	36
HEATER 4A HIGH LEVEL	HEATER 4B HIGH LEVEL	MOISTURE SEPARATOR & REHEATER D HIGH LEVEL	CONDENSER HIGH-LOW LEVEL	FEEDWATER PUMP 3A MOTOR BEARING HIGH TEMP	FEEDWATER PUMP 3B MOTOR BEARING HIGH TEMP	LOW PRESSURE HEATER BYPASS VALVE OPEN	HEATER DRAIN PUMP 3A DIFF PRESSURE TRIP	CONDENSATE PUMP 3B MOTOR BEARING HIGH TEMP
37	38	39	40	41	42	43	44	45
HEATER 5A HIGH LEVEL	HEATER 5B HIGH LEVEL	REHEATER DRAIN TANK 3A HIGH LEVEL	CONDENSATE RECOVERY TANK HI LEVEL	FEEDWATER PUMP 3A LUBE OIL LOW PRESS TRIP	FEEDWATER PUMP 3B LUBE OIL LOW PRESS TRIP	FEEDWATER PUMP 3A & 3B MOTOR STATOR HIGH TEMP	HEATER DRAIN PUMP 3B MOTOR BEARING HIGH TEMP	HEATER DRAIN TANK 3B HIGH LEVEL
46	47	48	49	50	51	52	53	54
HEATER 6A HIGH LEVEL	HEATER 6B HIGH LEVEL	REHEATER DRAIN TANK 3B HIGH LEVEL	STEAM JET AIR EJECTOR LOW PRESSURE	FEEDWATER PUMP 3A DISCHARGE VLV MOTOR OVERLOAD	FEEDWATER PUMP 3B DISCHARGE VLV MOTOR OVERLOAD	SPARE	HEATER DRAIN PUMP 3B DIFF PRESSURE TRIP	HEATER DRAIN TANK 3B LOW LEVEL

UNIT 3

ANNUNCIATOR PANEL E

1	2	3	4	5	6	7	8	9
TURBINE ROTOR ECCENTRICITY AND VIBRATION	TURBINE BEARING OIL LOW PRESSURE	TURNING GEAR MOTOR OVERLOAD	TURBINE AUXILIARY OIL PUMP RUN	TURBINE EXHAUST HOOD HIGH TEMP TRIP	TURBINE THRUST BEARING TRIP	GENERATOR NEGATIVE SEQUENCE TRIP	FIELD BREAKER AUTO TRIP	HYDROGEN SYS ALARM PANEL HYDROGEN TROUBLE
10	11	12	13	14	15	16	17	18
DIFFERENTIAL EXPANSION	TURBINE BEARING HIGH TEMP	TURNING GEAR OIL PUMP RUN	TURBINE AUX OIL PUMP HIGH TEMP OR MOTOR OVERLOAD	TURBINE EXHAUST HOOD HIGH TEMP ALARM	TURBINE BEARING OIL LOW PRESSURE TRIP	GENERATOR LOSS OF FIELD TRIP	GENERATOR FIELD FORCING OR REGULATOR LIMITING	HYDROGEN FROM COOLER HIGH TEMP
19	20	21	22	23	24	25	26	27
TURBINE THRUST BEARING WEAR	EMERGENCY BEARING OIL PUMP RUN	TURNING GEAR OIL PUMP MOTOR OVERLOAD OR HIGH TEMP	TURBINE LUBE OIL HIGH TEMP	CONDENSER LOW VACUUM	TURBINE CONDENSER LOW VACUUM TRIP	GENERATOR GROUND TRIP	GENERATOR FIELD GROUND	VOLTAGE REGULATOR LOSS OF COOLING
28	29	30	31	32	33	34	35	36
TURBINE ZERO SPEED	EMERGENCY BEARING OIL PP MTR OVERLD OR HIGH TEMP	BEARING LIFT PUMP MOTOR OVERLOAD	TURBINE LUBE OIL RESERVOIR HIGH PRESSURE	GLAND STEAM CONDENSER EXHAUSTER STOPPED	TURBINE OVERSPEED TRIP	GENERATOR DIFFERENTIAL TRIP	LOSS OF GENERATOR METER POTENTIAL	EXCITER AIR FROM COOLER HIGH TEMP
37	38	39	40	41	42	43	44	45
GENERATOR 3 UNDERFREQUENCY TRIP CIRCUIT FAILURE	SGFP TRIP TURBINE RUNBACK LOGIC DEFEATED	SEAL OIL BACK-UP PUMP MOTOR OVERLOAD	TURB LUBE OIL RESERVOIR HIGH/LOW LEVEL	STEAM SEAL LOW PRESSURE	TURBINE TRIP GENERATOR LOCK OUT	GENERATOR MOTORING TRIP	LOSS OF REGULATOR POTENTIAL	GENERATOR OVER EXCITATION
46	47	48	49	50	51	52	53	54
GENERATOR 3 UNDERFREQUENCY TRIP	TURBINE TRIP BY HI-HI STEAM GEN LEVEL	GEN LOOP SEAL VAPOR EXTRACTOR STOPPED	TURB LUBE OIL CONDITIONER HIGH/LOW LEVEL	GUARDED OIL 3 ACTUATION	TURBINE TRIPPED BY THE REACTOR	VOLTAGE REGULATOR TRIP TO MANUAL	VOLTAGE REGULATOR TROUBLE	GENERATOR STATOR HIGH TEMP

UNIT 3

ANNUNCIATOR PANEL F

1	2	3	4	5	6	7	8	9
3 RCP SHAFT VIBRATION	LOAD FREQUENCY CONTROL SYSTEM TRIP	GENERATOR OCB 240W26451* TRIP	MAIN TRANSFORMER DIFERENTIAL	AUXILIARY TRANSFORMER DIFFERENTIAL	CONDENSATE PUMP 3C MOTOR BEARING HIGH TEMP	RPI'S POWER TROUBLE	DIESEL GENERATOR 3 TROUBLE	LUBE H2O PP AUTO XFER TRIP
10	11	12	13	14	15	16	17	18
VITAL INSTRUMENT BUS INVERTER TROUBLE	LOAD FREQUENCY CONTROL SYSTEM EMERGENCY CONDITION	GERERATOR OCB 240W26539** TRIP	MAIN TRANSFORMER FAULT PRESSURE	AUXILIARY TRANSFORMER FAULT PRESSURE	STATIC NEG SEQ RELAY ALARM	480 V XFMR 3E LOW VOLTAGE, GND AND HIGH TEMP	DIESEL GEN BUS 3A BREAKER OVERCURRENT TRIP	480 V TRANSFORMERS 3A,3B,3C & 3D LOW VOLTAGE
19	20	21	22	23	24	25	26	27
SPARE	REMOTE-LOCAL CONTROL SWITCH LOCAL POSITION	GENERATOR 240W26451* 240W26539** LOW GAS PRESS	MAIN TRANSFORMER NEUTRAL OVERCURRENT	UNDERVOLTAGE SCHEME TEST	RELAY CABINET GEN PROTECTIVE RELAY TRIP	SPARE	DIESEL GEN 3 ENGINE TROUBLE	480 V TRANSFORMERS 3A,3B,3C & 3D GND & HI TEMP
28	29	30	31	32	33	34	35	36
BREATHING AIR SYSTEM TROUBLE	RCP 3A,3B & 3C UF TRIP CIRCUIT FAILURE	GENERATOR OCB FAILURE LOCK OUT RELAY TRIP	MAIN TRANSFORMER ALARM PANEL	AUXILIARY TRANSFORMER ALARM PANEL	GENERATOR R.T.D. HIGH TEMP ALARM	GENERATOR CORE TROUBLE	DIESEL GEN 4 ENGINE TROUBLE	480 V XFMR 3A, 3B,3C,3D & 3E BREAKER OVER- CURRENT TRIP
37	38	39	40	41	42	43	44	45
S/G BLOWDOWN TANK HI PRESSURE ALARM	SPARE	SPARE	MAIN TRANSFORMER ALARM PANEL EMERGENCY	AUX XFMR 4 KV BREAKER OVERCURRENT TRIP	GENERATOR R.T.D. RECOMMEND TRIP	SPARE	DIESEL GENERATOR 4 TROUBLE	EMER DIESEL A LOCAL-NORM SW OFF-NORM LOCAL START ONLY
46	47	48	49	50	51	52	53	54
S/G BLOWDOWN TANK HI/LO LEVEL ALARM	ISOLATED PHASE BUS BACK UP FAN OPERATING	ISOLATED PHASE BUS DUCT COOLING HIGH TEMP	DIESEL OIL DAY TANK HIGH LEVEL	DIESEL OIL DAY TANK LOW LEVEL	EMER START UP 4 KV BREAKER OVERCURRENT TRIP	4 KV BUS TIE BREAKER OVERCURRENT TRIP	DIESEL GEN BUS 3B BREAKER OVERCURRENT TRIP	EMER DIESEL B LOCAL-NORM SW OFF-NORM LOCAL START ONLY

UNIT 3

ANNUNCIATOR PANEL 6

1	2	3	4	5	6	7	8	9
CHARGING PUMPS LO SPEED	REACTOR COOLANT PUMP A STANDPIPE HI LEVEL	RTD BYPASS LOOP "A" LO FLOW	ANNUNCIATOR FIELD VOLTAGE FAILURE	$\Delta\Phi > 5\%$ MAX PWR 90%	MIDS INACTIVE	BREAKER TRIPPED 3P06	REFUELING WATER STORAGE TANK HIGH LEVEL	S.I. PUMP 3A LOW SUCTION PRESSURE
10	11	12	13	14	15	16	17	18
CHARGING PUMPS HI SPEED	REACTOR COOLANT PUMP B STANDPIPE HI LEVEL	RTD BYPASS LOOP "B" LO FLOW	REACTOR CONTROL EQUIPMENT ROOM HIGH TEMP	$\Delta\Phi$ 5% > 1 HR MAX PWR 50%	FLUX MAPPER FAILURE	BREAKER TRIPPED 3P07	REFUELING WTR STORAGE TANK TECH SPEC MIN LEVEL	S.I. PUMP 3B LOW SUCTION PRESSURE
19	20	21	22	23	24	25	26	27
CH. SET I PROTECTION RACK DOOR OPEN	REACTOR COOLANT PUMP C STANDPIPE HI LEVEL	RTD BYPASS LOOP "C" LO FLOW	METAL IMPACT ALARM	CONTAINMENT SUMP LEVEL $\uparrow$ > 1 GPM	3A SGFW PUMP STRAINER HIGH ΔP	BREAKER TRIPPED 3P08	"A" CONDENSATE PUMP LOW RECIRC FLOW	S.I. PUMP 4A LOW SUCTION PRESSURE
28	29	30	31	32	33	34	35	36
CH. SET II PROTECTION RACK DOOR OPEN	REACTOR COOLANT PUMP A STANDPIPE LO LEVEL	CHARGING PUMPS CONTROL STATION MANUAL	DEMINERAL- IZATION SYSTEM TROUBLE	ANNUNCIATOR SYSTEM GROUND	3B SGFW PUMP STRAINER HIGH ΔP	BREAKER TRIPPED 3P09	"B" CONDENSATE PUMP LOW RECIRC FLOW	S.I. PUMP 4B LOW SUCTION PRESSURE
37	38	39	40	41	42	43	44	45
CH. SET III PROTECTION RACK DOOR OPEN	REACTOR COOLANT PUMP B STANDPIPE LO LEVEL	REACTOR TRIP BY-PASS CLOSED	LUBE OIL DELUGE ACTIVATED	ANNUNCIATOR GROUND ISOLATE	CONDENSATE POLISHING SYSTEM TROUBLE	COMPUTER FAILURE	"C" CONDENSATE PUMP LOW RECIRC FLOW	CONTAINMENT SUMP RECORDER HIGH LEVEL
46	47	48	49	50	51	52	53	54
CH. SET IV PROTECTION RACK DOOR OPEN	REACTOR COOLANT PUMP C STANDPIPE LO LEVEL	PERMISSIVE P-10 IN TEST	SPARE	ANNUNCIATOR SPARE POWER SUPPLY	F(Z) NOT VERIFIABLE FOR 100% POWER	LINE PRINTER FAILURE	HIGH LEVEL NO.3 4160 SWGR ROOM SUMP	DDPS A-D FAILURE/ BASE LOAD MESSAGE

UNIT 3

ANNUNCIATOR PANEL H

1	2	3	4	5	6	7	8	9
SPENT FUEL PIT LOW LEVEL	ACCUMULATOR TANK A HIGH/LOW PRESS	SAFETY INJECTION PUMP 3A TRIP	SAFETY INJECTION PUMP 3A MOTOR OVERLOAD	CONTAINMENT HIGH OR HI-HI PRESSURE	CONTAINMENT SPRAY PUMPS 3A, 3B MOTOR OVERLOAD	RESIDUAL HEAT REMOVAL PUMP 3A HIGH PRESSURE	COMPONENT COOLING PUMPS 3A,3B,3C TRIP	RC PUMP 3A MOTOR AND PUMP BEARING HIGH TEMP
10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
SPENT FUEL PIT HIGH TEMP	ACCUMULATOR TANK A HIGH/LOW LEVEL	SAFETY INJECTION PUMP 3B TRIP	SAFETY INJECTION PUMP 3B MOTOR OVERLOAD	CTMT ISOLATION VENTILATION PHASE A & B OPERATED	RESIDUAL HEAT EXCHANGER LOW FLOW	RESIDUAL HEAT REMOVAL PUMP 3B HIGH PRESSURE	COMPONENT COOLING PUMPS 3A,3B,3C MOTOR OVERLOAD	RC PUMP 3B MOTOR AND PUMP BEARING HIGH TEMP
19	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
SPENT FUEL PIT HIGH LEVEL	ACCUMULATOR TANK B HIGH/LOW PRESS	SAFETY INJECTION PUMP 4A TRIP	SAFETY INJECTION PUMP 4A MOTOR OVERLOAD	CONTAINMENT ISOLATION CABINET A & B FUSE FAILURE	RESIDUAL HEAT REMOVAL PUMPS 3A, 3B MOTOR OVERLOAD	RHR PUMP 3A COOLING WATER LOW FLOW	COMPONENT COOLING PUMPS LOW PRESSURE	RC PUMP 3C MOTOR AND PUMP BEARING HIGH TEMP
28	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
PROCESS MONITOR HIGH RADIATION	ACCUMULATOR TANK B HIGH/LOW LEVEL	SAFETY INJECTION PUMP 4B TRIP	SAFETY INJECTION PUMP 4B MOTOR OVERLOAD	CONTAINMENT ISOLATION RACKS IN-TEST	RESIDUAL HEAT REMOVAL PUMPS 3A, 3B TRIP	RHR PUMP 3B COOLING WATER LOW FLOW	COMPONENT COOLING PUMPS SUCTION HIGH TEMP	RC PUMPS MOTOR BEARING COOLING WATER HIGH TEMP
37	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
CONTAINMENT HI RAD MONITOR HI-HI HI ALARM	ACCUMULATOR TANK C HIGH/LOW PRESS	RHR PUMP/HX DISCHARGE HI/LO TEMP	BORON INJECTION TANK HEADER HIGH PRESSURE	SAFEGUARD LOGIC TEST	REFUELING WATER STORAGE TANK LOW LEVEL	CONTAINMENT SPRAY PUMPS COOLING WATER LOW FLOW	COMP. COOLING HEAT EXCHANGER A/B OUTLET HIGH TEMP	RC PUMPS MOTOR BEARING COOLING WATER LOW FLOW
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**
RADIATION MONITORING SYSTEM CHANNEL TEST	ACCUMULATOR TANK C HIGH/LOW LEVEL	BORON INJECTION TANK HIGH TEMP	BORON INJECTION TANK LOW LEVEL	SAFEGUARD POWER SUPPLY FAILURE	REFUELING WATER STORAGE TANK LOW-LOW LEVEL	BORON INJECTION TANK HEADER HI-HI PRESSURE	COMPONENT COOLING SURGE TANK HIGH/LOW LEVEL	RCP PUMP OR MOTOR HIGH TEMP

UNIT 3

ANNUNCIATOR PANEL I

1	2	3	4	5	6	7	8	9
CIRC WATER PUMP 3A1 & 3A2 MOTOR OVERLOAD ALARM	CIRC WATER PUMP 3B1 & 3B2 MOTOR OVERLOAD ALARM	CIRC PUMP LUBE WATER LOW PRESSURE	INT. CLG. WTR. PUMPS 3A,3B,3C MOTOR OVERLOAD ALARM	TURB PLANT CLG WATER PUMPS 3A & 3B MOTOR OVERLOAD ALARM	INSTRUMENT AIR HIGH TEMP LOW PRESSURE	GLAND STEAM CONDENSATE RECEIVER HIGH LEVEL	DESUPERHEATER HIGH TEMP LOW PRESSURE	CONDENSER PIT SUMP HIGH LEVEL
10	11	12	13	14	15	16	17	18
CIRC WATER PUMP 3A1 & 3A2 MOTOR OVERLOAD TRIP	CIRC WATER PUMP 3B1 & 3B2 MOTOR OVERLOAD TRIP	BACK UP LUBE WATER VALVE OPEN	INT. CLG. WTR. PUMPS 3A,3B,3C MOTOR OVERLOAD TRIP	TURB PLANT CLG WATER PUMPS 3A & 3B MOTOR OVERLOAD TRIP	INSTRUMENT AIR COMPRESSOR AUTO START	N2 B.U. SUPPLY STATION 2 LOW PRESSURE	N2 B.U. SUPPLY STATION 1 LOW PRESSURE	PERSONNEL DOOR INTERLOCK VIOLATED
19	20	21	22	23	24	25	26	27
CIRC WATER PUMP 3A1 MOV3-1416 MOTOR OVERLOAD	CIRC WATER PUMP 3B1 MOV3-1414 MOTOR OVERLOAD	SCREENS HIGH DIFFERENTIAL	INT. CLG. WTR. PUMPS 3A,3B,3C MOTOR BEARING HIGH TEMP	TURB PLANT CLG WTR PUMPS 3A & 3B MTR BEAR- ING HIGH TEMP	N2 BACKUP SUPPLY STATION 3 LOW PRESSURE	N2 B.U. SUPPLY STATION 2 LOW-LOW PRESS	N2 B.U. SUPPLY STATION 1 LOW PRESSURE	EMERGENCY CTMT FILTER FAN 3A, 3B & 3C MOTOR TRIP
28	29	30	31	32	33	34	35	36
CIRC WATER PUMP 3A1 MOTOR BEARING HIGH TEMP	CIRC WATER PUMP 3B1 MOTOR BEARING HIGH TEMP	SCREENS STOPPED	INT. CLG. WTR. HEADER A AND B LOW PRESSURE	TURBINE PLANT COOLING WATER LOW PRESSURE HIGH TEMP	CONTAINMENT ELEVATOR CABINET ALARM	PRIMARY WATER STORAGE TANK LOW LEVEL	SPENT FUEL PIT EXHUAST FAN MOTOR TRIP	EMERGENCY CTMT COOLING FAN 3A, 3B & 3C MOTOR TRIP
37	38	39	40	41	42	43	44	45
CIRC WATER PUMP 3A2 MOV3-1415 MOTOR OVERLOAD	CIRC WATER PUMP 3B2 MOV3-1413 MOTOR OVERLOAD	CONDENSER WATER BOX LOW VACUUM	NPSH PERMISSIVE FOR RECIRC MODE LT-6309A AND B	TURBINE COOLING WATER SURGE TANK HIGH/LOW LEVEL	CONTAINMENT H2 MONITOR HI ALARM	PRIMARY WATER MAKEUP PUMPS 3A AND 3B DISCH LO PRESS	REACTOR CONTROL ROD DRIVE MECH. CLR MOTOR TRIP	CONTAINMENT STANDBY COOLING FAN FAST SPEED
46	47	48	49	50	51	52	53	54
CIRC WATER PUMP 3A2 MOTOR BEARING HIGH TEMP	CIRC WATER PUMP 3B2 MOTOR BEARING HIGH TEMP	RESIDUAL HEAT REMOVAL HEAT EXCHANGER SUMP HI LEVEL	CONTAINMENT SUMP HIGH LEVEL	STANDBY PRIMARY WATER MAKEUP PUMP RUNNING	DELUGE SYSTEM OPERATING	RESIDUAL HEAT REMOVAL ROOM "A" SUMP HIGH LEVEL	RESIDUAL HEAT REMOVAL ROOM "B" SUMP HIGH LEVEL	NORMAL CONTAINMENT COOLER OVERLOAD

UNIT 3

ANNUNCIATOR PANEL J

1	2	3	4	5	6	7	8	9
SPARE	3C BUS XFMR 4 KV BKR 3AC01 OVERCURRENT TRIP	480 VOLT XFMR 3E, 3F & 3G GROUND AND HIGH TEMP	BATTERY 3D34 TROUBLE	SPARE	3C BUS TRANSFORMER TROUBLE	SPARE	SPARE	STANDBY F.W. PP 'A' MOTOR OVERLOAD TRIP (PP 'B' FOR U4)
10	11	12	13	14	15	16	17	18
BUS 3C LOSS OF VOLTAGE	3C BUS XFMR 4 KV BKR 3AC16 OVERCURRENT TRIP	480 VOLT TRANSFORMER 3E, 3F & 3G LOW VOLTAGE	BATTERY CHARGER 3D32 TROUBLE	COMMON BATTERY CHARGER D33 TROUBLE	3C BUS TRANSFORMER FAULT PRESSURE	SPARE	SPARE	SPARE
19	20	21	22	23	24	25	26	27
BUS 3C LOSS OF CONTROL VOLTAGE	CRANKING DIES. INCOMING BKR 3AC03 OVER- CURRENT TRIP	LOAD CENTER 3F & 3G LOSS OF CONTROL VOLTAGE	INVERTER 3Y111 TROUBLE	SPARE	3C BUS TRANSFORMER GROUND FAULT	SPARE	SPARE	SPARE
28	29	30	31	32	33	34	35	36
BUS 3C LOSS OF U/V RELAY CONTROL VOLTAGE	CRANKING DIES. BKR 3W26466 CLOSED	SPARE	D.C. CONTROL CENTER 3D31 UNDERVOLTAGE	SPARE	3C BUS XFMR DIFFERENTIAL OPERATED	SPARE	SPARE	SPARE
37	38	39	40	41	42	43	44	45
BUS 3C LOSS OF L.O. RELAY CONTROL VOLTAGE	~~BUS 3A TIE BKR 3AC13 OVER- CURRENT TRIP~~ BUS 4B TIE BKR 4AC13 OVER- CURRENT TRIP	SPARE	D.C. CONTROL CENTER 3D31 GROUND	SPARE	3C BUS TRANS. RELAY PNL LOSS OF L.O. RELAY CONT. VOLTAGE	SPARE	SPARE	SPARE
46	47	48	49	50	51	52	53	54
BUS 3C GROUND OVER VOLTAGE	SPARE	480 VOLT XFMR BKR 3E,3F & 3G OVERCURRENT TRIP	D.C. ENCLOSURE BUILDING VENTILATION TROUBLE	SPARE	3C BUS TRANSF. RELAY PANEL SELECTOR SW IN LOCAL	SPARE	SPARE	SPARE

UNIT 4

ANNUNCIATOR PANEL A

1	2	3	4	5	6	7	8	9
RC PUMPS THERMAL BARR COOLING WATER HIGH FLOW	PORV/RELIEF VALVE OPEN	OMS LOW PRESSURE OPERATION	BORIC ACID TK C HIGH TEMP	CHARGING PUMP 4A TRIP	CHARGING PUMP 4A MOTOR OVERLOAD	PRESSURIZER RELIEF TANK HI TEMP/HI LVL HI PRES/LO LVL	PRESSURIZER PROTECTION HIGH PRESS	PRESSURIZER LIQUID/VAPOR HIGH TEMP
10	11	12	13	14	15	16	17	18
RC PUMPS THERMAL BARR COOLING WATER HIGH TEMP	INADEQUITE CORE COOLING 5610-E-591 SH. 3A	OMS HIGH PRESSURE ALERT	BORIC ACID TK C LOW TEMP	CHARGING PUMP 4B TRIP	CHARGING PUMP 4B MOTOR OVERLOAD	PRESSURIZER POWER RELIEF LINE HIGH TEMP	PRESSURIZER PROTECTION LOW PRESS	PRESSURIZER CONTROL HIGH/LOW PRESS
19	20	21	22	23	24	25	26	27
RC PUMPS THERMAL BARR COOLING WATER LOW FLOW	BORIC ACID TANK A LO-LO/LOW/HIGH LEVEL	OMS CONTROL ACTUATED	BORIC ACID TANK C LO-LO/LOW/HIGH LEVEL	CHARGING PUMP 4C TRIP	CHARGING PUMP 4C MOTOR OVERLOAD	PRESSURIZER SAFETY VALVE LINE A,B,C HIGH TEMP	PRESSURIZER PROTECTION HIGH LEVEL	PRESSURIZER CONTROL HIGH/LOW LEVEL
28	29	30	31	32	33	34	35	36
RC PUMPS SEAL LEAK-OFF LOW FLOW	BATCHING TANK HIGH TEMP	BATCHING TANK LOW TEMP	BATCHING TANK LOW LEVEL	HIGH PRESSURE LETDOWN LINE HIGH TEMP	REACTOR COOLANT PUMPS SHAFT SEAL WTR LOW ΔP	RC PUMP 4A SEAL WATER BYPASS LOW FLOW	PRESSURIZER PROTECTION LOW-LOW LEVEL	PRESSURIZER LOW LEVEL HEATER OFF AND LETDWN SECURED
37	38	39	40	41	42	43	44	45
RC PUMPS SEAL LEAK-OFF HIGH FLOW	RC MAKE-UP BORIC ACID FLOW DEVIATION	DEMINERALIZED FLOW DIVERTED HIGH TEMP	VOLUME CONTROL TANK HIGH TEMP HIGH/LOW PRESS	LOW PRESSURE LETDOWN LINE HIGH FLOW HIGH PRESS	REACTOR COOLANT PUMPS LABYRINTH SEAL LOW ΔP	RC PUMP 4B SEAL WATER BYPASS LOW FLOW	PRESSURIZER SPRAY LINE LOW TEMP	PRESSURIZER PRESSURE CONTROLLER HIGH OUTPUT
46	47	48	49	50	51	52	53	54
RC PUMPS SHAFT NO. 1 SEAL LEAK-OFF HIGH TEMP	RC MAKE-UP WATER FLOW DEVIATION	REACTOR VESSEL FLANGE. LEAK-OFF HIGH TEMP	VOLUME CONTROL TANK HIGH/LOW LEVEL	LOW PRESSURE LETDOWN RELIEF HIGH TEMP	SEAL WATER INJECTION FILTER HIGH ΔP	RC PUMP 4C SEAL WATER BYPASS LOW FLOW	PRESSURIZER SURGE LINE LOW TEMP	SPARE

UNIT 4

ANNUNCIATOR PANEL B

1	2	3	4	5	6	7	8	9
REACTOR COOLANT LOOP 4A LOW FLOW	P6 OR P10 NOT SATISFIED	PRESSURIZER HEATER CONTROLLER FAN OFF	SOURCE RANGE HIGH FLUX LEVEL AT SHUTDOWN	INTERM RANGE HIGH FLUX LVL ROD WITHDRAWL STOP	NIS PWR RANGE SINGLE CHANNEL HIGH RANGE ALERT	PWR RANGE ROD DROP AUTO TURB RNBK AUTO ROD WITHDRAW STOP	ROD BANKS A/B/C/D LOW LIMIT	SPARE
10	11	12	13	14	15	16	17	18
REACTOR COOLANT LOOP 4B LOW FLOW	POWER RANGE UPPER DETECTOR HI FLUX DEV OR AUTO DEFEAT	MAKEUP WATER TO BLEND SYSTEM LOW PRESSURE	SOURCE RANGE HIGH SHUTDOWN FLUX ALARM BLOCKED	INTERM RANGE LOSS OF DETECTOR VOLTAGE	NIS PWR RANGE SINGLE CHANNEL LOW RANGE ALERT	ROD BOTTOM ROD DROP AUTO TURB RNBK AUTO ROD WITHDRAW STOP	ROD BANKS A/B/C/D EXTRA LOW LIMIT	AXIAL FLUX TILT
19	20	21	22	23	24	25	26	27
REACTOR COOLANT LOOP 4C LOW FLOW	POWER RANGE LOWER DETECTOR HI FLUX DEV OR AUTO DEFEAT	ROD POSITION DC AUXILIARY POWER ON	SOURCE RANGE LOSS OF DETECTOR VOLTAGE	INTERM RANGE 1 LOSS OF COMPENSATION VOLTAGE	NIS PWR RANGE OVERPOWER ROD WITHDRAWL STOP	TURB RUNBACK DEFEAT	ROD BANK D WITHDRAWL LIMIT	SHUTDOWN RODS OFF TOP/ ROD DEVIATION
28	29	30	31	32	33	34	35	36
REACTOR COOLANT PUMPS 4A,4B,4C TRIP	RC PUMP 4A OIL RESERVOIR HIGH/LOW LEVEL	REACTOR COOLANT SYSTEM HIGH ΔT	T AVG DEVIATION T AVG-T REF	INTERM RANGE 2 LOSS OF COMPENSATION VOLTAGE	NIS PWR RANGE CHANNEL DEVIATION	NUCLEAR INSTR SYSTEM CHANNEL TEST	NUCLEAR INSTR SYSTEM TRIP BYPASS	ROD CONTROL SYSTEM URGENT FAILURE
37	38	39	40	41	42	43	44	45
REACTOR COOLANT PUMPS 4A,4B,4C MOTOR OVERLOAD	RC PUMP 4B OIL RESERVOIR HIGH/LOW LEVEL	OVERPOWER ΔT	REACTOR COOLANT SYSTEM HIGH/LOW T AVG	OVERTEMP ΔT OVERPOWER ΔT AUTO TURB RNBK BLK ROD WITHDW	NIS PWR RANGE LOSS OF DETECTOR VOLTAGE	PROTECTION RACKS IN TEST	ROD CONTROL M-G SETS TRIPPED	ROD CONTROL SYSTEM NON-URGENT FAILURE
46	47	48	49	50	51	52	53	54
UNDERVOLTAGE OR UNDERFREQUENCY 4 KV BUSES	RC PUMP 4C OIL RESERVOIR HIGH/LOW LEVEL	OVERTEMP ΔT	REACTOR COOLANT LOOPS T AVG DEVIATION	REACTOR COOLANT LOOPS ΔT DEVIATION	DEVIATION SYSTEM IN TEST	PROTECTION RACKS TEST PANEL COVER OPEN	ROD CONTROL SYSTEM GROUNDED	ROD POSITION SYSTEM IN TEST

UNIT 4

ANNUNCIATOR PANEL C

1	2	3	4	5	6	7	8	9
STEAM GEN A NARROW RANGE LOW/LO-LO LEVEL	STEAM GEN A NARROW RANGE HIGH LEVEL	STEAM GEN A WIDE RANGE HI/LO LEVEL	STEAM GEN A FLOW MISMATCH FEEDWATER > STEAM	STEAM GEN A FLOW MISMATCH STEAM > FEEDWATER	STEAM GEN A ACTUAL-SET POINT LEVEL DEVIATION	STEAM GEN A STEAMLINE HIGH FLOW	STEAMLINE LOW PRESSURE	REACTOR TRIP BREAKER A OR B TRIPPED
10	11	12	13	14	15	16	17	18
STEAM GEN B NARROW RANGE LOW/LO-LO LEVEL	STEAM GEN B NARROW RANGE HIGH LEVEL	STEAM GEN B WIDE RANGE HI/LO LEVEL	STEAM GEN B FLOW MISMATCH FEEDWATER > STEAM	STEAM GEN B FLOW MISMATCH STEAM > FEEDWATER	STEAM GEN B ACTUAL-SET POINT LEVEL DEVIATION	STEAM GEN B STEAMLINE HIGH FLOW	STEAMLINE ISOLATION	STM GEN SAMPLE HIGH TEMP TO RAD MON RD-19
19	20	21	22	23	24	25	26	27
STEAM GEN C NARROW RANGE LOW/LO-LO LEVEL	STEAM GEN C NARROW RANGE HIGH LEVEL	STEAM GEN C WIDE RANGE HI/LO LEVEL	STEAM GEN C FLOW MISMATCH FEEDWATER > STEAM	STEAM GEN C FLOW MISMATCH STEAM > FEEDWATER	STEAM GEN C ACTUAL-SET POINT LEVEL DEVIATION	STEAM GEN C STEAMLINE HIGH FLOW	STEAM DUMP	STEAMLINE HIGH ΔP
28	29	30	31	32	33	34	35	36
STEAM GEN A LO-LO LEVEL REACTOR TRIP	MANUAL SAFETY INJECTION REACTOR TRIP	PRESSURIZER LOW PRESSURE REACTOR TRIP	PRESSURIZER HIGH PRESSURE REACTOR TRIP	STEAM GEN A LOW LVL & STM/ FWF MISMATCH REACTOR TRIP	SOURCE RANGE HIGH FLUX LEVEL REACTOR TRIP	POWER RANGE HI FLUX LEVEL LOW RANGE REACTOR TRIP	STEAM GEN A STEAMLINE HI P SAFEGUARDS REACTOR TRIP	HI STM FLO w/ LO T AVG OR LO STM PRESS SAFE GUARDS RX TRIP
37	38	39	40	41	42	43	44	45
STEAM GEN B LO-LO LEVEL REACTOR TRIP	ONE LOOP LOW FLOW/ACB OPEN /LOW FREQ REACTOR TRIP	PRESSURIZER HIGH WATER LEVEL REACTOR TRIP	TURBINE TRIP REACTOR TRIP	STEAM GEN B LOW LVL & STM/ FWF MISMATCH REACTOR TRIP	INTERMEDIATE RANGE HI FLUX LEVEL REACTOR TRIP	POWER RANGE HI FLUX LEVEL HIGH RANGE REACTOR TRIP	STEAM GEN B STEAMLINE HI P SAFEGUARDS REACTOR TRIP	CONTAINMENT HIGH PRESS SAFEGUARDS REACTOR TRIP
46	47	48	49	50	51	52	53	54
STEAM GEN C LO-LO LEVEL REACTOR TRIP	TWO LOOP LOW FLOW/ACB OPEN /LOW FREQ REACTOR TRIP	PRESSURIZER LOW PRESSURE SAFEGUARDS REACTOR TRIP	UNDERVOLTAGE 4 KV BUSES REACTOR TRIP	STEAM GEN C LOW LVL & STM/ FWF MISMATCH REACTOR TRIP	OVERTEMP ΔT REACTOR TRIP	OVERPOWER ΔT REACTOR TRIP	STEAM GEN C STEAMLINE HI P SAFEGUARDS REACTOR TRIP	MANUAL REACTOR TRIP

UNIT 4

ANNUNCIATOR PANEL D

1 HEATER 1A HIGH LEVEL	2 HEATER 1B HIGH LEVEL	3 MOISTURE SEPARATOR & REHEATER A HIGH LEVEL	4 CONDENSATE LOW FLOW	5 FEEDWATER PUMP 4A & 4B MOTOR OVERLOAD ALARM	6 FEEDWATER PUMP 4A OR 4B MOTOR OVERLOAD TRIP	7 FEEDWATER ISOLATION VLV STM GEN 4A MOTOR OVERLOAD	8 HEATER DRAIN PUMP 4A & 4B MOTOR OVERLOAD ALARM	9 CONDENSATE PP 4A, 4B & 4C MOTOR OVERLOAD ALARM
10 HEATER 2A HIGH LEVEL	11 HEATER 2B HIGH LEVEL	12 MOISTURE SEPARATOR & REHEATER B HIGH LEVEL	13 CONDENSATE STORAGE TANK HIGH-LOW LEVEL	14 FEEDWATER PUMP 4A LOW FLOW	15 FEEDWATER PUMP 4B LOW FLOW	16 FEEDWATER ISOLATION VLV STM GEN 4B MOTOR OVERLOAD	17 HEATER DRAIN PUMP 4A & 4B MOTOR OVERLOAD TRIP	18 CONDENSATE PP 4A, 4B & 4C MOTOR OVERLOAD TRIP
19 HEATER 3A HIGH LEVEL	20 HEATER 3B HIGH LEVEL	21 MOISTURE SEPARATOR & REHEATER C HIGH LEVEL	22 STM GEN OR CONDENSATE HIGH CONDUCTIVITY	23 FEEDWATER PUMP 4A LOW SUCTION PRESSURE	24 FEEDWATER PUMP 4B LOW SUCTION PRESSURE	25 FEEDWATER ISOLATION VLV STM GEN 4C MOTOR OVERLOAD	26 HEATER DRAIN PUMP 4A MOTOR BEARING HIGH TEMP	27 CONDENSATE PUMP 4A MOTOR BEARING HIGH TEMP
28 HEATER 4A HIGH LEVEL	29 HEATER 4B HIGH LEVEL	30 MOISTURE SEPARATOR & REHEATER D HIGH LEVEL	31 CONDENSER HIGH-LOW LEVEL	32 FEEDWATER PUMP 4A MOTOR BEARING HIGH TEMP	33 FEEDWATER PUMP 4B MOTOR BEARING HIGH TEMP	34 LOW PRESSURE HEATER BYPASS VALVE OPEN	35 HEATER DRAIN PUMP 4A DIFF PRESSURE TRIP	36 CONDENSATE PUMP 4B MOTOR BEARING HIGH TEMP
37 HEATER 5A HIGH LEVEL	38 HEATER 5B HIGH LEVEL	39 REHEATER DRAIN TANK 4A HIGH LEVEL	40 CONDENSATE RECOVERY TANK HI LEVEL	41 FEEDWATER PUMP 4A LUBE OIL LOW PRESS TRIP	42 FEEDWATER PUMP 4B LUBE OIL LOW PRESS TRIP	43 FEEDWATER PUMP 4A AND 4B MOTOR STATOR HIGH TEMP	44 HEATER DRAIN PUMP 4B MOTOR BEARING HIGH TEMP	45 HEATER DRAIN TANK 4B HIGH LEVEL
46 HEATER 6A HIGH LEVEL	47 HEATER 6B HIGH LEVEL	48 REHEATER DRAIN TANK 4B HIGH LEVEL	49 STEAM JET AIR EJECTOR LOW PRESSURE	50 FEEDWATER PUMP 4A DISCHARGE VLV MOTOR OVERLOAD	51 FEEDWATER PUMP 4B DISCHARGE VLV MOTOR OVERLOAD	52 FEEDWATER PUMP 4B MOTOR STATOR HIGH TEMP	53 HEATER DRAIN PUMP 4B DIFF PRESSURE TRIP	54 HEATER DRAIN TANK 4B LOW LEVEL

UNIT 4

ANNUNCIATOR PANEL E

1	2	3	4	5	6	7	8	9
TURBINE ROTOR ECCENTRICITY AND VIBRATION	TURBINE BEARING OIL LOW PRESSURE	TURNING GEAR MOTOR. OVERLOAD	TURBINE AUXILIARY OIL PUMP RUN	TURBINE EXHAUST HOOD HIGH TEMP TRIP	TURBINE THRUST BEARING TRIP	GENERATOR NEGATIVE SEQUENCE TRIP	FIELD BREAKER AUTO TRIP	HYDROGEN SYS ALARM PANEL HYDROGEN TROUBLE
10	11	12	13	14	15	16	17	18
DIFFERENTIAL EXPANSION	TURBINE BEARING HIGH TEMP	TURNING GEAR OIL PUMP RUN	TURBINE AUX OIL PUMP HIGH TEMP OR MOTOR OVERLOAD	TURBINE EXHAUST HOOD HIGH TEMP ALARM	TURBINE BEARING OIL LOW PRESSURE TRIP	GENERATOR LOSS OF FIELD TRIP	GENERATOR FIELD FORCING OR REGULATOR LIMITING	HYDROGEN FROM COOLER HIGH TEMP
19	20	21	22	23	24	25	26	27
TURBINE THRUST BEARING WEAR	EMERGENCY BEARING OIL PUMP RUN	TURNING GEAR OIL PUMP MOTOR OVERLOAD OR HIGH TEMP	TURBINE LUBE OIL HIGH TEMP	CONDENSER LOW VACUUM	TURBINE CONDENSER LOW VACUUM TRIP	GENERATOR GROUND TRIP	GENERATOR FIELD GROUND	VOLTAGE REGULATOR LOSS OF COOLING
28	29	30	31	32	33	34	35	36
TURBINE ZERO SPEED	EMERGENCY BEARING OIL PP MTR OVERLD OR HIGH TEMP	BEARING LIFT PUMP MOTOR OVERLOAD	TURBINE LUBE OIL RESERVOIR HIGH PRESSURE	GLAND STEAM CONDENSER EXHAUSTER STOPPED	TURBINE OVERSPEED TRIP	GENERATOR DIFFERENTIAL TRIP	LOSS OF GENERATOR METER POTENTIAL	EXCITER AIR FROM COOLER HIGH TEMP
37	38	39	40	41	42	43	44	45
GENERATOR 4 UNDERFREQUENCY TRIP CIRCUIT FAILURE	SGFP TRIP TURBINE RUNBACK LOGIC DEFEATED	SEAL OIL BACK-UP PUMP MOTOR OVERLOAD	LUBE OIL RESERVOIR HIGH/LOW LEVEL HI FILTER D/P	STEAM SEAL LOW PRESSURE	TURBINE TRIP GENERATOR LOCK OUT	GENERATOR MOTORING TRIP	LOSS OF REGULATOR POTENTIAL	GENERATOR OVER EXCITATION
46	47	48	49	50	51	52	53	54
GENERATOR 4 UNDERFREQUENCY TRIP	TURBINE TRIP BY HI-HI STEAM GEN LEVEL	GEN LOOP SEAL VAPOR EXTRACTOR STOPPED	TURB LUBE OIL CONDITIONER HIGH/LOW LEVEL	GUARDED OIL 4 ACTUATION	TURBINE TRIPPED BY THE REACTOR	VOLTAGE REGULATOR TRIP TO MANUAL	VOLTAGE REGULATOR TROUBLE	GENERATOR STATOR HIGH TEMP

UNIT 4

ANNUNCIATOR PANEL F

1	2	3	4	5	6	7	8	9
4 RCP SHAFT VIBRATION	LOAD FREQUENCY CONTROL SYSTEM TRIP	GENERATOR OCB 240W26452* TRIP	MAIN TRANSFORMER DIFERENTIAL	AUXILIARY TRANSFORMER DIFFERENTIAL	CONDENSATE PUMP 4C MOTOR BEARING HIGH TEMP	RPI'S POWER TROUBLE	DIESEL GENERATOR 3 TROUBLE	LUBE H2O PP AUTO XFER TRIP
10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
VITAL INSTRUMENT BUS INVERTER TROUBLE	LOAD FREQUENCY CONTROL SYSTEM EMERGENCY CONDITION	GENERATOR OCB 240W26545** TRIP	MAIN TRANSFORMER FAULT PRESSURE	AUXILIARY TRANSFORMER FAULT PRESSURE	STATIC NEG SEQ RELAY ALARM	480 V XFMR 4E LOW VOLTAGE, GND AND HIGH TEMP	DIESEL GEN BUS 4A BREAKER OVERCURRENT TRIP	480 V TRANSFORMERS 4A,4B,4C & 4D LOW VOLTAGE
19	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
SPARE	REMOTE-LOCAL CONTROL SWITCH LOCAL POSITION	GENERATOR 240W26452* 240W26545** LOW GAS PRESS	MAIN TRANSFORMER NEUTRAL OVERCURRENT	UNDERVOLTAGE SCHEME TEST	RELAY CABINET GEN PROTECTIVE RELAY TRIP	GENERATOR ARCING ALERT	DIESEL GEN 3 ENGINE TROUBLE	480 V TRANSFORMERS 4A,4B,4C & 4D GND & HI TEMP
28	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
SPARE	RCP 4A,4B & 4C UF TRIP CIRCUIT FAILURE	GENERATOR OCB FAILURE LOCK OUT RELAY TRIP	MAIN TRANSFORMER ALARM PANEL	AUXILIARY TRANSFORMER ALARM PANEL	GENERATOR R.T.D. HIGH TEMP ALARM	GENERATOR CORE TROUBLE	DIESEL GEN 4 ENGINE TROUBLE	480 V XFMR 4A, 4B,4C,4D & 4E BREAKER OVER-CURRENT TRIP
37	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
S/G BLOWDOWN TANK HI PRESSURE ALARM	SPARE	SPARE	MAIN TRANSFORMER ALARM PANEL EMERGENCY	AUX XFMR 4 KV BREAKER OVERCURRENT TRIP	GENERATOR R.T.D. RECOMMEND TRIP	GENERATOR ARCING RECOMMEND SHUTDOWN	DIESEL GENERATOR 4 TROUBLE	EMER DIESEL A LOCAL-NORM SW OFF-NORM LOCAL START ONLY
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**
S/G BLOWDOWN TANK HI/LO LEVEL ALARM	ISOLATED PHASE BUS BACK UP FAN OPERATING	ISOLATED PHASE BUS DUCT COOLING HIGH TEMP	DIESEL OIL DAY TANK HIGH LEVEL	DIESEL OIL DAY TANK LOW LEVEL	EMER START UP 4 KV BREAKER OVERCURRENT TRIP	4 KV BUS TIE BREAKER OVERCURRENT TRIP	DIESEL GEN BUS 4B BREAKER OVERCURRENT TRIP	EMER DIESEL B LOCAL-NORM SW OFF-NORM LOCAL START ONLY

UNIT 4

ANNUNCIATOR PANEL 6

1	2	3	4	5	6	7	8	9
CHARGING PUMPS LO SPEED	REACTOR COOLANT PUMP A STANDPIPE HI LEVEL	RTD BYPASS LOOP "A" LO FLOW	ANNUNCIATOR FIELD VOLTAGE FAILURE	$\Delta\Phi$ > 5% MAX PWR 90%	MIDS INACTIVE	BREAKER TRIPPED 4P06	REFUELING WATER STORAGE TANK HIGH LEVEL	S.I. PUMP 3A LOW SUCTION PRESSURE
10	11	12	13	14	15	16	17	18
CHARGING PUMPS HI SPEED	REACTOR COOLANT PUMP B STANDPIPE HI LEVEL	RTD BYPASS LOOP "B" LO FLOW	REACTOR CONTROL EQUIPMENT ROOM HIGH TEMP	$\Delta\Phi$ 5% > 1 HR MAX PWR 50%	FLUX MAPPER FAILURE	BREAKER TRIPPED 4P07	REFUELING WTR STORAGE TANK TECH SPEC MIN LEVEL	S.I. PUMP 3B LOW SUCTION PRESSURE
19	20	21	22	23	24	25	26	27
CH. SET I PROTECTION RACK DOOR OPEN	REACTOR COOLANT PUMP C STANDPIPE HI LEVEL	RTD BYPASS LOOP "C" LO FLOW	METAL IMPACT ALARM	CONTAINMENT SUMP LEVEL $\uparrow$ > 1 GPM	4A SGFW PUMP STRAINER HIGH ΔP	BREAKER TRIPPED 4P08	TAPE TROUBLE	S.I. PUMP 4A LOW SUCTION PRESSURE
28	29	30	31	32	33	34	35	36
CH. SET II PROTECTION RACK DOOR OPEN	REACTOR COOLANT PUMP A STANDPIPE LO LEVEL	CHARGING PUMPS CONTROL STATION MANUAL	CONDENSATE PUMP "A" LOW FLOW	ANNUNCIATOR SYSTEM GROUND	4B SGFW PUMP STRAINER HIGH ΔP	BREAKER TRIPPED 4P09	SPARE	S.I. PUMP 4B LOW SUCTION PRESSURE
37	38	39	40	41	42	43	44	45
CH. SET III PROTECTION RACK DOOR OPEN	REACTOR COOLANT PUMP B STANDPIPE LO LEVEL	REACTOR TRIP BY-PASS CLOSED	CONDENSATE PUMP "B" LOW FLOW	ANNUNCIATOR GROUND ISOLATE	CONDENSATE POLISHING PANEL TROUBLE	RECORDER SHUTDOWN	LUBE OIL DELUGE ACTIVATED	CONTAINMENT SUMP RECORDER HIGH LEVEL
46	47	48	49	50	51	52	53	54
CH. SET IV PROTECTION RACK DOOR OPEN	REACTOR COOLANT PUMP C STANDPIPE LO LEVEL	PERMISSIVE P-10 IN TEST	CONDENSATE PUMP "C" LOW FLOW	ANNUNCIATOR SPARE POWER SUPPLY	F(Z) NOT VERIFIABLE FOR 100% POWER	FAULT SENSED	HIGH LEVEL NO. 4160 SWGR ROOM SUMP	DDPS A-D FAILURE/ BASE LOAD MESSAGE

UNIT 4

ANNUNCIATOR PANEL H

1	2	3	4	5	6	7	8	9
SPENT FUEL PIT LOW LEVEL	ACCUMULATOR TANK A HIGH/LOW PRESS	SAFETY INJECTION PUMP 3A TRIP	SAFETY INJECTION PUMP 3A MOTOR OVERLOAD	CONTAINMENT HIGH OR HI-HI PRESSURE	CONTAINMENT SPRAY PUMPS 4A, 4B MOTOR OVERLOAD	RESIDUAL HEAT REMOVAL PUMP 4A HIGH PRESSURE	COMPONENT COOLING PUMPS 4A,4B,4C TRIP	RC PUMP 4A MOTOR AND PUMP BEARING HIGH TEMP
10	11	12	13	14	15	16	17	18
SPENT FUEL PIT HIGH TEMP	ACCUMULATOR TANK A HIGH/LOW LEVEL	SAFETY INJECTION PUMP 3B TRIP	SAFETY INJECTION PUMP 3B MOTOR OVERLOAD	CTMT ISOLATION VENTILATION PHASE A & B OPERATED	RESIDUAL HEAT EXCHANGER LOW FLOW	RESIDUAL HEAT REMOVAL PUMP 4B HIGH PRESSURE	COMPONENT COOLING PUMPS 4A,4B,4C MOTOR OVERLOAD	RC PUMP 4B MOTOR AND PUMP BEARING HIGH TEMP
19	20	21	22	23	24	25	26	27
SPENT FUEL PIT HIGH LEVEL	ACCUMULATOR TANK B HIGH/LOW PRESS	SAFETY INJECTION PUMP 4A TRIP	SAFETY INJECTION PUMP 4A MOTOR OVERLOAD	CONTAINMENT ISOLATION CABINET A & B FUSE FAILURE	RESIDUAL HEAT REMOVAL PUMPS 4A, 4B MOTOR OVERLOAD	RHR PUMP 4A COOLING WATER LOW FLOW	COMPONENT COOLING PUMPS LOW PRESSURE	RC PUMP 4C MOTOR AND PUMP BEARING HIGH TEMP
28	29	30	31	32	33	34	35	36
PROCESS MONITOR HIGH RADIATION	ACCUMULATOR TANK B HIGH/LOW LEVEL	SAFETY INJECTION PUMP 4B TRIP	SAFETY INJECTION PUMP 4B MOTOR OVERLOAD	CONTAINMENT ISOLATION RACKS IN-TEST	RESIDUAL HEAT REMOVAL PUMPS 4A, 4B TRIP	RHR PUMP 4B COOLING WATER LOW FLOW	COMPONENT COOLING PUMPS SUCTION HIGH TEMP	RC PUMPS MOTOR BEARING COOLING WATER HIGH TEMP
37	38	39	40	41	42	43	44	45
CONTAINMENT HI RAD MONITOR HI-HI HI ALARM	ACCUMULATOR TANK C HIGH/LOW PRESS	RHR PUMP/HX DISCHARGE HI/LO TEMP	BORON INJECTION TANK HEADER HIGH PRESSURE	SAFEGUARD LOGIC TEST	REFUELING WATER STORAGE TANK LOW LEVEL	CONTAINMENT SPRAY PUMPS COOLING WATER LOW FLOW	COMP. COOLING HEAT EXCHANGER A/B OUTLET HIGH TEMP	RC PUMPS MOTOR BEARING COOLING WATER LOW FLOW
46	47	48	49	50	51	52	53	54
RADIATION MONITORING SYSTEM CHANNEL TEST	ACCUMULATOR TANK C HIGH/LOW LEVEL	SPARE	BORON INJECTION TANK LOW LEVEL	SAFEGUARD POWER SUPPLY FAILURE	REFUELING WATER STORAGE TANK LOW-LOW LEVEL	BORON INJECTION TANK HEADER HI-HI PRESSURE	COMPONENT COOLING SURGE TANK HIGH/LOW LEVEL	RCP PUMP OR MOTOR HIGH TEMP

UNIT 4

ANNUNCIATOR PANEL I

1	2	3	4	5	6	7	8	9
CIRC WATER PUMP 4A1 & 4A2 MOTOR OVERLOAD ALARM	CIRC WATER PUMP 4B1 & 4B2 MOTOR OVERLOAD ALARM	CIRC PUMP LUBE WATER LOW PRESSURE	INT. CLG. WTR. PUMPS 4A,4B,4C MOTOR OVERLOAD ALARM	TURB PLANT CLG WATER PUMPS 4A & 4B MOTOR OVERLOAD ALARM	INSTRUMENT AIR HIGH TEMP LOW PRESSURE	GLAND STEAM CONDENSATE RECEIVER HIGH LEVEL	DESUPERHEATER HIGH TEMP LOW PRESSURE	CONDENSER PIT SUMP HIGH LEVEL
10	11	12	13	14	15	16	17	18
CIRC WATER PUMP 4A1 & 4A2 MOTOR OVERLOAD TRIP	CIRC WATER PUMP 4B1 & 4B2 MOTOR OVERLOAD TRIP	BACK UP LUBE WATER VALVE OPEN	INT. CLG. WTR. PUMPS 4A,4B,4C MOTOR OVERLOAD TRIP	TURB PLANT CLG WATER PUMPS 4A & 4B MOTOR OVERLOAD TRIP	INSTRUMENT AIR COMPRESSOR AUTO START	N2 B.U. SUPPLY STATION 2 LOW PRESSURE	N2 B.U. SUPPLY STATION 1 LOW PRESSURE	PERSONNEL DOOR INTERLOCK VIOLATED
19	20	21	22	23	24	25	26	27
CIRC WATER PUMP 4A1 MOV4-1416 MOTOR OVERLOAD	CIRC WATER PUMP 4B1 MOV4-1414 MOTOR OVERLOAD	SCREENS HIGH DIFFERENTIAL	INT. CLG. WTR. PUMPS 4A,4B,4C MOTOR BEARING HIGH TEMP	TURB PLANT CLG WTR PUMPS 4A & 4B MTR BEAR- ING HIGH TEMP	N2 BACKUP SUPPLY STATION 3 LOW PRESSURE	N2 B.U. SUPPLY STATION 2 LOW-LOW PRESS	N2 B.U. SUPPLY STATION 1 LOW PRESSURE	EMERGENCY CTMT FILTER FAN 4A, 4B & 4C MOTOR TRIP
28	29	30	31	32	33	34	35	36
CIRC WATER PUMP 4A1 MOTOR BEARING HIGH TEMP	CIRC WATER PUMP 4B1 MOTOR BEARING HIGH TEMP	SCREENS STOPPED	INT. CLG. WTR. HEADER A AND B LOW PRESSURE	TURBINE PLANT COOLING WATER LOW PRESSURE HIGH TEMP	CONTAINMENT ELEVATOR CABINET ALARM	PRIMARY WATER STORAGE TANK LOW LEVEL	SPENT FUEL PIT EXHUAST FAN MOTOR TRIP	EMERGENCY CTMT COOLING FAN 4A, 4B & 4C MOTOR TRIP
37	38	39	40	41	42	43	44	45
CIRC WATER PUMP 4A2 MOV4-1415 MOTOR OVERLOAD	CIRC WATER PUMP 4B2 MOV4-1413 MOTOR OVERLOAD	CONDENSER WATER BOX LOW VACUUM	NPSH PERMISSIVE FOR RECIRC MODE LT-6309A AND B	TURBINE COOLING WATER SURGE TANK HIGH/LOW LEVEL	CONTAINMENT H2 MONITOR HI ALARM	PRIMARY WATER MAKEUP PUMPS 4A AND 4B DISCH LO PRESS	REACTOR CONTROL ROD DRIVE MECH. CLR MOTOR TRIP	CONTAINMENT STANDBY COOLING FAN FAST SPEED
46	47	48	49	50	51	52	53	54
CIRC WATER PUMP 4A2 MOTOR BEARING HIGH TEMP	CIRC WATER PUMP 4B2 MOTOR BEARING HIGH TEMP	RESIDUAL HEAT REMOVAL HEAT EXCHANGER SUMP HI LEVEL	CONTAINMENT SUMP HIGH LEVEL	STANDBY PRIMARY WATER MAKEUP PUMP RUNNING	DELUGE SYSTEM OPERATING	RESIDUAL HEAT REMOVAL ROOM "A" SUMP HIGH LEVEL	RESIDUAL HEAT REMOVAL ROOM "B" SUMP HIGH LEVEL	NORMAL CONTAINMENT COOLER OVERLOAD

UNIT 4

ANNUNCIATOR PANEL J

1	2	3	4	5	6	7	8	9
SPARE	4C BUS XFMR 4 KV BKR 4AC01 OVERCURRENT TRIP	480 VOLT XFMR 4E, 4F & 4G GROUND AND HIGH TEMP	BATTERY 4D34 TROUBLE	SPARE	C BUS TRANSFORMER TROUBLE	SPARE	COMPUTER/CABLE SPREADING ROOM HVAC CHILLER TROUBLE	SPARE
10	11	12	13	14	15	16	17	18
BUS 4C LOSS OF VOLTAGE	4C BUS XFMR 4 KV BKR 4AC16 OVERCURRENT TRIP	480 VOLT TRANSFORMER 4E, 4F & 4G LOW VOLTAGE	BATTERY CHARGER 4D32 TROUBLE	COMMON BATTERY CHARGER D33 TROUBLE	C BUS TRANSFORMER FAULT PRESSURE	SPARE	SPARE	SPARE
19	20	21	22	23	24	25	26	27
BUS 4C LOSS OF CONTROL VOLTAGE	CRANKING DIES. INCOMING BKR 4AC03 OVER-CURRENT TRIP	LOAD CENTER 4F & 4G LOSS OF CONTROL VOLTAGE	INVERTER 4Y111 TROUBLE	SPARE	C BUS TRANSFORMER GROUND FAULT	SPARE	SPARE	SPARE
28	29	30	31	32	33	34	35	36
BUS 4C LOSS OF U/V RELAY CONTROL VOLTAGE	CRANKING DIES. BKR 4W26466 CLOSED	SPARE	D.C. CONTROL CENTER 4D31 UNDERVOLTAGE	SPARE	C BUS TRANSFORMER DIFFERENTIAL	SPARE	SPARE	SPARE
37	38	39	40	41	42	43	44	45
BUS 4C LOSS OF L.O. RELAY CONTROL VOLTAGE	BUS 4B TIE BREAKER 4AC13 OVERCURRENT TRIP	SPARE	D.C. CONTROL CENTER 4D31 GROUND	SPARE	C BUS TRANS. RELAY PANEL TRIP CIRCUIT FAILURE	SPARE	SPARE	SPARE
46	47	48	49	50	51	52	53	54
BUS 4C GROUND OVER CURRENT	SPARE	480 VOLT XFMR BKR 4E,4F & 4G OVERCURRENT TRIP	D.C. ENCLOSURE BUILDING VENTILATION TROUBLE	SPARE	C BUS TRANSF. RELAY PANEL SELECTOR SW IN LOCAL	3C BUS 3X21 OR RELAY PANEL 3C260 TROUBLE	UNIT 3 DC BLDG EQUIPMENT TROUBLE	UNIT 3 BATTERY TROUBLE

COMMON

ANNUNCIATOR PANEL X

1	2	3	4	5	6	7	8	9
DC LOAD CENTER TROUBLE BUS 3A	4 KV BUS 3A LOW VOLTAGE	3 START-UP TRANSFORMER DIFFERENTIAL	AREA MONITOR HIGH RADIATION	BATTERY CHARGER FAILURE	CONTROL BUILDING ELEVATOR CABINET ALARM	4 START-UP TRANSFORMER DIFFERENTIAL	4 KV BUS 4A LOW VOLTAGE	DC LOAD CENTER TROUBLE BUS 4B
10	11	12	13	14	15	16	17	18
DC GROUND BUS 3A	4 KV BUS 3A SUPPLY BREAKER FAN FAILURE	3 START-UP TRANSFORMER FAULT PRESS	AUXILIARY AND RADWASTE BLDG SUPPLY FAN MOTOR TRIP	WATER TREATMENT PLANT TROUBLE	RADWASTE BUILDING ARMS HI RADIATION	4 START-UP TRANSFORMER FAULT PRESS	4 KV BUS 4A SUPPLY BREAKER FAN FAILURE	DC GROUND BUS 4B
19	20	21	22	23	24	25	26	27
SAFEGUARDS SEQUENCING TIMER 3A FUSE FAILURE	4 KV BUS 3B LOW VOLTAGE	3 START-UP TRANSFORMER GROUND FAULT	AUXILIARY AND RADWASTE BLDG EXHUAST FAN MOTOR TRIP	FIRE PUMP TROUBLE	WASTE DISPOSAL BORON RECYCLE PANEL TROUBLE	4 START-UP TRANSFORMER GROUND FAULT	4 KV BUS 4B LOW VOLTAGE	SAFEGUARDS SEQUENCING TIMER 4A FUSE FAILURE
28	29	30	31	32	33	34	35	36
SAFEGUARDS SEQUENCING TIMER 3B FUSE FAILURE	4 KV BUS 3B SUPPLY BREAKER FAN FAILURE	3 START-UP TRANSFORMER ALARM PANEL	AUX. BUILDING STM CONDENSATE RECEIVER HIGH LEVEL	BORIC ACID TANK B HIGH TEMP	WASTE HOLDUP ROOM SUMP HIGH LEVEL	4 START-UP TRANSFORMER ALARM PANEL	4 KV BUS 4B SUPPLY BREAKER FAN FAILURE	SAFEGUARDS SEQUENCING TIMER 4B FUSE FAILURE
37	38	39	40	41	42	43	44	45
DC LOAD CENTER TROUBLE BUS 3B	4 KV BUS 3A OR 3B GROUND	3 START-UP TRANSFORMER 4 KV BREAKER OVERCURR. TRIP	3-4 KV SYSTEM BUS A AND B LOSS OF VOLT. FUSE FAILURE	BORIC ACID TANK B LOW TEMP	4-4 KV SYSTEM BUS A AND B LOSS OF VOLT. FUSE FAILURE	4 START-UP TRANSFORMER 4 KV BREAKER OVERCURR. TRIP	4 KV BUS 4A OR 4B GROUND	DC LOAD CENTER TROUBLE BUS 4A
46	47	48	49	50	51	52	53	54
DC GROUND BUS 3B	LOSS OF A.C. PAGE SYSTEM & SITE EVACUATION	HIGH HEAD S.I. PUMP COOLING WATER LOW FLOW	3 GEN START-UP XFMR & 4KV BUS A & B LOCKOUT RLY FUSE FAIL.	BORIC ACID TANK B LO-LO/LOW/HIGH LEVEL	4 GEN START-UP XFMR & 4KV BUS A & B LOCKOUT RLY FUSE FAIL.	HEAT TRACING TROUBLE	WASTE HOLDUP TANK HI LEVEL	DC GROUND BUS 4A

APPENDIX C

ANNUNCIATOR WINDOW TILE SPECIFICATION

TABLE OF CONTENTS

APPENDIX C

ANNUNCIATOR WINDOW TILE SPECIFICATION

C1.0 MATERIAL SPECIFICATION

C1.1 Annunciator tiles can be either purchased from Beta Products, Inc. or fabricated by FPL's Equipment Repair Center. Tiles are prioritized by color according to their level of importance as follows:

Level	Operator Action	Tile Color	
		Front	Back
1	Immediate	White	Red
2	Urgent	White	Blue
3	Normal	White	White
1 (first out)	Immediate	White	White

C1.2 Beta Tiles

Purchase the following from Beta Products, Inc., P.O. Box 5004, 1416 Upfield Drive, Carrollton, Texas 75006, Telex 74-0701/(214) 242-0644:

P/N 301479-003 2x3 window, blank, white

P/N 116082-001 Thumbscrew

Apply a self-adhesive colored foil, Chartpak or Pantone acetate gloss, Cat. Nos. PF01 (red) and PF02 (blue) to the back of level 1 and level 2 tiles, respectively. Level 3 tiles need no colored foil on the back.

C1.3 Fabricated Tiles

Some tile can be fabricated by FPL's Equipment Repair Center, 6001 N.W. 70 Avenue, Miami, Florida 33166, (305) 885-9731. Thumbscrews, PN 116082-001, are to be purchased from Beta.

Tiles are cut and machined from plastic sheets, Plexiglas G, to the dimensions shown in Exhibit C-1. All edges and corners are chamfered to form a smooth contour.

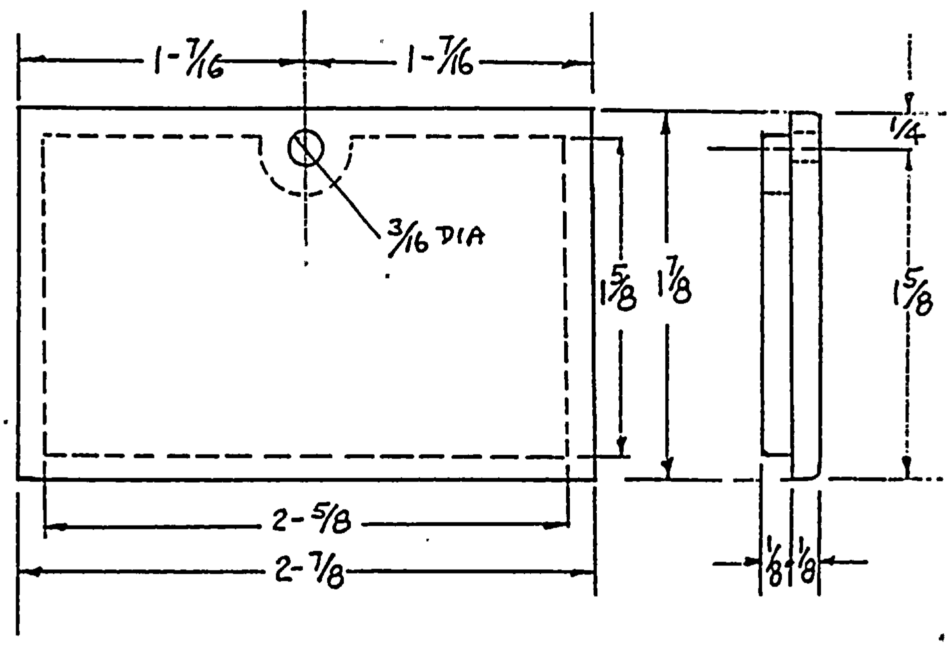


EXHIBIT C-1: Tile Specifications

Level 1 tiles are fabricated from 1/8-inch white plastic sheets (color 2283) on the front and a 1/8-inch red plastic sheet on the back glued together to form a single composite tile.

Level 2 tiles are fabricated in a similar manner, except a 1/8-inch blue plastic sheet (color 2051) is glued on the back.

Level 3 tiles are fabricated from a single 1/4-inch white plastic sheet.

C1.4 Tiles are engraved by FPL's equipment repair center in accordance with the guidelines set forth in Sections C2.0 and C3.0 of this specification. Thumbscrews are flared in place after engraving.

C2.0 LEGEND SPECIFICATION

C2.1 The criteria delineated below shall be used for tile engraving. Engraved characters shall be filled with non-gloss black paint. Tile dimensions are 1-7/8 inches by 2-7/8 inches. The engraved portion of the tile is 1-1/4 inches by 2-1/4 inches.

- o Character height - .21875 inch (7/32 inch) measured from the top of the character to the bottom of the character.
- o Character width - .15 inch (5/32 inch).
- o Stroke width - .042 inch (3/64 inch).
- o Space between lines - .125 inch (1/8 inch) measured from the bottom of the characters of one line to the top of the characters of the next line.
- o Space between words - .15 inch (5/32 inch)
- o Space between characters - .042 inch (3/64 inch)
- o Wide character width (M,W) - .020 inch (13/64 inch).

The dimensions listed above will accommodate four lines of text, no more than 13 characters per line, and at least 1/8-inch borders. An example of a Turkey Point annunciator tile is shown in Exhibit C-2.

C3.0 USE OF ABBREVIATIONS AND ACRONYMS

C3.1 To prevent ambiguity in messages, the use of whole words is desired. However, labeling space is constrained by annunciator size, and as such, whole word messages often cannot be used. Abbreviations and acronyms are used to increase the amount of information presented within the compact space of an annunciator. In order to relay information most effectively, this nomenclature must be consistent and clear. Several rules and guidelines should be considered when using abbreviations and acronyms.

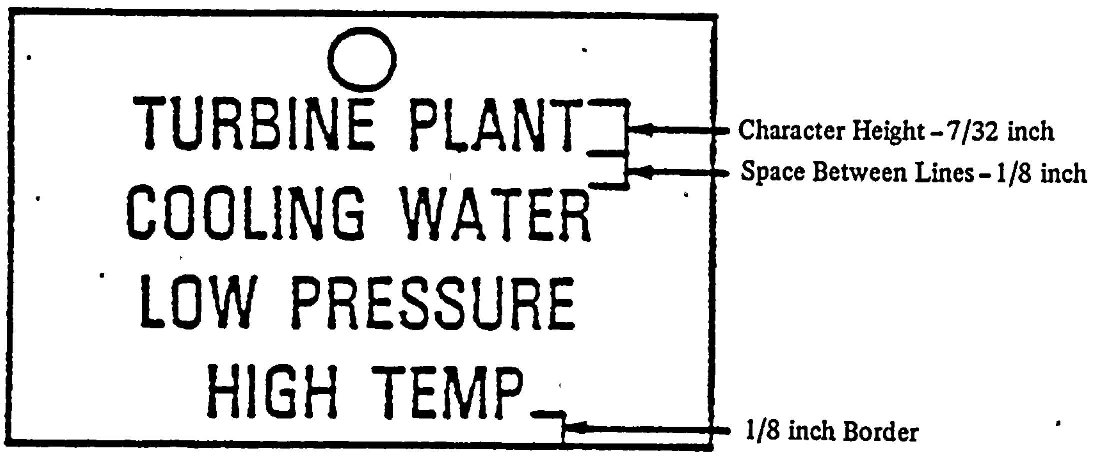


EXHIBIT C-2: Annunciator Tile Example

C3.2 General Use Requirements

- ONLY the abbreviations and acronyms in the Turkey Point constrained dictionary shall be used and ONLY when space constraints require shortened forms of words.

- If available character space exists on a label, spell out the message. Exceptions: HI, LO, TEMP, PRESS, RHR, RWST, RPS, RCP, RCS, VCT, SG, CCW.

- The same abbreviation shall be used for all tenses and for both singular and plural forms of the word.

  If a plural form is necessary, use an apostrophe with the abbreviation to ensure the term cannot be confused with another. (Often the addition of a single letter can change the meaning a word conveys.) Examples: RM - RM's; RCP - RCP's

  Verb tense should only be used when serious misinterpretation of the message is possible.

- Punctuation marks should be avoided since they use space and do not contribute to the message.

- An abbreviation has only one associated meaning; one abbreviation exists for each term.

- Single-word labels of four or fewer letters should not be abbreviated.

- Words of four or fewer letters should seldom, if ever, be abbreviated.

  - Exception: Word is within a phrase represented by an acronym.

  - Specific exceptions: LOW-LO

- Two-character abbreviations are avoided. The number of two-character combinations is limited and word meaning is generally not conveyed with only two letters.

- Words depicting extreme emergency conditions (e.g., DANGER, CAUTION, RADIOACTIVE MATERIALS, RADIATION AREA) should never be abbreviated.

- Words for which no abbreviation is listed should appear fully spelled out. Examples where abbreviations are not recommended:

  - The word is used infrequently.

- The abbreviation does not significantly decrease the number of characters required.

- The only acceptable abbreviation has other meanings associated with it.

APPENDIX D

GUIDELINES FOR PANEL DEMARCATION LINES

D1.0 Demarcation lines are to be painted on the board in accordance with sketched details (see Exhibit D-1) and notes below.

D2.0 Lines are to be ¼-inch wide.

D3.0 Lines are to be non-gloss, flat black in color.

D4.0 Lines are to be evenly placed between component devices.

D5.0 Lines are to be straight and parallel to the board outline except where obviously indicated otherwise.

D6.0 Corners are to be beveled at a 45-degree angle.

D7.0 Masking of the board is to be inspected by start-up and operations prior to painting in the lines.

D8.0 Nameplates are to be installed for each demarcated group of devices. Nameplates are to be fabricated in accordance with the following guidelines:

Material:	Lamicord gravoply black surface with engraved white core
Size:	Width - 3/4"
	Length - to be determined, depending on the size of the area demarcated.
Letter:	3/16 inch engraved, no more than two lines
Wording:	Using standard abbreviations and acronyms (see Appendix F).
Location:	On top of a demarcated group, placed horozontally on or above the demarcation line.

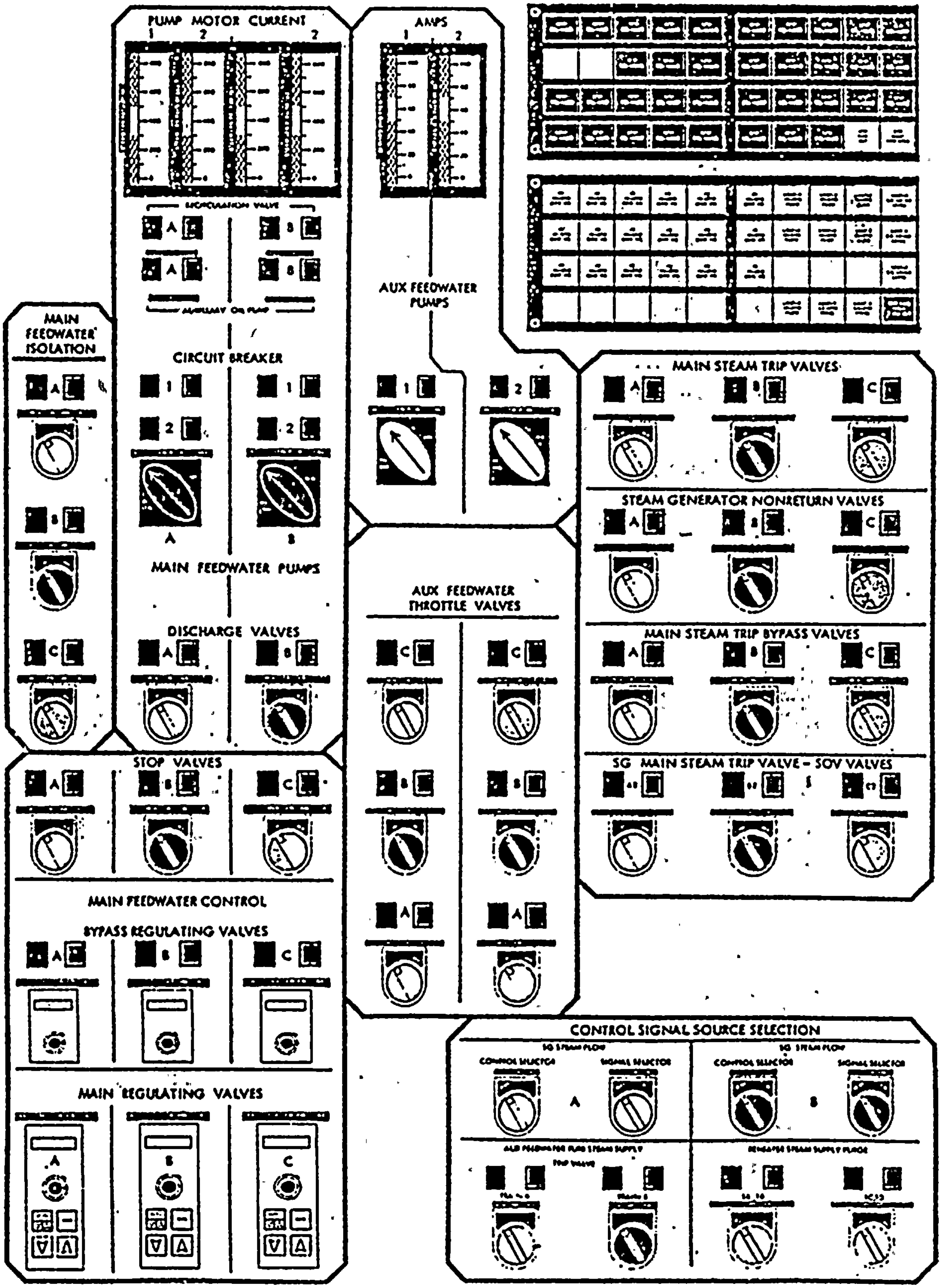


EXHIBIT D-1: Control Board Demarcation (Typical)

APPENDIX E

LABELS

TABLE OF CONTENTS

APPENDIX E

LABELS

E1.0 MATERIALS

All labels shall be of reverse-engravable stock, Romark "Sign Up" 600 series or equivalent. Material shall have a matte-finish clear face with color substrate.

E2.0 COLORS

Most labels shall be black letters on a white ground. Channel-coded devices and warning "OPERATOR AID" labels are colored as follows:

Channel I:	White letters/red ground
Channel II:	Black letters/white ground
Channel III:	White letters/medium blue ground
Channel IV:	Black letters/yellow ground
Operator Aids:	Color as required to highlight, usually red letters/white ground.

E3.0 STYLES

See Exhibit E-1 for illustrations of standard label types, with accompanying letter size and format information. For non-standard labels, prioritize letter size over label dimensions or format.

E4.0 FONT

Letters engraved in "Normal Gothic" (Dahlgren equipment), or equivalent. Height/width ratio not to exceed 2:1, measured on "E".

E5.0 METHOD OF ENGRAVING

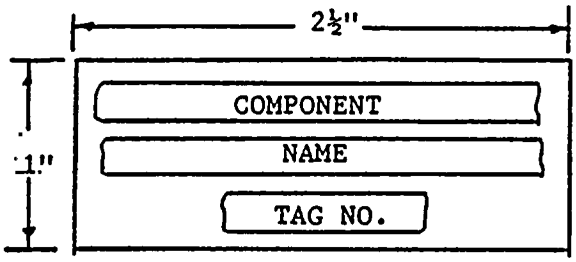
All labels shall be reverse-engraved through color substrate to clear, then filled in with letter color.

E6.0 METHOD OF APPLICATION TO PANEL SURFACE

Use of double-sided, foam-center tape is preferred. Do not mount with screws. (Labels provided to plant with adhesive attached.)

CONTROL/INDICATION DEVICES
(character/line includes between-word spaces)

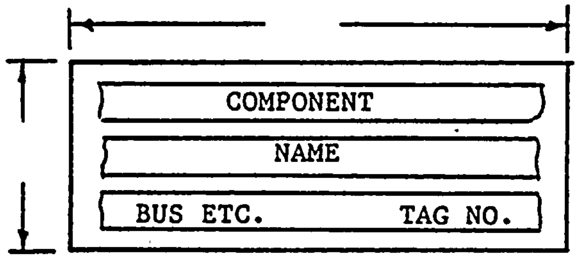
A)



Black letters/white ground
3/16" letters, 3 lines, max. = 17 char./line

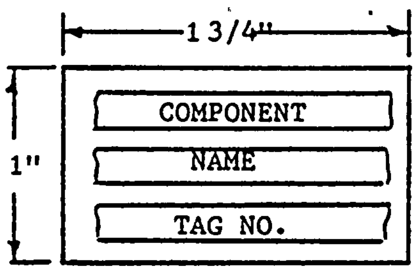
For control switches, selector switches, lights, pushbuttons, controllers

B)



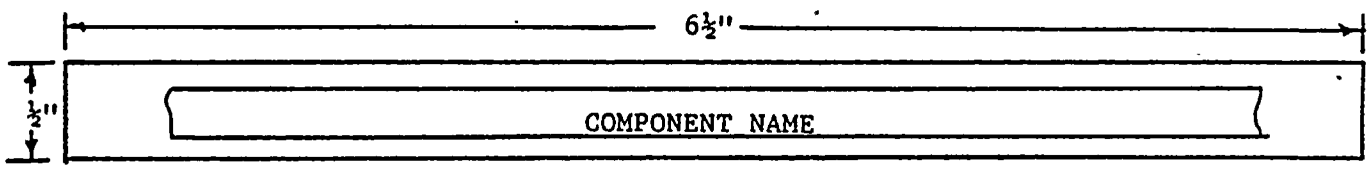
Same as above, except tag no. location

C)



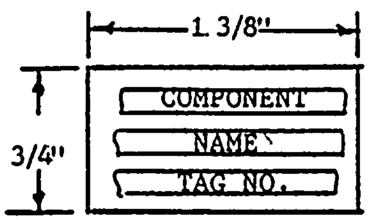
For Sigma and "TBS" indicators
color varies - see chart
3/16" letters, 3 lines, max. = 13 char./line

D)



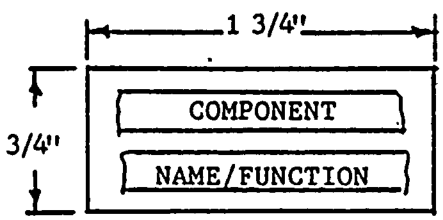
For recorders and panel inserts, modules.
Black letters/white ground 1/4" letters, max. = 1 line of no more than 28 char.

E)



For safety status lights
black letters/white ground
1/8" letters, 3 lines, max. = 13 char./line

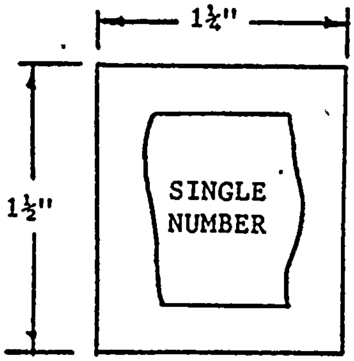
F)



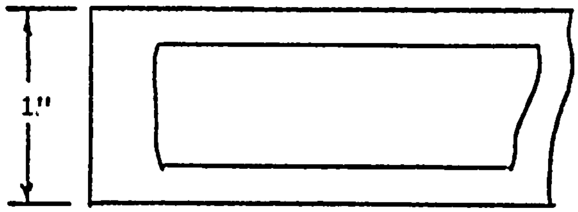
For hydrogen monitor panels
3/16" letters, 2 lines, max. = 13 char./line
black letters/white ground

EXHIBIT E-1: Control/Indication Devices

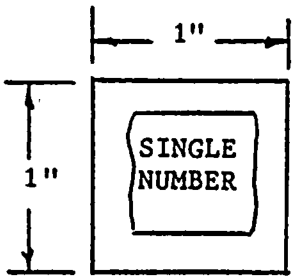
ANNUNCIATORS (All annunciator labels are black letters/white ground)



For annunciator panel identifier
1" letter, 1 per label



For annunciator panel functional name
5/8" letters, 1 line, length determined by text + 1 character margin



For matrix location identifiers
5/8" letter (number), 1 per label

SPECIAL CASES

Engraved position labels are black letters/white ground, 1/8" high, format and dimensions determined by space available. (See NIS racks as example)

Maximum deviation labels are black letters/white ground, 1/4" letters, 1/2" height by device length label size.

If lack of space, default to different label size or format, shrinking letter size as last choice.

EXHIBIT E-1 (Continued)

APPENDIX F

ABBREVIATIONS AND ACRONYMS

There are many methods and techniques for making abbreviations. The following table demonstrates the various abbreviations for "append" and "execute." Because of this variety, it is necessary to develop an approved plant-specific abbreviation list to ensure consistent usage. The following pages list abbreviations and acronyms in use at Turkey Point Plant Units 3 and 4.

Abbreviation Technique	Description	Append	Execute	References
ABBREV	Retain the first syllable intact and progressively delete vowels and then consonants from the remainder of the word.	APPN	EXEC	McBride et al (1981)
Contraction	Retain the first letter and the last letter of the word but eliminate some of the internal letters.	APND	EXTE	Hodge and Pennington (1973)
Frequent Letters Drop	Delete letters from a word according to their frequency of occurrence in the English language. The highest-frequency letters are successively eliminated until the desired abbreviation length is achieved. However, the first letter of the word is never eliminated.	APPD	EXCU	Moses and Potash (1979)
Phonetic (Phonics)	Form abbreviations that when pronounced sound like the original word.	APND	XQT	Hirsch-Pasek et al (1982)
Truncation	Retain the first few contiguous letters of a word and delete the rest.	APPE	EXEC	Hirsch-Pasek et al (1982) Hodge and Pennington (1973) Moses and Potash (1979) Streeter et al (1983)

Abbreviation Technique	Description	Append	Execute	References
Vowel Deletion (Vowel Drop)	Delete all vowels from the word. However, the first letter of the word is never deleted. (Many vowel-deletion techniques are a variation of this theme.)	APPND	EXCT	Hirsch-Pasek et al (1982) Moses and Potash (1979) Streeter et al (1983)
(Unnamed)	A set of rules that seeks to systematically generate abbreviations that are identical to the ones that people naturally produce.	AP	EX	Streeter et al (1983)

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
ABNORMAL	ABNRML
ABSOLUTE	ABS
ABSORBER	ABSORB
ACCELERATE, ACCELERATION	ACCEL
ACCELEROGRAPH	ACCLGR
ACCIDENT IDENTIFICATION AND DISPLAY SYSTEM	AIDS
ACCUMULATED, ACCUMULATOR	ACCUM
ACKNOWLEDGE	ACKNL
ACTIVATE	ACTV
ADAPTER	ADPTR
ADJUST, ADJUSTMENT, ADJUSTABLE	ADJ
ADMINISTRATIVE PROCEDURE	AP
ADSORBER	ADSORB
AIR CIRCUIT BREAKER	ACB
AIR CONDITIONING	A/C
AIR EJECTOR	AEJ
AIR-OPERATED VALVE	AOV
ALARM	ALM
ALTERNATING CURRENT	AC
ALTERNATOR	ALT
AMBIENT	AMB
AMMETER	AMM
AMPERE(S)	AMP(S)

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
AMPERE HOUR METER	AHM
AMPLIFIER	AMPL
ANALYZER	ANAL
AND	&
ANNUNCIATOR	ANN
ANTICIPATED TRANSIENT WITHOUT SCRAM	ATWS
APPROXIMATE, APPROXIMATELY	APPROX
AREA RADIATION MONITOR SYSTEM	ARMS
ARMATURE	ARMT
ARRANGEMENT	ARR
ARRESTOR	ARSTR
ASSEMBLY	ASSY
ATMOSPHERE, ATMOSPHERIC	ATM
AUTOMATIC	AUTO
AUTOMATIC FREQUENCY CONTROL	AFC
AUTOMATIC VOLUME CONTROL	AVC
AUTOMATIC WITHDRAWAL PROHIBIT	AWP
ATOMIC INDUSTRIAL FORUM	AIF
AUXILIARY	AUX
AUXILIARY COOLANT SYSTEM	ACS
AUXILIARY FEEDWATER	AFW
AUXILIARY FEEDWATER ACTUATION SIGNAL	AFAS
AUXILIARY FEEDWATER PUMP	AFWP

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
AVERAGE	AVG
AVERAGE REACTOR COOLANT TEMPERATURE	TAVG
AXIAL	AX

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
BACKUP	BU
BALANCE	BAL
BALANCED VOLTAGE	BAL VOLT
BALANCE OF PLANT	BOP
BAROMETER	BAROM
BARRIER	BARR
BATCHING	BATCH
BATTERY	BATT
BEARING	BRG
BEGINNING OF LIFE	BOL
BENCHBOARD	BNCHBD
BILL OF MATERIAL	B/M
BISTABLE	B/S
BLEED	BLD
BLEEDOFF	BLDOFF
BLOCKED	BLKD
BLOWDOWN	BLDN
BLOWER	BLO
BOARD	BD
BOILER	BLR
BOILER/TURBINE GENERATOR	BTG
BOOSTER	BSTR
BORIC ACID	BA

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
BORIC ACID CONCENTRATION	C_B
BORIC ACID EVAPORATOR	BAE
BRAKE HORSEPOWER	BHP
BREAKERS	BKR
BRITISH THERMAL UNIT	BTU
BUILDING	BLDG
BURNABLE POISON ROD ASSEMBLY	BPRA
BURNER	BNR
BUSHING CURRENT TRANSFORMER	BCT
BUS TIE	BT
BUTTERFLY	BTFLY
BYPASS	BYP

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
CABINET	CAB
CALCULATION, CALCULATOR, CALCULATE	CAL
CALIBRATE	CALIB
CAPACITY, CAPACITOR	CAP
CARBON DIOXIDE	CO_2
CARBON MONOXIDE	CO
CARRIER	CARR
CASING	CSG
CATHODE RAY TUBE	CRT
CAUTION	CAUTION (no abbreviation permitted)
CAVITY	CAV
CENTER	CTR
CENTIMETER	CM
CHANNEL	CHNL
CHARGE, CHARGING	CHG
CHARGER	CHGR
CHEMICAL, CHEMISTRY	CHEM
CHEMICAL VOLUME CONTROL SYSTEM	CVCS
CHILLER	CHILL
CHLORINATION	CLRNTN
CHLORINATOR	CHLORNR
CHLORINE	CL

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
CIRCUIT	CKT
CIRCULAR	CIR
CIRCULATING, CIRCULATE, CIRCULATION	CIRC
CLASSIFICATION	CLASS
CLOCKWISE	CLKWS
COIL POWER PROGRAMMERS	CPP
COLD LEG TEMPERATURE	TCOLD
COLLECTOR/COLLECTION	COLL
COLUMN	CLMN
COMBUSTION	COMB
COMMON	COM
COMMUNICATION	COMM
COMPARTMENT	COMPT
COMPONENT	COMP
COMPONENT COOLING WATER	CCW
COMPONENT COOLING WATER DISTRIBUTION HEADER	CCW DISTR HDR
COMPONENT COOLING WATER SUCTION HEADER	CCW SUCT HDR
COMPRESSOR	COMPR
COMPUTER	CMPTR
CONCENTRATED, CONCENTRATION,	CONC
CONCENTRATES HOLDING TANK	CHT
CONDENSATE	COND

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
CONDENSATE POLISHING DEMIN SYSTEM	CPDL
CONDENSATE STORAGE TANK	CST
CONDENSER	CNDSR
CONDITIONER	CNDTNR
CONDUCTIVITY	CNDTVY
CONNECTOR, CONNECTION, CONNECTED	CONN
CONSOLE	CONS
CONTAINMENT	CNTMT
CONTAINMENT ISOLATION ACTUATION SIGNAL	CIAS
CONTAINMENT ISOLATION SIGNAL	CIS
CONTAINMENT SPRAY ACTUATION SIGNAL	CSAS
CONTAINMENT SPRAY PUMP	CSP
CONTAMINATED, CONTAMINATION	CONTAM
CONTROL, CONTROLLER	CONT
CONTROLLED	CONTRD
CONTROL ROD DRIVE	CRD
CONTROL ROD DRIVE MECHANISM	CRDM
CONTROL ROD DRIVE SYSTEM	CRDS
CONTROL SWITCH	CS
CONTROL VALVE	CCV
CONVERTER	CONV
COOLANT	COOL

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
COOLER	CLR
COOLING	CLG
COOLING WATER	CW
CORRECTED, CORRECTION, CORRECT	CORR
COUNTERCLOCKWISE	CCLKWE
COUNTS PER SECOND	CPS
COUPLING	CPLG
CRITICAL	CRIT
CRITICAL SAFETY FUNCTION	CSF
CUBIC	CU
CUBIC CENTIMETERS	CC
CUBIC FEET PER MINUTE	CFM
CURRENT TRANSFORMER	CT
CYCLES	CYC
CYCLES PER SECOND	HZ

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
DAMPER	DMPR
DANGER	DANGER (no abbreviation - always spell out)
DEAERATOR	DEAER
DECONTAMINATION FACTOR	DF
DECREASE	DECR
DEGREE	DEG(°)
DEGREES CELSIUS	°C
DEGREES FAHRENHEIT	°F
DEMAND	DMND
DEMINERALIZED, DEMINERALIZER	DEMIN
DEMINERALIZED WATER DEGASSIFICATION SYSTEM	DWDS
DEMINERALIZED WATER STORAGE TANK	DWST
DEPARTMENT	DEPT
DESUPERHEATER	DSUPHTR
DETECTOR, DETECTION, DETECTED	DET
DEVIATION	DEV
DIAPHRAGM	DIAPH
DIESEL FUEL OIL	DFO
DIESEL GENERATOR	D/G
DIFFERENCE, DIFFERENTIAL	DIFF Δ
DIFFERENTIAL PRESSURE	ΔP D/P

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
DIFFERENTIAL TEMPERATURE	ΔT
DIGITAL DATA PROCESS SYSTEM	DDPS
DIGITAL ELECTRO-HYDRAULIC	DEH
DIRECT CURRENT	DC
DIRECT, DIRECTION	DIR
DISCHARGE, DISCHARGING	DISCH
DISENGAGED	DSENGA
DISINTEGRATIONS PER MINUTE	DPM
DISTANCE	DIST
DISTRIBUTION	DISTR
DIVISION	DIV
DOUBLE POLE	DP
DOWN	DN
DOWNCOMER	DNCMR
DOWNWARD	DNWD
DRAIN	DRN

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
EAST	E
ECCENTRICITY	ECCY
EFFLUENT	EFL
EJECTOR	EJECT
ELECTRICAL/PNEUMATIC	I/P
ELECTRIC, ELECTRICAL, ELECTRONIC	ELEC
ELECTRIC POWER RESEARCH INSTITUTE	EPRI
ELECTRO-HYDRAULIC CONTROL	EHC
ELECTROMOTIVE FORCE	EMF
ELEMENT	ELEM
EMERGENCY	EMERG
EMERGENCY CORE COOLING SYSTEM	ECCS
EMERGENCY DIESEL GENERATOR	EDG
EMERGENCY OPERATING PROCEDURE	EOP
ENABLE	ENBL
ENCLOSE, ENCLOSURE	ENCL
END OF LIFE	EOL
ENERGIZED	ENRGZ
ENGAGE	ENGA
ENGINE, ENGINEERING	ENG
ENGINEERED SAFEGUARDS	ES
ENGINEERED SAFEGUARDS SYSTEM	ESS
EQUAL, EQUATION	EQ (=)

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
EQUIPMENT	EQUIP
ESTIMATED CRITICAL CONDITION	ECC
EVACUATION	EVAC
EVAPORATION, EVAPORATOR	EVAP
EXCESSIVE	EXCESS
EXCHANGE, EXCHANGER	EXCH
EXCITATION	EXCTN
EXCITER	EXCTR
EXHAUST	EXH
EXHAUSTER	EXHR
EXPANSION	EXPAN
EXTRACT, EXTRACTION, EXTRACTOR	EXTR

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
FAIL AS IS	FAI
FAIL CLOSED	FC
FAIL OPEN	FO
FAILURE	FAIL
FEED	FD
FEEDER	FDR
FEEDWATER	FW
FEEDWATER FLOW	FWF
FEET	FT
FIELD	FLD
FILTER	FLTR
FILTRATION	FLTRN
FINAL SAFETY ANALYSIS REPORT	FSAR
FIRE SUSPENSION SYSTEM	FSS
FIRST	1st
FLOW	FLO
FLOW CONTROL DEVICE WITH INDICATION	FIC
FLOW CONTROL VALVE	FCV
FLOW ELEMENT	FE
FLOW FUNCTION (SQ. ROOT EXTRACTOR)	FLO FUNC
FLOW INDICATING SWITCH	FIS
FLOW INDICATOR	FI

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
FLOW RECORDER	FR
FLOW SOLENOID ELEMENT	FSE
FLOW SWITCH	FS
FORCED DRAFT FAN	FDFAN
FORWARD	FWD
FREQUENCY	FREQ
FREQUENCY METER	FM
FREQUENCY RECORDER	HZ/R
FUEL/AIR RATIO	F/A RATIO

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
GALLONS	GAL
GALLONS PER MINUTE	GPM
GAS ANALYZER	GA
GAS COLLECTION HEADER	GCH
GAS DECAY TANKS	GDT
GAS RELEASE PERMIT	GRP
GAS STRIPPER	GS
GAS SURGE HEADER	GSH
GENERATOR	GEN
GLAND	GLND
GLOBE VALVE	GLBV
GOVERNOR	GOV
GRAVITY	GRVY
GROUND	GND

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
HAND CONTROL VALVE	HCV
HANDLE	HDL
HANDLING	HDLG
HAND SWITCH	HS
HEADER	HDR
HEATER	HTR
HEAT EXCHANGER	HX
HEATING	HTG
HEATING AND VENTILATION	H&V
HEATING AND VENTILATION SYSTEM	HV SYS
HEATING, VENTILATION AND AIR CONDITIONING	HVAC
HERTZ	HZ
HIGH	HI
HIGH EFFICIENCY PARTICULATE AIR	HEPA
HIGH-HIGH	HI-HI
HIGH/HIGH HIGH	HI/HI-HI
HIGH/LOW	HI/LO
HIGH PRESSURE	HP
HIGH PRESSURE SAFETY INJECTION	HPSI
HOLDUP TANK	HT
HOT FULL POWER	HFP
HOT LEG TEMPERATURE	THOT
HOT SHUTDOWN	HSD

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
HOT SHUTDOWN CONTROL PANEL	HSCP
HOT STANDBY	HSB
HOTWELL	HTWL
HOT ZERO POWER	HZP
HOUR	HR
HOUSING	HSG
HUMIDITY	HUMD
HYDRAULIC	HYD
HYDRAZINE	N_2H_4
HYDROELECTRIC	HYDROELEC
HYDROGEN	H_2

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
INADEQUATE CORE COOLING	ICC
INCHES	IN
INCOMING	INCMG
INCREASE	INC
INDICATION/INDICATORS/INDICATING	INDIC
INDUCED DRAFT FAN	IDFAN
INFORMATION	INFO
INJECTION	INJ
INLET/INTAKE	INT
INOPERATIVE	INOP
INSERT, INSERTION	INSERT
INSIDE CONTAINMENT	IC
INSIDE MISSILE BARRIER	IMB
INSTRUMENT AIR SYSTEM	IAS
INSTRUMENT, INSTRUMENTATION	INSTR
INTAKE COOLING WATER	ICW
INTEGRATE, INTEGRATOR	INTEG
INTERLOCK	INTLK
INTERMEDIATE RANGE	IR
INTERMEDIATE RANGE MONITOR	IRM
INTERRUPT	INTRPT
INVERTER	INVTR
ION EXCHANGER	IX

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
ISOLATED	ISOLD
ISOLATION	ISOL

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
JOCKEY	JOCK

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
KILOGRAM	KG
KILOMETER	KM
KILO/THOUSAND	K
KILOVARS	KVAR
KILOVOLT	KV
KILOVOLT-AMPERE	KVA
KILOVOLT-AMPERE HOUR	KVAH
KILOWATT	KW
KILOWATT HOUR	KWH

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
LEAK	LK
LEAKAGE	LKG
LEAK DETECTION SYSTEM	LDS
LEAKOFF	LKOFF
LETDOWN	L/D
LEVEL	LVL
LEVEL CONTROL DEVICE WITH INDICATION	LIC
LEVEL CONTROL VALVE	LCV
LEVEL ELEMENT	LE
LEVEL INDICATING SYSTEM	LIS
LEVEL INDICATION WITH CONTROL	LIC
LEVEL INDICATOR	LI
LEVEL, PRESSURE, RADIATION	LPR
LEVEL RECORDER	LR
LEVEL SOLENOID ELEMENT	LSE
LEVEL SWITCH	LS
LICENSEE EVENT REPORT	LER
LIGHT/LIGHTING	LTG
LIGHTNING ARRESTOR	LTGNG ARSTR
LIMIT, LIMITING	LMT
LIMITED	LTD
LIMITER	LMTR
LINEAR	LIN

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
LINEAR VARIABLE DIFFERENTIAL TRANSMITTER	LVDT
LINEUP	L/U
LIQUID	LIQ
LIQUID RELEASE PERMIT	LRP
LIQUID WASTE PROCESSING SYSTEM	LWPS
LOAD TAP CHANGE	LTC
LOCATION, LOCATE	LOC
LOCKED CLOSED	LC
LOCKED OPEN	LO
LOCKOUT	LCKOUT
LOCKOUT RELAY	LOR
LOGARITHMIC, LOGARITHM	LOG
LOSS OF COOLANT ACCIDENT	LOCA
LOSS OF SECONDARY COOLANT	LOSC
LOW	LO
LOWER	LWR
LOW-LOW	LO-LO
LOW/LOW-LOW	LO/LO-LO
LOW PRESSURE	LP
LOW PRESSURE CONTROL VALVE	LPCV
LOW PRESSURE HEATER	LPH
LOW PRESSURE SAFETY INJECTION	LPSI
LOW PRESSURE STOP VALVE	LPSV

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
LOW TEMPERATURE OPERATING PRESSURE	LTOP
LUBRICATION	LUBE

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
MAIN CONTROL BOARD	MCB
MAIN FEEDWATER CONTROL SYSTEM	MFCS
MAIN FEEDWATER ISOLATION VALVE	MFIV
MAIN OIL PUMP	MOP
MAIN STEAM	MS
MAIN STEAM ISOLATION SIGNAL	MSIS
MAIN STEAM ISOLATION VALVE	MSIV
MAIN STEAM LINE	MSL
MAIN STEAM VALVE	MSV
MAINTENANCE, MAINTAINED	MAINT
MAINTENANCE PROCEDURE	MP
MAKEUP, MAKE-UP	MKUP
MANIFOLD	MANF
MANUAL	MAN
MANUAL/AUTOMATIC	M/A
MAXIMUM	MAX
MEASUREMENT/MEASURE	MEAS
MECHANICAL, MECHANISM	MECH
MEGAVAR HOURS	MVARH
MEGAVARS	MVAR
MEGAWATT HOURS	MWH
MEGAWATTS	MW
MEGOHM	MOHM

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
MERCURY	HG
METAL IMPACT MONITORING SYSTEM	MIMS
MICROCURIES	Uci
MICROWAVE	MCWV
MILLIAMPERE	MAMP
MILLIMETER	MM
MILLIREM	MR
MILLIVOLT	MV
MINI INCORE DETECTOR SYSTEM	MIDS
MINIMUM	MIN
MISALIGNED	MISALGN
MISCELLANEOUS	MISC
MIXTURE	MIX
MOISTURE	MOIST
MOISTURE SEPARATOR REHEATER	MSR
MONITOR	MON
MONITOR TANK	MT
MOTOR	MOT
MOTOR CONTROL CENTER	MCC
MOTOR DRIVEN	MD
MOTOR GENERATOR	MG
MOTORING	MTRG
MOTOR OPERATED	MO

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
MOTOR OPERATED DISCONNECT	MOD
MOTOR OPERATED VALVE	MOV

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
NARROW RANGE	NR
NEEDLE VALVE	NDL VLV
NEGATIVE	NEG
NET POSITIVE SUCTION HEAD	NPSH
NEUTRALIZING, NEUTRAL	NEUT
NEW FUEL POOL	NFP
NEW FUEL STORAGE	NFS
NILDUCTILITY TRANSITION TEMPERATURE	NDTT
NITROGEN	N_2
NOMENCLATURE	NOMEN
NON-CRITICAL	NON-CRIT
NON-ESSENTIAL	NON-ESSEN
NONNUCLEAR SAFETY	NNS
NONREGENERATIVE HEAT EXCHANGER	NRHX
NON-SAFETY	N/S
NORMAL	NORM
NORMALLY CLOSED	NC
NORMALLY OPEN	NO
NORTH	N
NOT APPLICABLE	N/A
NUCLEAR	NUC
NUCLEAR CONTROL CENTER OPERATOR	NCCO
NUCLEAR INSTRUMENTATION (SYSTEM)	NI(S)

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
NUCLEAR PLANT SUPERVISOR	PS-N
NUCLEAR REGULATORY COMMISSION	NRC
NUCLEAR SAFETY ANALYSIS CENTER	NSAC
NUCLEAR STEAM SUPPLY SYSTEM	NSSS
NUCLEAR WATCH ENGINEER	NWE
NUMBER	NUM

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
OFF NORMAL OPERATING PROCEDURE	ONOP
OIL CIRCUIT BREAKER	OCB
OPERATE, OPERATED, OPERATION, OPERATING	OPER
OPERATING PROCEDURE	OP
ORIFICE	ORFC
OUTBOARD	OUTBD
OUTDOOR	OUTDR
OUTLET	OUT
OUT OF SEQUENCE	OUT OF SEQ
OUT OF SERVICE	OOS
OUTSIDE	OUTSD
OUTSIDE AIR	OA
OUTSIDE CONTAINMENT	OC
OUTSIDE MISSILE BARRIER	OMB
OUTSIDE REACTOR CONTAINMENT	ORC
OVERCURRENT	OVRCURR
OVERLOAD	OVRLD
OVERPOWER, DIFFERENTIAL TEMPERATURE	OP, ΔT
OVERPRESSURE MITIGATING SYSTEM	OMS
OVERRIDE	OVRRD
OVERSPEED	OVRSPD
OVER TEMPERATURE	OT
OXYGEN	O_2

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
PANEL	PNL
PARTICULATE	PART
PARTS PER MILLION	PPM
PENETRATION	PENET
PERCENT	%, PCT
PERMANENT	PERM
PERMISSIVE, PERMISSIBLE/PERMIT	PERMISS
PERSONNEL	PRSNL
ph(HYDROGEN ION CONCENTRATION)	PH
PHASE	PHS, Ø
PLANT	PLT
PLANT TURKEY POINT	PTP
PLENUM	PLNM
PNEUMATIC	PNEU
PNEUMATIC/ELECTRIC	I/P
POINT	PNT
POSITIVE	POS
POSITIVE DISPLACEMENT PUMP	PDP
POSTACCIDENT CONTAINMENT VENTILATION	PACV
POSTACCIDENT MONITORING SYSTEM	PAMS
POSTACCIDENT PANEL	PAP
POST INDICATING VALVE	PIV
POTENTIAL	POTX

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
POTENTIAL DEVICE	PD
POTENTIAL TRANSFORMER	PT
POUNDS PER HOUR	PPH
POUNDS PER SQUARE INCH	PSI
POUNDS PER SQUARE INCH ABSOLUTE	PSIA
POUNDS PER SQUARE INCH DIFFERENTIAL	PSID
POUNDS PER SQUARE INCH GAUGE	PSIG
POUNDS/POUND	LBS/LB
POWER	PWR
POWER DEPENDENT.INSERTION LIMIT	PDIL
POWER FACTOR	PWR FAC
POWER OPERATED RELIEF VALVE	PORV
PRECIPITATOR	PRECIP
PREHEATER	PREHTR
PRELIMINARY	PRELIM
PREPARE/PREPARATION	PREP
PRE-POWER DEPENDENT INSERTION LIMIT	PPDIL
PRESSURE	PRESS
PRESSURE CONTROL VALVE	PCV
PRESSURE DIFFERENTIAL INDICATING SWITCH	PDIS
PRESSURE DIFFERENTIAL INDICATOR	PDI
PRESSURE INDICATING SWITCH	PIS

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
PRESSURE INDICATOR	PI
PRESSURE INDICATOR CONTROLLER	PIC
PRESSURE RECORDER	PR
PRESSURE SWITCH	PS
PRESSURE TRANSMITTER	PXMTR
PRESSURIZATION	PRZN
PRESSURIZED SAMPLE VESSEL	PSV
PRESSURIZED WATER REACTOR	PWR
PRESSURIZER	PRZR
PRESSURIZER RELIEF TANK	PRT
PRIMARY	PRI
PRIMARY AIDS PARAMETERS	PAPS
PRIMARY MAKEUP SYSTEM	PMUS
PRIMARY SAMPLING COOLER	PSC
PRIMARY WATER STORAGE TANK	PWST
PRIMING	PRMG
PROCESS, PROCESSING/PROCEDURE	PROC
PROCESS RADIATION MONITOR SYSTEM	PRMS
PROCESS SAMPLING SYSTEM	PSS
PROPORTION(AL)	PROPN
PROTECT, PROTECTION, PROTECTIVE	PROT
PULVERIZER	PULV
PUMP(S)	PP

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
PURIFICATION	PURIF
PUSHBUTTON	PB

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
QUALIFIED SAFETY PARAMETER DISPLAY SYSTEM	QSPDS
QUALITY	QUAL
QUALITY ASSURANCE	QA
QUALITY CONTROL	QC
QUENCH	QNCH

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
RADIATION CONTROL AREA	RCA
RADIATION ELEMENT (DETECTOR)	RE
RADIATION INDICATOR	RI
RADIATION MEASUREMENT MONITORING	RMM
RADIATION MONITORING SYSTEM	RMS
RADIATION/RADIOACTIVITY	RAD
RADIATION WASTE	RADWST
RADIATION WORK PERMIT	RWP
RANGE	RNG
RATE OF CHANGE	ROC
REACH ROD	RR
REACTOR	RX
REACTOR AUXILIARY BUILDING	RAB
REACTOR CONTAINMENT BUILDING	RCB
REACTOR CONTROL OPERATOR	RCO
REACTOR COOLANT	RC
REACTOR COOLANT DRAIN TANK	RCDT
REACTOR COOLANT PUMP	RCP
REACTOR COOLANT SYSTEM	RCS
REACTOR DRAIN TANK	RDT
REACTOR MAKEUP WATER	RMW
REACTOR OPERATOR	RO
REACTOR PROTECTIVE SYSTEM	RPS

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
REACTOR REGULATING SYSTEM	RRS
REACTOR VESSEL	RV
RECEIVER	RCVR
RECIRCULATION, RECIRCULATING	RECIRC
RECIRCULATION ACTUATION SIGNAL	RAS
RECOMBINER	RCMB
RECORD, RECORDER, RECORDING	RCD, RCDR, RCDG
RECTIFIER	RECT
RECYCLE HOLDUP TANK	RHUT
REFERENCE	REF
REFUELING	REFUEL
REFUELING WATER STORAGE TANK	RWST
REGENERATING, REGENERATIVE, REGENERATION	REGEN
REGENERATIVE HEAT EXCHANGER	RHX
REGULATOR, REGULATING	REG
REHEAT	RHT
REHEATER	RHTR
RELATIVE POSITION INDICATION	RPI
RELAY	RLY
RELIEF	RLF
REM	R
REMOTE	RMT
REMOTE SHUTDOWN CONTROL PANEL	RSDCP

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
REMOVE, REMOVABLE	RMV
REMS PER HOUR	R/HR
RESERVOIR	RSVR
RESIDUAL HEAT REMOVAL	RHR
RESISTANCE TEMPERATURE DETECTOR	RTD
RESISTOR, RESISTANCE	RES
RESTRICTOR ORIFICE	RESTR ORFC
RETURN	RTN
REVERSE CURRENT VALVE	RCV
REVISION	REV
REVOLUTIONS PER MINUTE	RPM
REVOLUTIONS PER SECOND	R/S
RHEOSTAT	RHEO
ROD CONTROL CLUSTER	RCC
ROD CONTROL CLUSTER ASSEMBLY	RCCA
ROD POSITION INDICATOR	RPI
ROTATION	ROTN
ROTOR	ROT

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
SAFEGUARD	SFGD
SAFETY	SFTY
SAFETY ASSESSMENT SYSTEM	SAS
SAFETY INJECTION	SI
SAFETY INJECTION ACTUATION SIGNAL	SIAS
SAFETY INJECTION PUMP	SIP
SAFETY INJECTION SYSTEM	SIS
SAFETY PARAMETER DISPLAY SYSTEM	SPDS
SAMPLE, SAMPLING	SMPL
SATURATION/SATURATED	SAT
SCREEN	SCRN
SEAL STEAM BYPASS VALVE	SSBV
SEAL STEAM CONTROL	SSC
SEAL STEAM CONTROL VALVE	SSCV
SEAL WATER HEAT EXCHANGER	SWHX
SECOND	2ND
SECONDARY	SECDRY
SECONDARY AIDS PARAMETERS	SAPS
SECONDARY SAMPLE SYSTEM	SSS
SECTION	SECT
SELECTED, SELECTION, SELECTOR	SEL
SELSYN	SELS
SENIOR REACTOR OPERATOR	SRO

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
SENSOR	SENS
SEPARATOR	SEPR
SEQUENCE	SEQ
SEQUENCE OF EVENTS RECORDER	SER
SEQUENTIAL	SEQL
SERVICE	SERV
SERVICE WATER SYSTEM	SSW
SETPOINT	SETPT
SHIELD	SHLD
SHIELD BUILDING VENTILATION SYSTEM	SBVS
SHIFT SUPERVISOR	SS
SHUTDOWN	S/D
SHUTDOWN BANK	SB
SHUTDOWN COOLING	SDC
SHUTOFF	S/O
SIGNAL	SIG
SNUBBER	SNBR
SODIUM	NA
SODIUM HYDROXIDE	NAOH
SODIUM ION	NA+
SOLENOID	SOL
SOLID WASTE PROCESSING SYSTEM	SWPS
SOURCE RANGE	SR

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
SOURCE RANGE MONITOR	SRM
SOUTH	S
SPARE	SP
SPECIFICATION	SPEC
SPEED	SPD
SPENT FUEL ASSEMBLY	SFA
SPENT FUEL PIT	SFP
SPENT FUEL PIT COOLING SYSTEM	SFPC
SPENT FUEL POOL	SFP
SPENT RESIN STORAGE TANK	SRST
SPILLOVER	SPLOVR
SPRAY	SPR
SPREAD/SPREADING	SPRD
SPRINKLER	SPKLR
SQUARE	SQ
SQUARE FOOT	SQFT
SQUARE ROOT	SQRT
STABILIZER	STAB
STAGE/STAGING	STG
STANDARD	STD
STANDBY	S/B
START-UP	S/U
START-UP RATE	SUR

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
STATION	STA
STEAM	STM
STEAM BYPASS CONTROL SYSTEM	SBCS
STEAM FLOW	SF
STEAM GENERATOR	S/G
STEAM GENERATOR FEED PUMP	SGFP
STEAM GENERATOR TUBE RUPTURE	SGTR
STEAM JET AIR EJECTOR	SJAE
STORAGE	STOR
STRAINER	STRNR
STRUCTURE	STRUC
STUFFING BOX	STFG BX
SUBCOOLED	SC
SUBCOOLING	SUBCOOL
SUBCOOLING MARGIN MONITOR	SMM
SUBSTATION	SUBSTA
SUCTION	SUCT
SUPERHEAT(ER) (ED)	SUPHT(R) (D)
SUPERVISORY/SUPERVISION	SUPV
SUPPRESSION, SUPPRESSOR	SUPPR
SUPPLY	SPLY
SWITCH	SW
SWITCHBOARD	SWBD

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
SWITCHGEAR	SWGR
SWITCHYARD	SWYD
SYNCHRONIZE, SYNCHRONIZER, SYNCHRONIZING, SYNCHRONOUS	SYNC
SYNCHROSCOPE	SYNSCP
SYSTEM	SYS

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
TACHOMETER	TACH
TANK	TK
TECHNICAL	TECH
TECHNICAL SUPPORT CENTER	TSC
TELEMETER	TLM
TEMPERATURE	TEMP
TEMPERATURE AVERAGE	TAVG
TEMPERATURE CONTROL DEVICE WITH INDICATOR	TIC
TEMPERATURE CONTROL VALVE	TCV
TEMPERATURE DIFFERENCE	ΔT, D/T
TEMPERATURE ELEMENT	TE
TEMPERATURE INDICATING SWITCH	TIS
TEMPERATURE INDICATOR CONTROL	TIC
TEMPERATURE REFERENCE	TREF
TEMPERATURE TRANSMITTER	TT
TERMINAL	TERM
THERMAL	THRML
THERMOMETER	THERM
THERMOSTAT	THERMO
THOUSAND (KILO)	K
THROTTLE	THROT
THYRISTOR VOLTAGE REGULATOR	TVR
TIME DELAY CLOSE	TDC

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
TIME DELAY DROPOUT	TDD
TIME DELAY OPEN	TDO
TIME DELAY PICKUP	TDP/U
TIMING	TMG
TOTALIZER	TOTLZR
TOWER	TWR
TRAIN	TRN
TRANSFER	XFER
TRANSFORMER	XFMR
TRANSIENT	TRANS
TRANSMITTER	XMTR
TRAVELING	TRVLG
TREATMENT	TREAT
TRIAXIAL	TRIAX
TRINISTAT	TRIN
TRIP(S)	TRIP (no abbreviation permitted)
TRIP CIRCUIT BREAKER	TCB
TROUBLE	TRBL
TURBIDITY	TRBY
TURBINE	TURB
TURBINE BUILDING	TB
TURBINE DRIVEN	TD
TURBINE GENERATOR	TURB GEN

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
TURBINE GLAND SEAL SYSTEM	TGSS
TURBINE PLANT COOLING WATER	TPCW
TURNING	TURN

[illegible] [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
ULTIMATE HEAT SINK	UHS
UNAVAILABLE	UNAVAIL
UNBALANCED	UNBAL
UNDERFREQUENCY	U/F
UNDERGROUND	UG
UNDERVOLTAGE	U/V
UPPER	UPR
UPPER GUIDE STRUCTURE	UGS
UTILITY	UTIL

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
VACUUM	VAC
VALVE(S)	VLV
VAPOR	VAP
VENT HEADER	VH
VENTILATION	VENT
VERTICAL	VERT
VERTICAL PANEL A	VPA
VERTICAL PANEL B	VPB
VESSEL	VSL
VIBRATION	VIB
VIBRATION ECCENTRICITY MONITOR	VEM
VISCOSITY	VISC
VOLT	V
VOLTAGE	VOLT
VOLTMETER	VM
VOLTS ALTERNATING CURRENT	V AC
VOLTS AMPERES REACTIVE	VARS
VOLTS DIRECT CURRENT	V DC
VOLUME	VOL
VOLUME CONTROL TANK	VCT

[illegible] ABBREVIATIONS AND ACRONYMS

ABBREVIATION

W/U

WST

W3 [illegible] ECYCLE

WDS

[illegible]

WHT

[illegible]

[illegible]

[illegible]

WTP

WH

WHM

[illegible]

W

WR

WTG

WTHEAWL

W/O

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
WARMUP	W/U
WASTE	WST
WASTE DISPOSAL-BORON RECYCLE	WB
WASTE DISPOSAL SYSTEM	WDS
WASTE GAS DECAY TANK	WGDT
WASTE HOLDUP TANK	WHT
WASTE MANAGEMENT SYSTEM	WMS
WASTE PROCESSING SYSTEM	WPS
WATER	WTR
WATER TREATMENT PLANT	WTP
WATT HOUR	WH
WATT HOUR METER	WHM
WEST	W
WESTINGHOUSE	W
WIDE RANGE	WR
WINDING	WDG
WITHDRAWAL	WTHDRWL
WITHOUT	W/O

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

ABBREVIATION	[illegible]
&	
@	
Δ	
Ø	
1/C	
1 P	
[illegible]	
<	
[illegible]	
/	
[illegible]	
1/C	
[illegible]/C	
[illegible] PH	
[illegible]/C	
3 [illegible]	
3 P	
3/C	
3 PH	

DICTIONARY OF ABBREVIATIONS AND ACRONYMS

NOMENCLATURE	ABBREVIATION
AND	&
AT	@
DIFFERENTIAL	Δ
FLUX	Ø
FOUR CONDUCTOR	4/C
FOUR POLE	4 P
GREATER THAN	>
LESS THAN	<
OHM (diagrams only)	Ω
OR	/
PERCENT	%
SEVEN CONDUCTOR	7/C
SINGLE CONDUCTOR	1/C
SINGLE PHASE	1 PH
THREE CONDUCTOR	3/C
THREE PHASE	3 PH
THREE POLE	3 P
TWO CONDUCTOR	2/C
TWO PHASE	2 PH