

Basic Print Reading

ACADs (08-006) Covered

5.1.1.2.1.7 5.1.2.18

Keywords

Drawings, amendments, electrical components, mechanical components,

Description

Supporting Material



BASIC PRINT READING

NNIFD0020



A decorative graphic on the left side of the slide. It features a vertical blue arrow pointing upwards, a grey arrow pointing to the left, and a pink arrow pointing to the right. The background of the slide is a gradient from light grey at the top to dark grey at the bottom.

COURSE TERMINAL OBJECTIVE

When presented with a task to evaluate the condition of an electrical or mechanical component, the Student will be able to correctly locate and obtain the appropriate drawing and its amendments and identify the condition of the electrical or mechanical components on the drawing. Mastery will be demonstrated by passing an exam with a minimum score of 80%.



LESSON ENABLING OBJECTIVES

E001 Given a Drawing number, identify the components, which make up the Drawing number.

E002 State why As-Built Drawings are the most current available type drawing.



LESSON ENABLING OBJECTIVES

E003 State the reason that As-Built Drawings are preferred over Design drawings for use in the plant.

E004 State where the standard numbering and symbols used on electrical or mechanical drawings at PVNGS can be found.

LESSON ENABLING OBJECTIVES



EO05 State the purpose of a Piping and Instrument Diagram

EO06 Identify and describe the use of each Piping and Instrument Diagram Symbol used at PVNGS

LESSON ENABLING OBJECTIVES



EO07 Locate and find the latest revision to a Single Line electrical drawing.

LESSON ENABLING OBJECTIVES



EO08 Locate a vendor drawing.

LESSON ENABLING OBJECTIVES

EO09 Given a Single Line electrical drawing, locate and describe the information found in the following:

- 1.The Title Block
- 2.The Legend
- 3.The Functional Table
- 4.The Notes Section

FUNCTIONAL TABLE	
CODE	DESCRIPTION
F-A	ANNUNCIATOR
F-B	TRIPS 4.16KV BUS FEEDER BREAKER
F-C	TRIPS 4.16KV FEEDER BREAKER
F-Q	INPUT TO COMPUTER
F-S	TRIPS 4.16KV SELECTED BREAKER
F-H	STARTS BREAKER COOLING FAN
F-K	PERMITS SUPPLY AUTO TRANSFER
F-N	BLOCKS SUPPLY AUTO TRANSFER

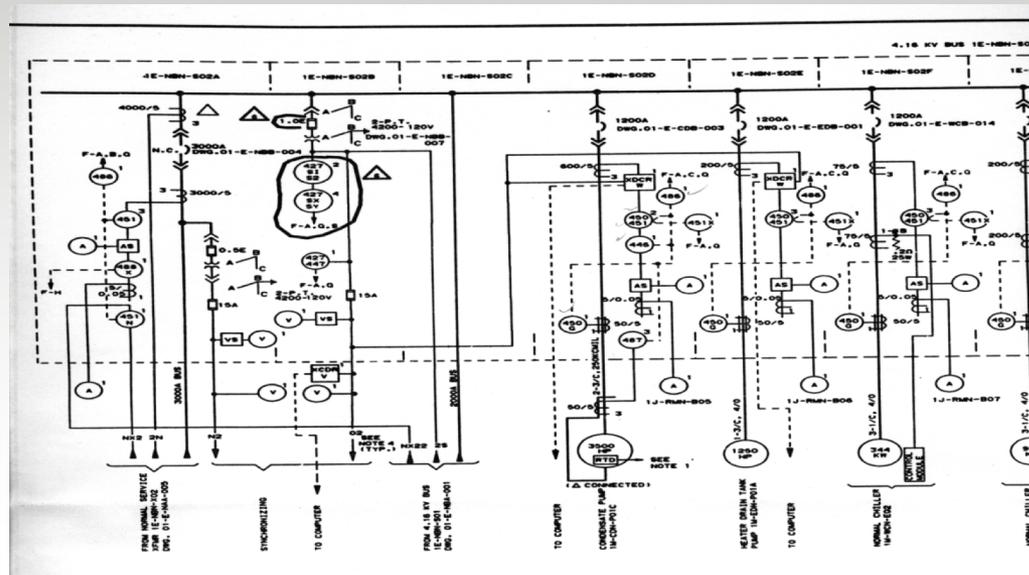
INDOOR SWITCHGEAR BUILDING				NOR				
 PALO VERDE NUCLEAR GENERATING STATION					SINGLE LINE DIAGRAM 4.16KV NON-CLASS 1E POWER SYSTEM SWITCHGEAR 1E-NBN-502			
					SCALE	JOB NO.	DRAWING NO.	REV.
		01-E-NBA-002	6					
01ENBA002.DGN								

Lesson Enabling Objectives

EO10 Given a Single Line electrical drawing, locate and trace the following:

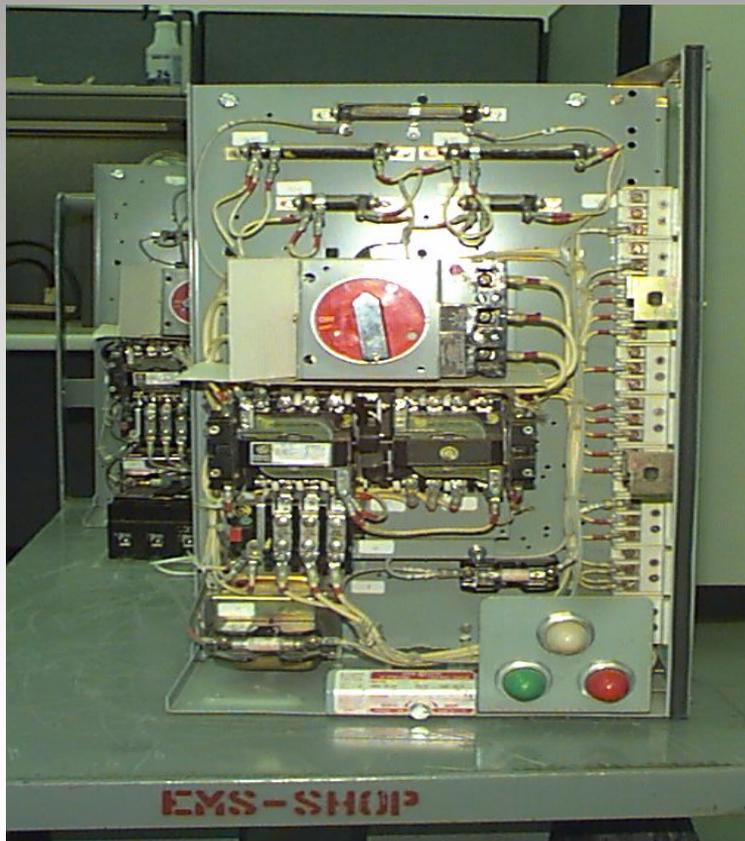
1.The Main Power Path

2.The Protection and Indication Path



Lesson Enabling Objectives

E011 Given a Single Line electrical drawing identify the Components and Symbols located on the drawing.



Lesson Enabling Objectives



EO12 Given an Elementary electrical drawing, locate and describe the information found in the following:

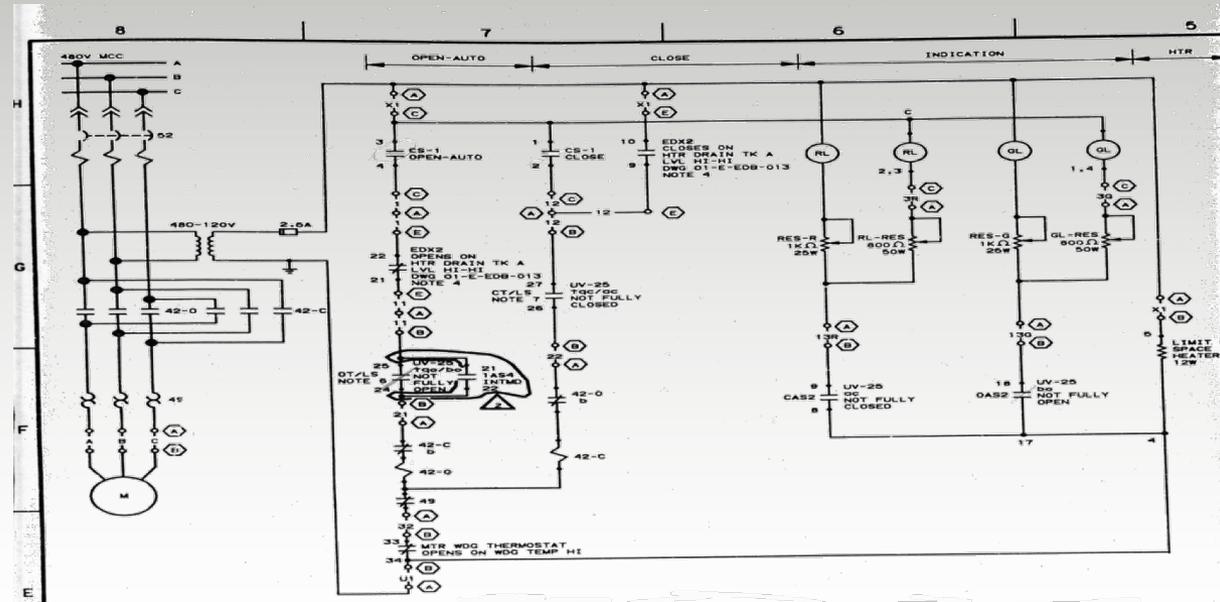
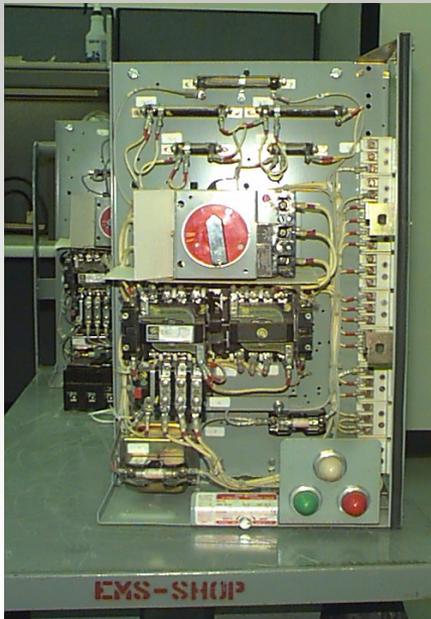


- 1.The Title Block**
- 2.The Cabling Block Diagram**
- 3.The Switch Contact Scheme**

Lesson Enabling Objectives

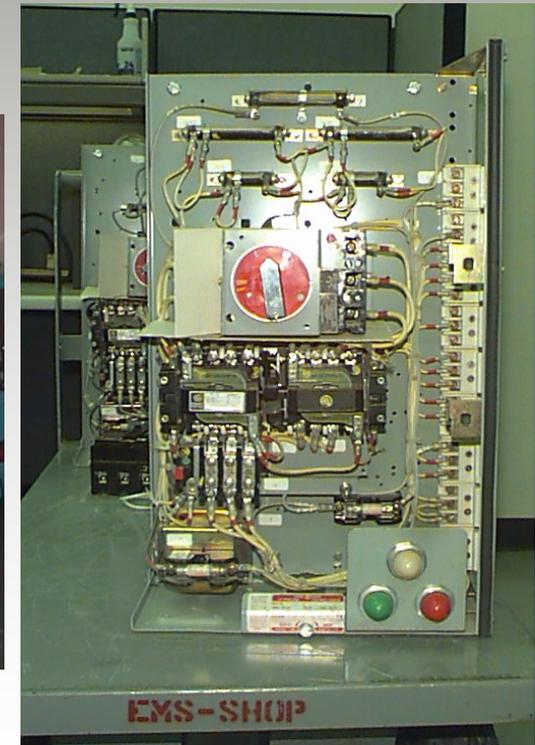
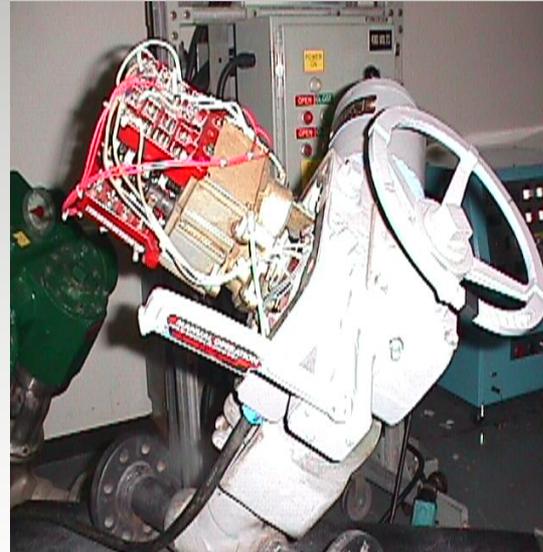
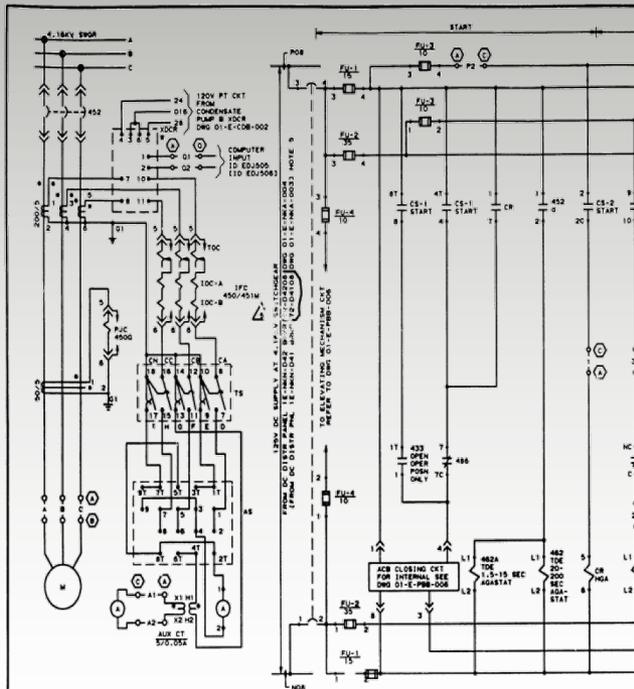
E013 Given an Elementary electrical drawing, locate and trace the following:

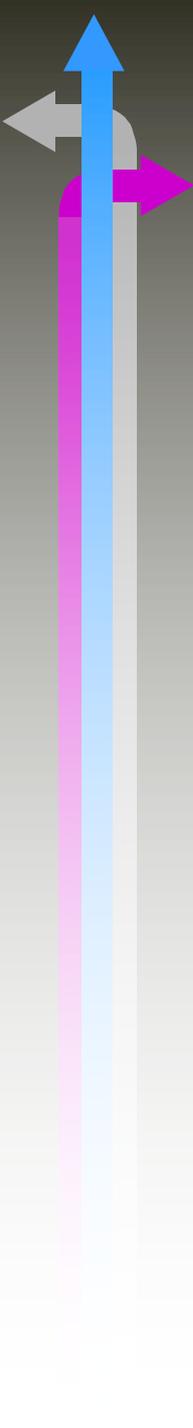
- 1.The Protection and Indication Path**
- 2.The steps to energize or de-energize a load**



Lesson Enabling Objectives

EO14 Given an Elementary electrical drawing, identify the Components and Symbols located on the drawing.





EO01

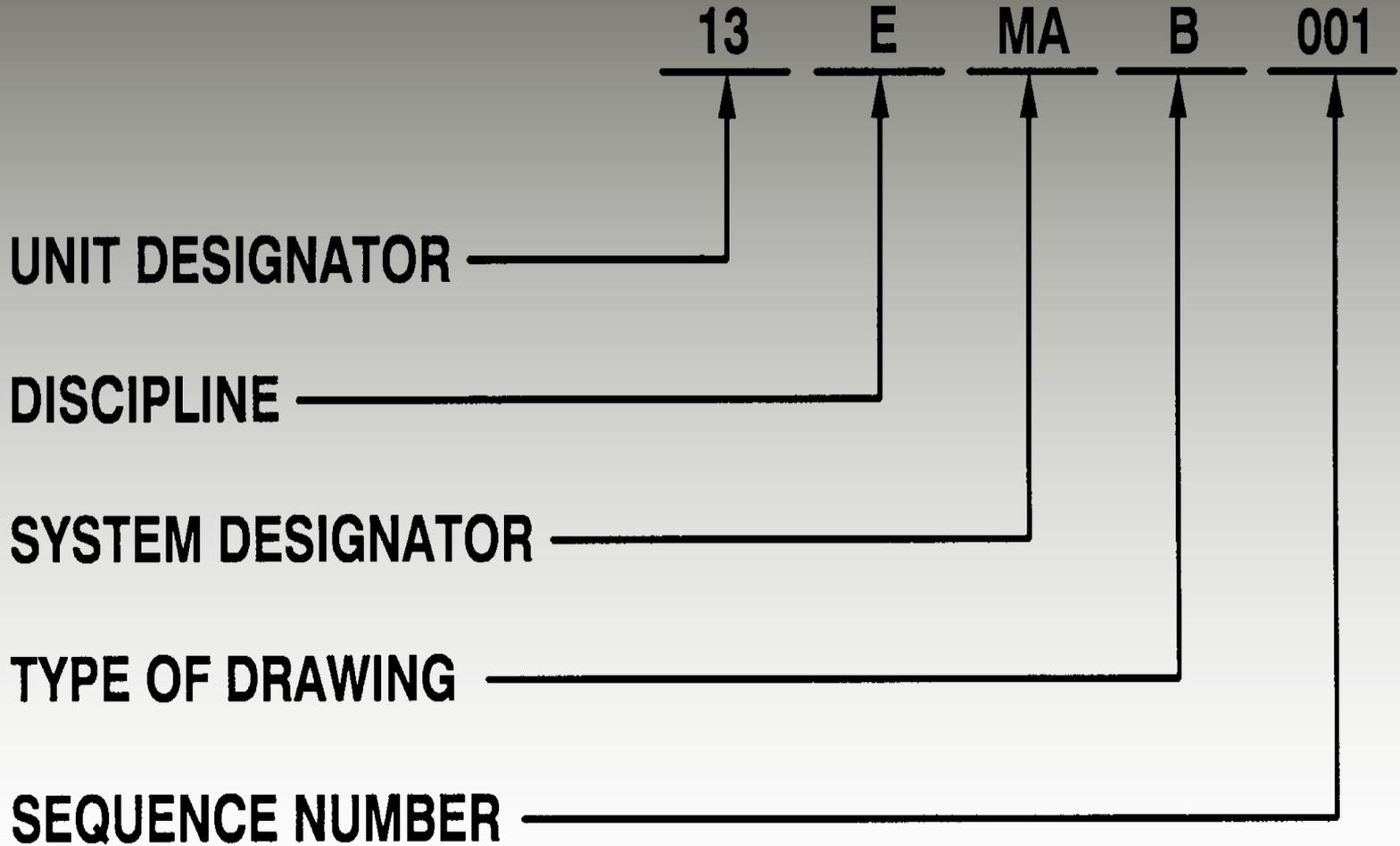
Given a Drawing number, identify the components, which make up the Drawing number.

Drawing Number

13-E-MAB-001

Drawing Number

EO01



Unit Designator Chart

E001

UNIT DESIGNATOR CHART

01 - UNIT 1 **13-E-MAB-001**

02 - UNIT 2

03 - UNIT 3

12 - UNITS 1 & 2

23 - UNITS 2 & 3

31 - UNITS 1 & 3

13 - ALL 3 UNITS **13 and AO** Indicates these are
a design drawing

AO - COMMON (SHARED)

Discipline Identifiers

E001

DISCIPLINE IDENTIFIERS

13-**E**-MAB-001

A - ARCHITECTURAL

C - CIVIL/STRUCTURAL

E - ELECTRICAL

J - CONTROL

M - MECHANICAL

N - NUCLEAR ENVIRONMENT

P - PLANT DESIGN

S - PIPE SUPPORT

System Designators (1)

E001

MECHANICAL SYSTEMS

Main Power Cycle and Auxiliaries

AF Auxiliary Feedwater

CD Condensate
CT Condensate Transfer & Storage
ED Feedwater Heater Extraction Steam & Drain
FW Feedwater
MT Main Turbine & MSR's
SG Main Steam

NSSS - Steam Generator Controls and Auxiliaries

CH Chemical and Volume Control
RC Reactor Coolant
RX Reactor Core
SC Secondary Chemical Control
SI Safety Injection and Shutdown Cooling
SS Nuclear Sampling System

Turbine Generator and Auxiliaries

AR Condenser Air Removal
CE Stator Cooling
CO Main Turbine Control Oil
GH Generator Hydrogen and CO₂
GS Turbine Steam Seal and Drain
LO Lube Oil
OS Lube Oil Storage, Transfer and Purification
SO Generator Seal Oil

13-E-MAB-001

Circulation Water

CC Chemical Production
CI Chlorine Injection
CW Circulating Water
TB Cooling Tower Makeup
and Blowdown

System Designators (2)

E001

13-E-MAB-001

Auxiliary Steam

AS Auxiliary Steam
FT Steam Generator Feedwater Pump Turbine

Heating, Ventilation, Air-Conditioning (HVAC)

CL Containment Leak Test
CP Containment Purge
EC Essential Chilled Water
HA HVAC - Auxiliary Building
HC HVAC - Containment
HD HVAC - Diesel Generator Building
HF HVAC - Fuel Building
HJ HVAC - Control Building
HN HVAC - Ancillary Buildings
HP Containment Hydrogen Control
HR HVAC - Radwaste Building
HS HVAC - Miscellaneous Site Structures
HT HVAC - Turbine Building
WC Chilled Water

Radwaste

GR Gaseous Radwaste
LR Liquid Radwaste
RD Radioactive Waste Drains
RE Radiation Exposure and Maintenance System
RL Radioactive Laundry
SR Solid Radwaste

Fuel Oil

DF Diesel Fuel Oil and Transfer

Cooling Water

EW Essential Cooling Water
NC Nuclear Cooling Water
PC Fuel Pool Cooling and Cleanup
PW Plant Cooling Water
SP Essential Spray Ponds
TC Turbine Cooling Water

System Designators (3) E001

Services

DG	Diesel Generator Systems
DS	Domestic Water
DW	Demineralized Water
FP	Fire Protection
GA	Service Gases (N2 and H2)
IA	Instrument and Service Air

Drains

CM	Chemical Waste
OW	Oily Waste and Nonradioactive Waste
ST	Sanitary Drainage and Treatment

Miscellaneous

FH	Fuel Handling (Nuclear)
FX	Fuel Handling Operations
ZA	Auxiliary Building
ZC	Containment
ZF	Fuel Building
ZG	Diesel Generator Building
ZJ	Control Building
ZM	Main Steam Support Structure
ZR	Radwaste Building
ZT	Turbine Building
ZY	Outside Areas

13-E-*MAB*-001

ELECTRICAL SYSTEMS

Generation and Transmission

MA	Main Generation
MB	Excitation and Voltage Regulation
PB	4.16KV Power
PE	Standby Generation
PG	480V Power Switchgear
PH	480V Power, MCC
PK	125V DC Power
PN	Instrument AC Power

System Designators (4)

E001

Non-Class I E Power Systems

NA	13.8KV Power
NB	4.16kV Power
NG	480V Power Switchgear
NH	480V Power, MCC
NK	125V DC Power
NN	Instrument AC Power
NQ	Uninterruptible AC Power

Miscellaneous Systems

QA	Normal Lighting (Includes 208V/120 Power)
QB	Essential Lighting
QC	Yard, Roadway, and Fence Lighting
QD	Emergency Lighting
QE	Public Offsite Communications
QF	In-Plant Communications
QG	Grounding (entire site ground grid-personnel safety)
QH	Cathodic Protection
QJ	Freeze Protection
QK	Fire Detection and Alarm
QL	Private Offsite Communications
QM	Special Process Trace Heating

13-E-MAB-001

CONTROL SYSTEMS

ES	Safety Equipment Status System
RG	Meteorological Instrumentation
RJ	Plant Computer
RK	Plant Annunciator
RM	Main Control Board
SA	Engineered Safety Features Actuation
SB	Reactor Protection
RI	In-Core Instrumentation
SE	Ex-Core Neutron Monitoring
SF	Reactor Control
SM	Seismic Instrumentation
SK	Plant Security
SQ	Radiation Monitoring
SV	Loose Parts and Vibration Monitoring

Drawing Type Designators

E001

DRAWING TYPE DESIGNATORS

NUCLEAR

- F- BASIC FLOW
- P- PIPING AND INSTRUMENTATION DIAGRAM
- R- RADIATION

CIVIL STRUCTURE

- A- GENERAL
- C- CIVIL
- S- STRUCTURAL

ELECTRICAL

- A- ONE LINE DIAGRAM
- B- ELEMENTARY
- C- CONDUIT AND TRAY
- D- LOGIC
- E- FIRE AND SAFETY
- G- GROUNDING
- J- COMMUNICATIONS
- L- LIGHTING
- P- EQUIP. REQ. AND ARRANGEMENTS
- U- UNDERGROUND CIRCUIT
- W- WIRING DIAGRAMS (PDMS)
- F- CONTROL WIRING DIAGRAMS

CONTROL

- C- CONTROL DIAGRAMS/FLOW CHARTS
- D- INSTALLATION DETAIL
- E- LOOP
- F- FIELD LOCATION
- I- INSTRUMENT INDEX
- K- LEVEL SETTING DIAGRAM
- L- LOGIC
- P- PANEL OR CONSOLE
- S- SPECIAL DRAWINGS

MECHANICAL

- A- AREA
- B- GENERAL ARRANGEMENT
- C- HVAC
- D- PIPING (PROCESS)
- E- PLUMBING (WASTE AND SANITARY)
- F- BASIC FLOW
- G- MISCELLANEOUS
- H- HEAT BALANCE OR H-WRF
- I- HANGARS/SUPPORTS
- J- EQUIPMENT INDEX
- L- SPOOL DRAWINGS
- P- EQUIPMENT LOCATION
- P- P&ID
- U- STARTUP PIPING
- Y- YARD PIPING

PLANT DESIGN

- A- AREA
- B- GENERAL ARRANGEMENT
- C- HVAC (AREA ONLY)
- E- PLUMBING (AREA ONLY)
- F- ISOMETRICS
- G- MISCELLANEOUS
- L- EQUIPMENT LOCATION
- P- P&ID
- R- RADIATION

PROCESS DESIGN (WRF)

- A- PROCESS FLOW
- B- GENERAL ARRANGEMENT & EQUIP LOCATION
- D- DEMONSTRATION PLANT
- G- DETAILS & MISCELLANEOUS
- P- P&ID

ARCHITECTURAL

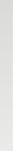
- D- ARCHITECTURAL DESIGN

13-E-MAB-001

Given the drawing number 01-E-CHB-004
Which one of the following designates the discipline of the drawing?

- 1. E
- 2. CH
- 3. B
- 4. 01

0%



0 of 28

E002 State why As-Built drawings are the most current available type drawing.

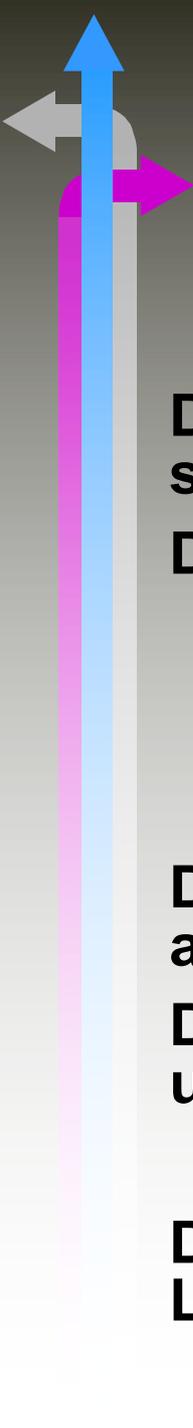


Timing of Updates:

- A. Key Drawings are updated within 14 working days of a change**
- B. Other drawings identified as Non Key Drawings are updated according to management expectations, which is currently 60 days.**

Key Drawings include

- 1. Mechanical, Nuclear, and Plant Design P & ID's**
- 2. Electrical**
 - a) Single Line**
 - b) Elementary**
 - c) Emergency Lighting**



EO04 State where the standard numbering and symbols used on electrical or mechanical drawings at PVNGS can be found.

Mechanical Drawings

Drawings 13-M-ZZP-001 through 004 list the standard symbols used.

Drawing 13-M-ZZP-004 lists abbreviations used.

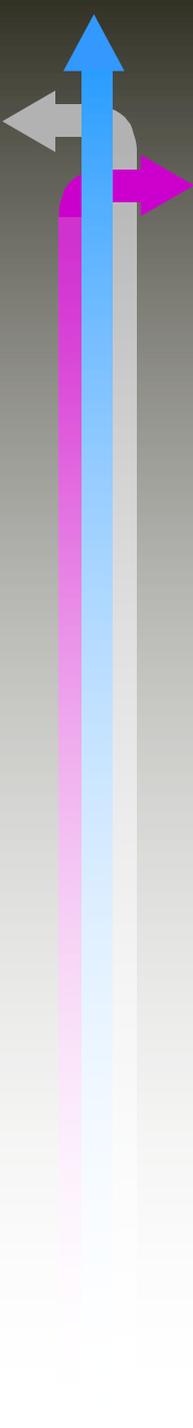
Electrical Drawings

Drawings 13-E-ZZB-001 through 003 list the standard abbreviations used.

Drawing 13-E-ZZB-004 lists the General Function Numbers used.

86 = Locking-Out Relay

Drawing 13-E-ZZB-005 through 007 is the General Symbol List.



EO05 State the purpose of a Piping and Instrument Diagram.

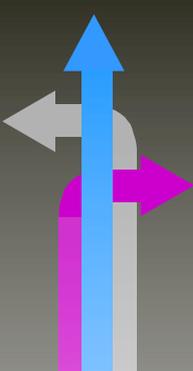
Purposes of a Piping and Instrument Diagram:

- A. Shows the functional relationship between components of a piping system**
 - 1. Energy connections between components**
 - 2. Piping design requirements**
 - 3. Flow direction**

- B. Does not show location or configuration**

- C. No attempt to show lines or equipment to scale.**

- D. Provides information on how something is done in that system.**

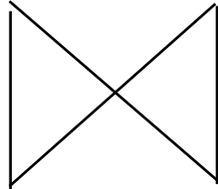


EO06 Identify and describe the use of each Piping and Instrument Diagram Symbol used at PVNGS.

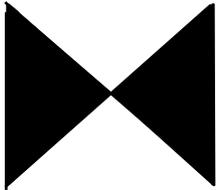
Use of each Piping and Instrument Diagram symbol used at PVNGS:

Equipment: (From left column of 13-M-ZZP-001)

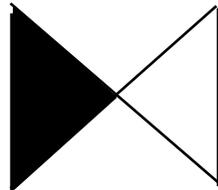
- 1. Horizontal Centrifugal Pump**
- 2. Vertical Pump**
- 3. Positive Displacement Pump**
- 4. Heat Exchangers**
 - a) U-Tube**
 - b) Straight Tube**
- 5. Ion Exchanger**
- 6. Tanks**
- 7. Reciprocating Air Compressor**
- 8. Mixer**



Open During
Normal Operation



Closed During
Normal Operation



Throttled During
Normal Operation

Piping Code Classification

First Letter

INFORMATION IS FOUND IN 13-P-ZZG-012

<u>FIRST LETTER - PRIMARY RATING</u>		
A	-	SPECIAL VALVE RATING
B	-	2500#
C	-	1500#
D	-	900#
E	-	600#
F	-	400#
G	-	300#
H	-	150#
J	-	125# ANSI B16.1
K	-	175# WOG UNDERWRITER'S LABORATORIES, INC.
L	-	255# ANSI B16.1
M	-	200# WOG
N	-	150# WOG
P	-	100# AWWA (OR MANUFACTURER'S RATING)
R	-	75# AWWA (OR MANUFACTURER'S RATING)
S	-	50# AWWA (OR MANUFACTURER'S RATING)
T	-	25# AWWA (OR MANUFACTURER'S RATING)
X	-	GRAVITY RATING
Y	-	GENERAL USE AND DESIGNATED ON CALL SHEETS
Z	-	AS APPLICABLE

Piping Code Classification

Second Letter

INFORMATION IS FOUND IN 13-P-ZZG-012

SECOND LETTER - MATERIAL

A	-	ALLOY STEEL
B	-	CARBON STEEL
C	-	AUSTENITIC STAINLESS STEEL
D	-	COPPER, BRASS OR BRONZE
E	-	ALUMINUM
F	-	CARBON STEEL - COOPER BEARING
G	-	CARBON STEEL - LINED
H	-	CAST IRON
J	-	CONCRETE PIPE
K	-	VITRIFIED CLAY PIPE
L	-	CARBON STEEL - IMPACT TEST
M	-	CAST IRON - HIGH SILICON
N	-	CARBON STEEL - GALVANIZED
P	-	CAST IRON - CEMENT LINED
Q	-	ASBESTOS - CEMENT
R	-	DUCTILE IRON
S	-	90-10 CuNi
T	-	CHLORINATED POLYVINYL CHLORIDE (CPVC)
U	-	FIBERGLASS REINFORCED PLASTIC (FRP)
X	-	SPECIAL MATERIAL SEE CLASS SHEET
Z	-	AS APPLICABLE

Piping Code Classification

Third Letter

E006

INFORMATION IS FOUND IN 13-P-ZZG-012

THIRD LETTER - APPLICABLE CODES

A	-	NUCLEAR POWER PLANT COMPONENTS, ASME B&PV CODE, SEC. III, CLASS 1
B	-	NUCLEAR POWER PLANT COMPONENTS, ASME B&PV CODE, SEC. III, CLASS 2
C	-	NUCLEAR POWER PLANT COMPONENTS, ASME B&PV CODE, SEC. III, CLASS 3
D	-	POWER PIPING CODE, ANSI B31.1
F	-	NATIONAL FIRE PROTECTION ASSOCIATION CODE
G	-	NATIONAL OR APPLICABLE PLUMBING CODE
H	-	POWER BOILERS, ASME B&PV CODE, SEC. 1
J	-	AMERICAN WATER WORKS STANDARD
K	-	AS APPLICABLE
U	-	FIBER GLASS REINFORCED PLASTIC PRESSURE VESSEL, ASME B&PV CODE, SEC. X

FORTH LETTER - VARIABLE

A	-	Basic Pipe Material Classification
B through H	-	See Individual Material Class Sheet for Variation
R,S,T,and U	-	Basic Pipe Classification - Water Reclamation Plant

EO07 Locate and find the latest revision of a single line electrical drawing

The first step in locating a drawing is to have some information about what you are looking for. Identifying or picking the system designator is a good place to start.

Use the system designator and 'build' the drawing number.

You know what unit you are in, 01 for unit 1 etc. If it is mechanical, you know that it will be the mechanical discipline (M) 01-M, the system designator (CH for example), 01-M-CH, if it is a piping drawing, then it will have a (P), 01-M-CHP, and you start with drawing sequence number 001. So the number for the first CH system As-Built P & ID in Unit 1 is, 01-M-CHP-001.

Using an Electrical Equipment number:

For the Load Centers (LC) and Motor Control Centers (MCC) the sequence number can USUALLY be related to the Load Center or MCC number.

Example: Load Center 1-E-NGN-L05 is found on Drawing 01-E-NGA-005.

Motor Control Center M21 is located on Drawing 01-E-NHA-021

This is easy to tell because the title of the drawing 01-E-NHA-021 is (Single Line Diagram 480 V Non-Class IE Power System Motor Control Center IE-NHA-M21

Using SWMS

Another way to identify a drawing for a system or a component is to use the SWMS.

You will be given access to SWMS system. You will need training so you can get access.

There are various computer workstations in the plant for you to use. There are computers set up in the AO staging area for example.

SWMS is a computerized system designed to manage station work activities and Equipment Design Data.

Vendor Tech Manuals



EO09 Given a Single Line electrical drawing, locate, and describe the information found in the following:

- The Title Block
- The Legend
- The Functional Table
- The Notes Section

The Title Block:

Important features include:

1. Drawing Number
2. Description
3. Revision
4. Quality Class Indicator (highest class on Drawing):
 - a) Q - component necessary for nuclear safety of the public.
 - b) QAG - component necessary for continued full power operation OR safety of plant personnel. It will be treated like a Q system or component.
 - c) NQR - components not quality related.
 - d) Will indicate the highest class of any component on the drawing.
 - e) 'S' Any structure, system or component not designated quality class 'Q' or 'NQR'. 'S' is no longer used but still appears on some drawings.
 - f) Revision History.

INDOOR SWITCHGEAR BUILDING		NQR	
PALO VERDE NUCLEAR GENERATING STATION			
SINGLE LINE DIAGRAM 4.16KV NON-CLASS 1E POWER SYSTEM SWITCHGEAR 1E-NBN-S02			
SCALE	JOB NO.	DRAWING NO.	REV.
		01-E-NBA-002	6
01ENBA002.DGN			

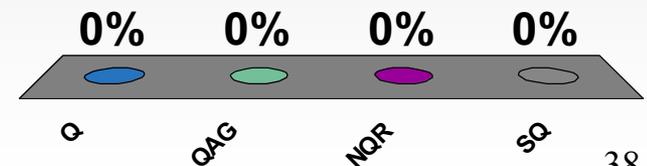
Title Block for Electrical Single Line Diagram

 PALO VERDE NUCLEAR GENERATING STATION		INDOOR SWITCHGEAR BUILDING		NQR
		SINGLE LINE DIAGRAM 4.16KV NON-CLASS 1E POWER SYSTEM SWITCHGEAR 1E-NBN-S02		
SCALE	JOB NO.	DRAWING NO.	REV.	A
		01-E-NBA-002	6	
2		01ENBA002.DGN 1		



Given the 01-E-NBA-001 print, which one of the following is the quality class indicator?

1. Q
2. QAG
- ★ 3. NQR
4. SQ



Legend on 01-E-NBA-002

The Legend: Example 01-E-NBA-002 (C-7)

A table which gives a description of each device number used on the single line drawing. It gives information on the manufacturer, type and usually model number. This information can be used in gaining more information on individual devices from vendor manuals.

LEGEND				
FUNCT. NO.	MFR	TYPE	DESCRIPTION	REMARKS
427S	GE	IAY	BUS UNDERVOLTAGE RELAY, 55-140V	12IAY53K1A
427/447	W	CVQ	BUS UNDERVOLTAGE & NEGATIVE SEQUENCE ALARM RELAY, 100V	ST.NO. 293B146A10
427-11,21	ITE	27H	SUPPLY TRANSFER BLOCKING UNDERVOLTAGE RELAY, D.O. 60-110V	CAT. NO. 211RQ175
446	GE	IJC	PHASE CURRENT UNBALANCE RELAY	MOD. 12IJC51B3A
450G	GE	PJC	INSTANT GROUND FAULT OVERCURRENT RELAY, 0.5-2.0 RANGE	MOD. 12PJC11AY1A
450/451	GE	IFC	MOTOR PHASE OVERCURRENT RELAY, 2.5-7.5A RANGE 2-8A ITH & 6-150A IT	MOD. 12IFC66K1A
451	GE	IFC	BUS FEEDER PHASE OVERCURRENT RELAY, 1.0-12A	MOD. 12IFC77A1A
425	W	CVE	SUPPLY TRANSFER SYNCHRONISM CHECK RELAY, 120V, 20° CALIBRATION	ST.NO. 293B265A09
451N	GE	IFC	BUS FEEDER NEUTRAL OVERCURRENT RELAY, 0.5-4.0A	MOD. 12IFC53A2A
451X	GE	NQA	AUXILIARY ALARM RELAY, 125V DC, 2 PDT CONTACT	MOD. 12NQA15A24F6A
451NT	GE	IFC	BUS TIE NEUTRAL OVERCURRENT RELAY, 0.15-0.6A	MOD. 12IFC53A6A
486	GE	HEA	AUXILIARY TRIPPING LOCKOUT RELAY, HAND RESET, 125V DC	MOD. 12HEA61B235
487	GE	PJC	MOTOR SELF BALANCING PRIMARY CURRENT DIFFERENTIAL RELAY, 0.5-2.0A	MOD. 12PJC11AV1A
427-SX1, SX2	GE	HFA	AUXILIARY RELAY 125V DC COIL	MOD. 12HFA51A42F
AS	GE	SBM	AMMETER SWITCH	MOD. SBM10SP017
VS	GE	SBM	VOLTMETER SWITCH	MOD. SBM10AB286
XDCR/W	SCI		WATT TRANSDUCER 38,2 ELEMENT, 0.25% ACCURACY, 0-1MA OUTPUT	MOD. XL31K5A4
A	GE	AB-40	AMMETER	
V	GE	AB-40	VOLTMETER	
486X	GE	HGA	BREAKER COOLING FAN STARTING RELAY, 4A, 60HZ	MOD. 12HGA14AF137
XDCR-V	SCI		VOLT TRANSDUCER, 0.25% ACCURACY, 0-1 MA OUTPUT	MOD. VT-110A2
427-SX, SY	GE	HFA	AUXILIARY RELAY 125V DC COIL	12HFA151A2F

4.16 kV Electrical Function Table

From 01-E-NBA-001

FUNCTIONAL TABLE	
CODE	DESCRIPTION
F-A	ANNUNCIATOR
F-B	TRIPS 4.16KV BUS FEEDER BREAKER
F-C	TRIPS 4.16KV FEEDER BREAKER
F-Q	INPUT TO COMPUTER
F-S	TRIPS 4.16KV SELECTED BREAKER
F-H	STARTS BREAKER COOLING FAN
F-K	PERMITS SUPPLY AUTO TRANSFER
F-N	BLOCKS SUPPLY AUTO TRANSFER

Notes from 01-E-NBA-002

The Notes Section:

1. This section gives information on non-standard conditions on the Drawing, or amplifying remarks about certain devices.
2. For example, Drawing 01-E-NBA-002 has no functional table. Note 2 states 'For relay functional table see DWG 01-E-NBA-001.'

NOTES:

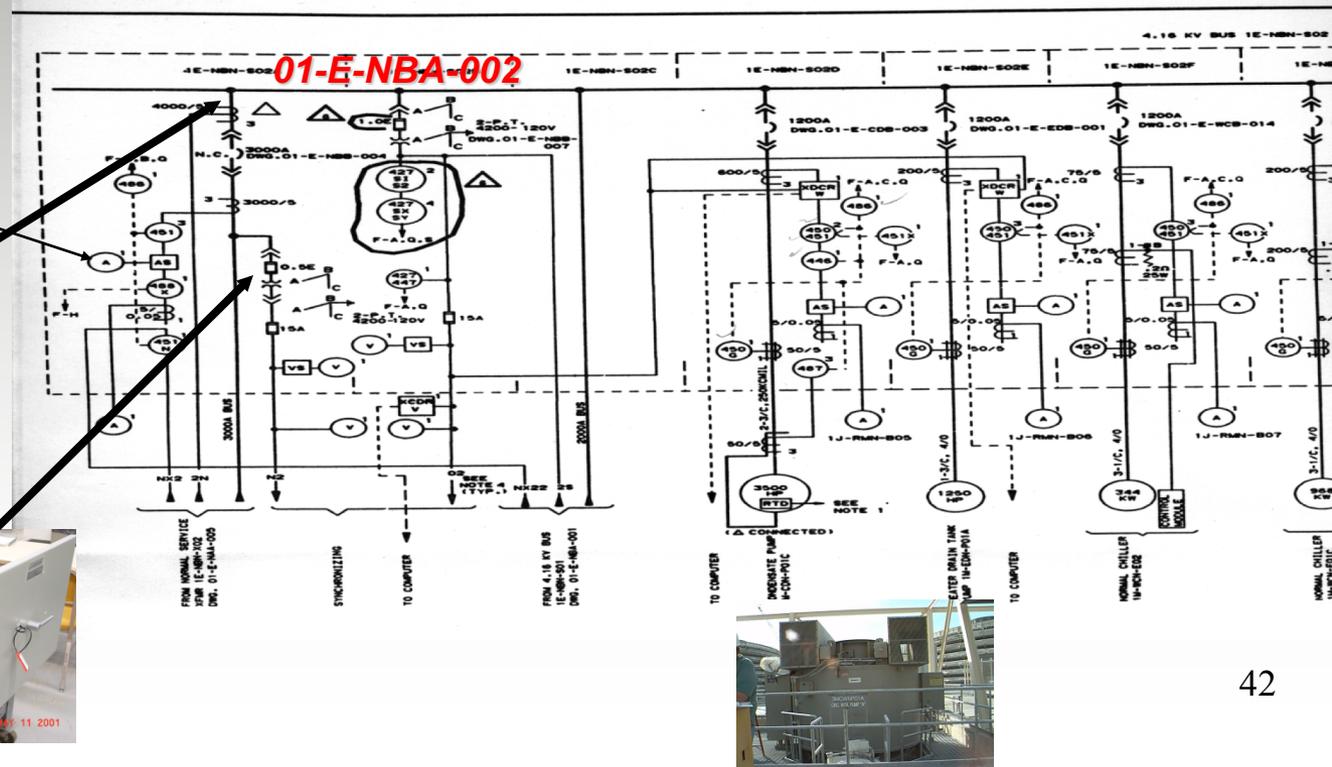
1. STATOR RESISTANCE TEMPERATURE DETECTOR TO BE USED FOR ALARM SCANNER. (COMPUTER).
2. FOR RELAY FUNCTIONAL TABLE SEE DWG.01-E-NBA-001
3. ALL AUXILIARY CT'S 5/0.05A FOR AMMETERS ARE CONNECTED ON PHASE "B".
4. THIS CODE IS USED TO IDENTIFY THE CONTINUATION OF THIS CIRCUIT ON THE REFERENCE DRAWING.
5. CONDENSATE PUMP 1M-CDN-POIC PROT. RELAY 450/451 SHALL BE CONNECTED ON PHASES A & C.
6. ALL INSTRUMENTS EXTERNAL TO SWITCHGEAR ARE MOUNTED ON CONTROL BOARD 1J-RMN-001 EXCEPT AS NOTED.
7. ALL POWER AND CONTROL CABLES ARE TOP ENTRY, UNLESS OTHERWISE INDICATED
"BOT" DESIGNATION FOR POWER CIRCUIT ONLY.
8. FOR LEGEND AND GENERAL NOTES REFER TO DWG. 13-E-ZZB-001 THROUGH 007.

EO10 Given a single line electrical diagram, locate or and trace the following:

- The Main Power Path
- Protection and Indication Path

The Main Power Path

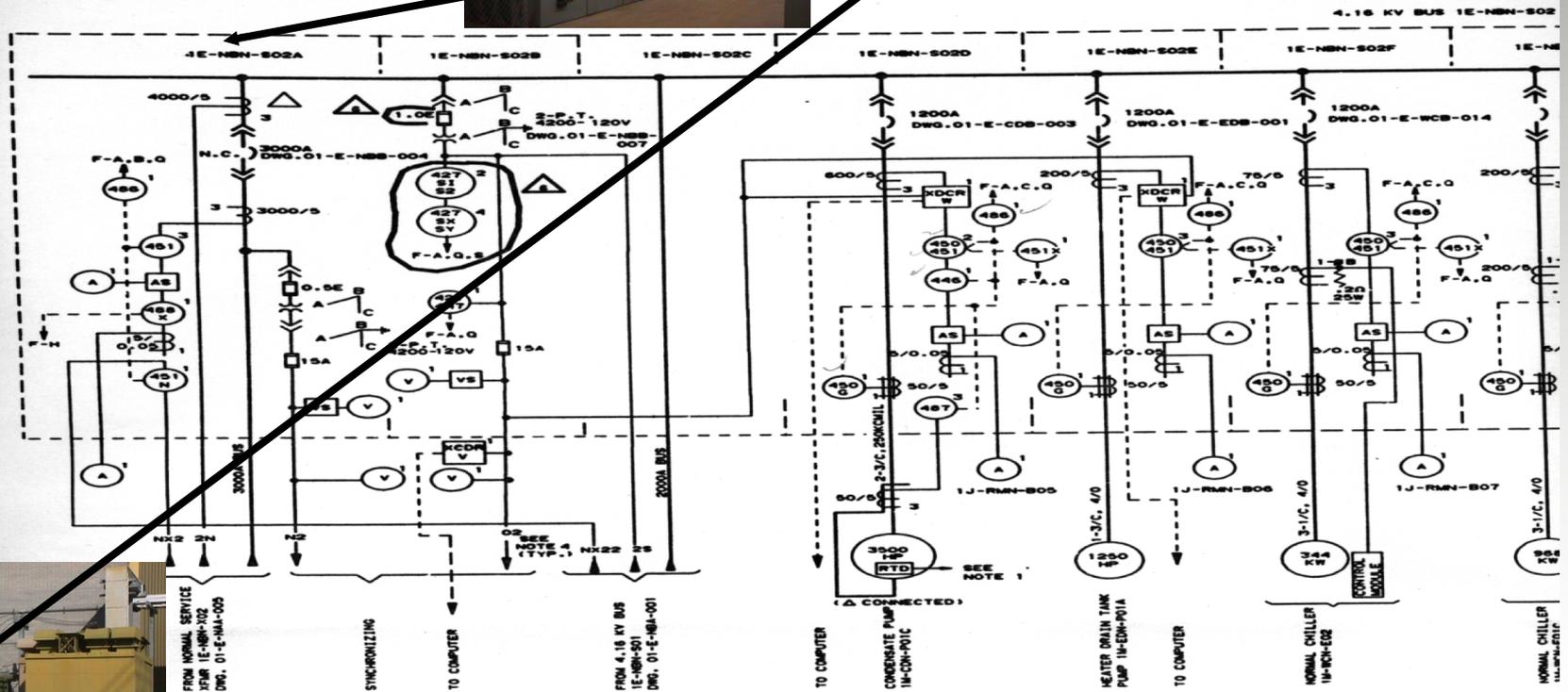
The main power path is indicated by the bold lines on the single line drawing. Typically, the main power path will include the bus supply; both normal and alternate if applicable; the bus itself, and each of the bus loads.



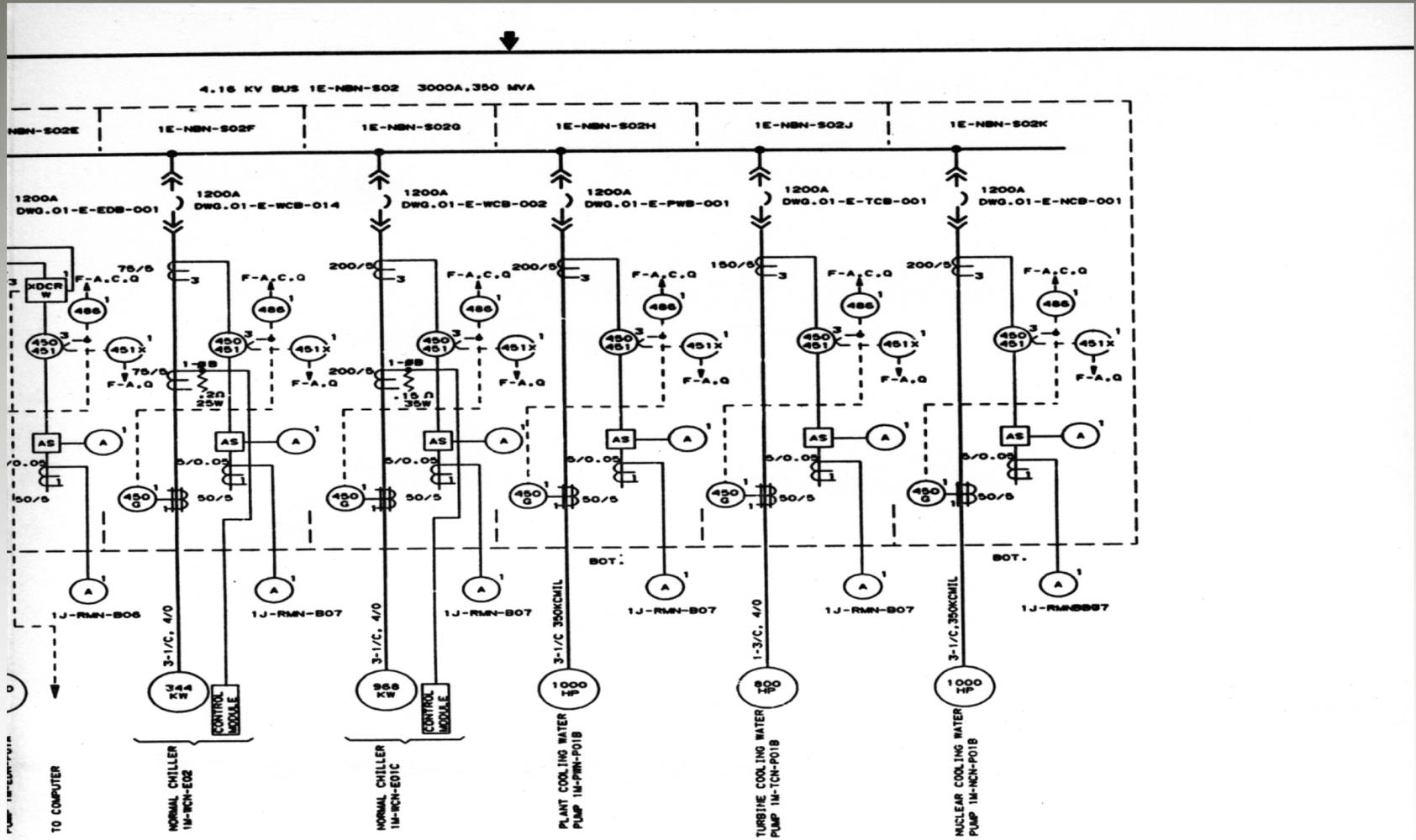
01-E-NBA-002 Left Side

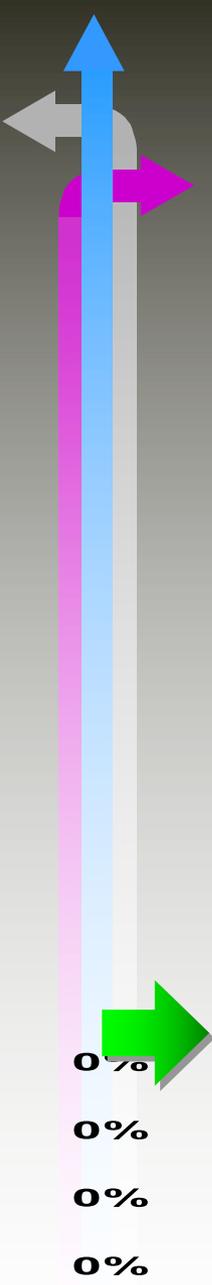
Power inputs to the bus are shown in bold face type at the upper left corner of the Drawing:

Normal power comes from the Normal Service Transformer, 1E-NBN-X02.



01-E-NBA-002 Right Side

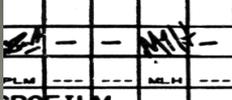




Given print 01-ENBA-001, at coordinate G-8 there is a transformer with a number three at the right hand corner. What does this signify?

1. There is one transformer that goes around all three phases.
2. There is one three phase transformer.
3. There is three transformers on the “B” phase.
4. There is one transformer for each of the three phases.

01-E-EDB-006 Title Block

					NQR			
 BECHTEL LOS ANGELES		ELEMENTARY DIAGRAM FDW HTR EXTN STEAM & DRAIN SYSTEM STEAM BLOCK VALVES 1J-EDN-UV-25,26,27,28,31 & 32						
 MICROFILM		ARIZONA NUCLEAR POWER PROJECT PALO VERDE NUCLEAR GENERATING STATION			SCALE	JOB NO.	DRAWING NO.	REV.
					NONE	10407	01-E-EDB-006	2
3		2			01EEDB006.DGN 1 34/44 "E" SIZE			

Title Block and Notes:

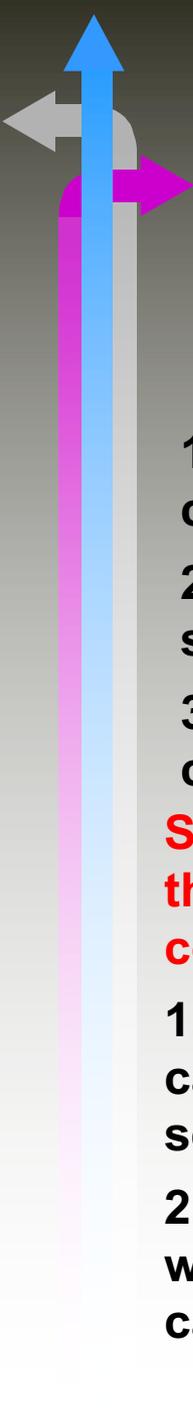
Notice that this title block indicates that this drawing is for six different valves.

1-J-EDN-UV-25, 26, 27, 28, 31, and 32.

Looking at the drawing you will notice that it has a left half and a right half. Each half displays a valve that is wired a little differently than the other half.

You will have to look at the (NOTES) to what half of the drawing is for what valve.

1. Note # 3 tells you what valves are covered on this drawing
2. Note # 10 says (Elementary diagram shown on the left is for valve 1-J-EDN-UV-25. Valves 1-J-EDN-UV 26, 27, & 28 are similar except as shown or indicated in the cabling block diagram.)
3. Note # 11 says (Elementary diagram shown on the right is for valve 1-J-EDN-UV-31. Valve 1-J-EDN-UV-32 is similar except as shown or indicated in the cabling block diagram.)



EO12. Given an Elementary Electrical Drawing, locate and describe the information found in the following:

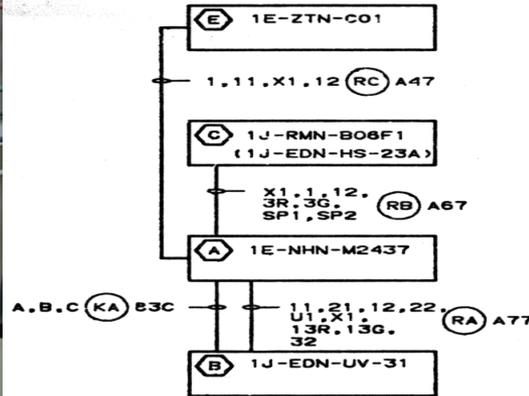
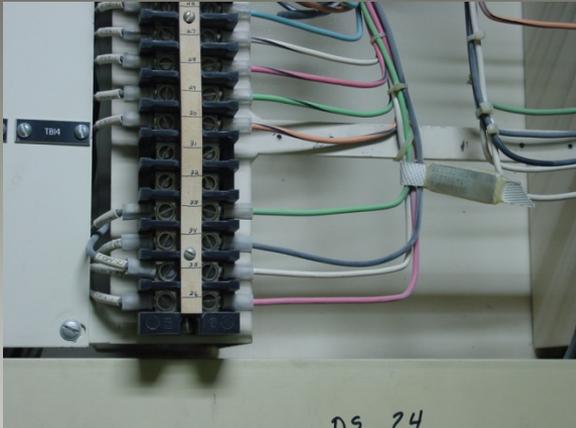
- **The Title Block**
- **The Cabling Block Diagram**
- **The Switch Contact Scheme**

1. The Block Diagram shows the circuit by location and the interconnecting cables. *Look at 01-E-EDB-006*
2. Some of the boxes contain information on the instruments and power supplies associated with a particular components diagram.
3. The hexes in the boxes identify the box for referencing from the main circuit drawing.

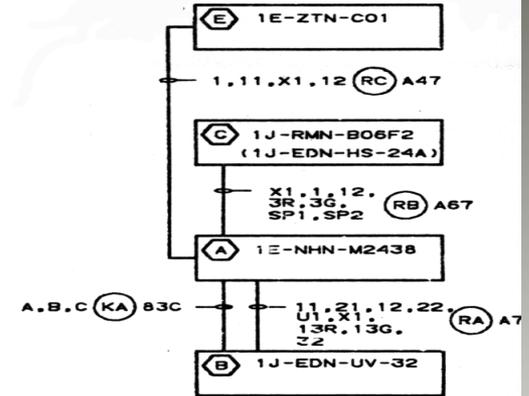
Some Drawings may have more than one block diagram if there are more than one circuit on the drawing, or if the circuit applies to several identical components. Each block diagram is called a SCHEME.

1. The lines connecting the boxes in the block diagrams are cables. The cable code consists of the scheme number plus the individual cable sequence designator.
2. The scheme number is a 9-digit code at the bottom of the block diagram, while the sequence number is the 2-letter code in the circle next to each cable.

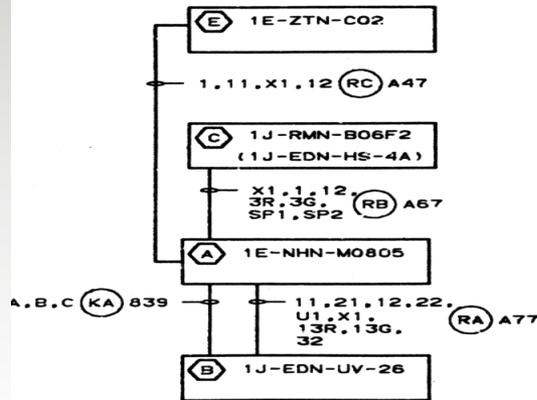
01-E-EDB-006 Schemes



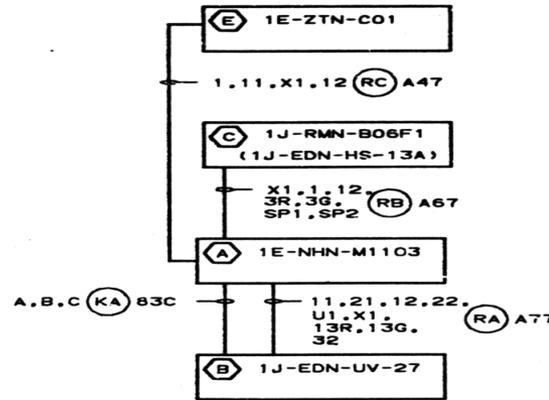
SCHEME 1E-ED06-NC-5
FDW HTR 7A STEAM BLOCK VALVE
1J-EDN-UV-31



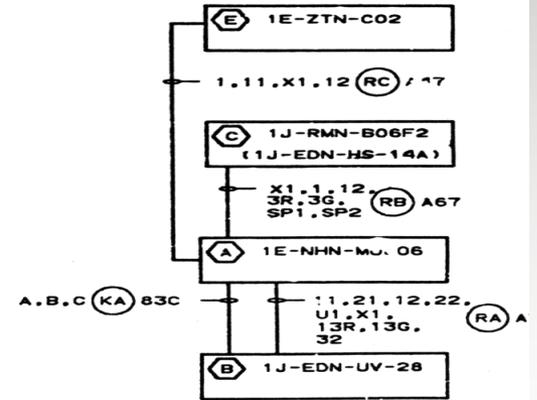
SCHEME 1E-ED06-NC-6
FDW HTR 7B STEAM BLOCK VALVE
1J-EDN-UV-32



SCHEME 1E-ED06-NC-2
FDW HTR 5B STEAM BLOCK VALVE
1J-EDN-UV-26

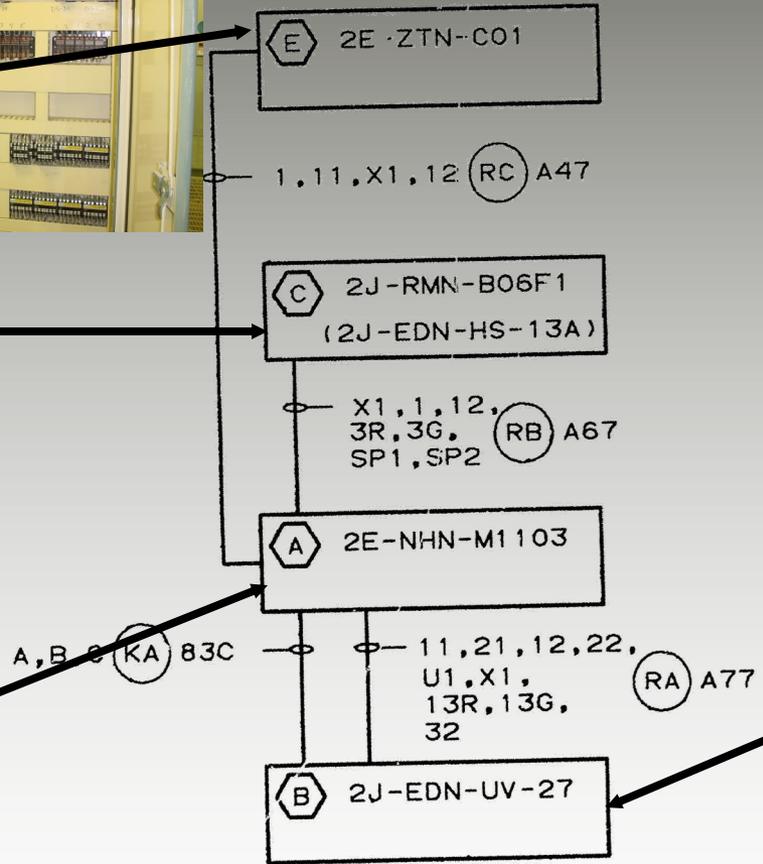


SCHEME 1E-ED06-NC-3
FDW HTR 6A STEAM BLOCK VALVE
1J-EDN-UV-27

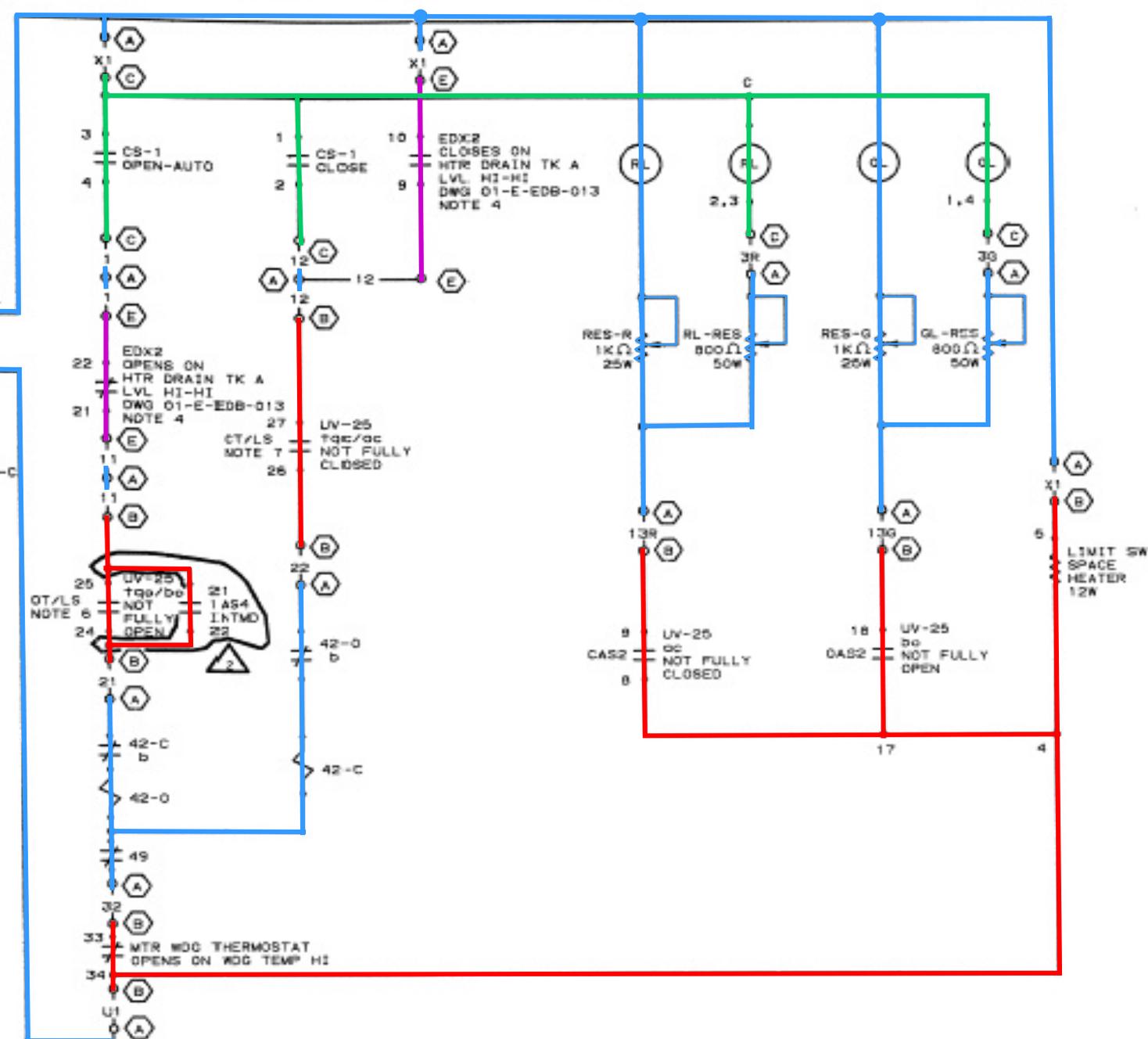
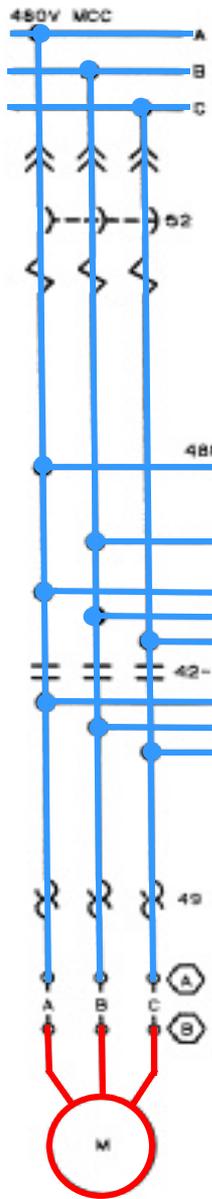


SCHEME 1E-ED06-NC-4
FDW HTR 6B STEAM BLOCK VALVE
1J-EDN-UV-28

02-E-EDB-006 UV-27 Scheme



SCHEME 2E-ED06-NC-3 (---)
 FDW HTR 6A STEAM BLOCK VALVE
 2J-EDN-UV-27



Resistor for lights

Breaker 52

Relay

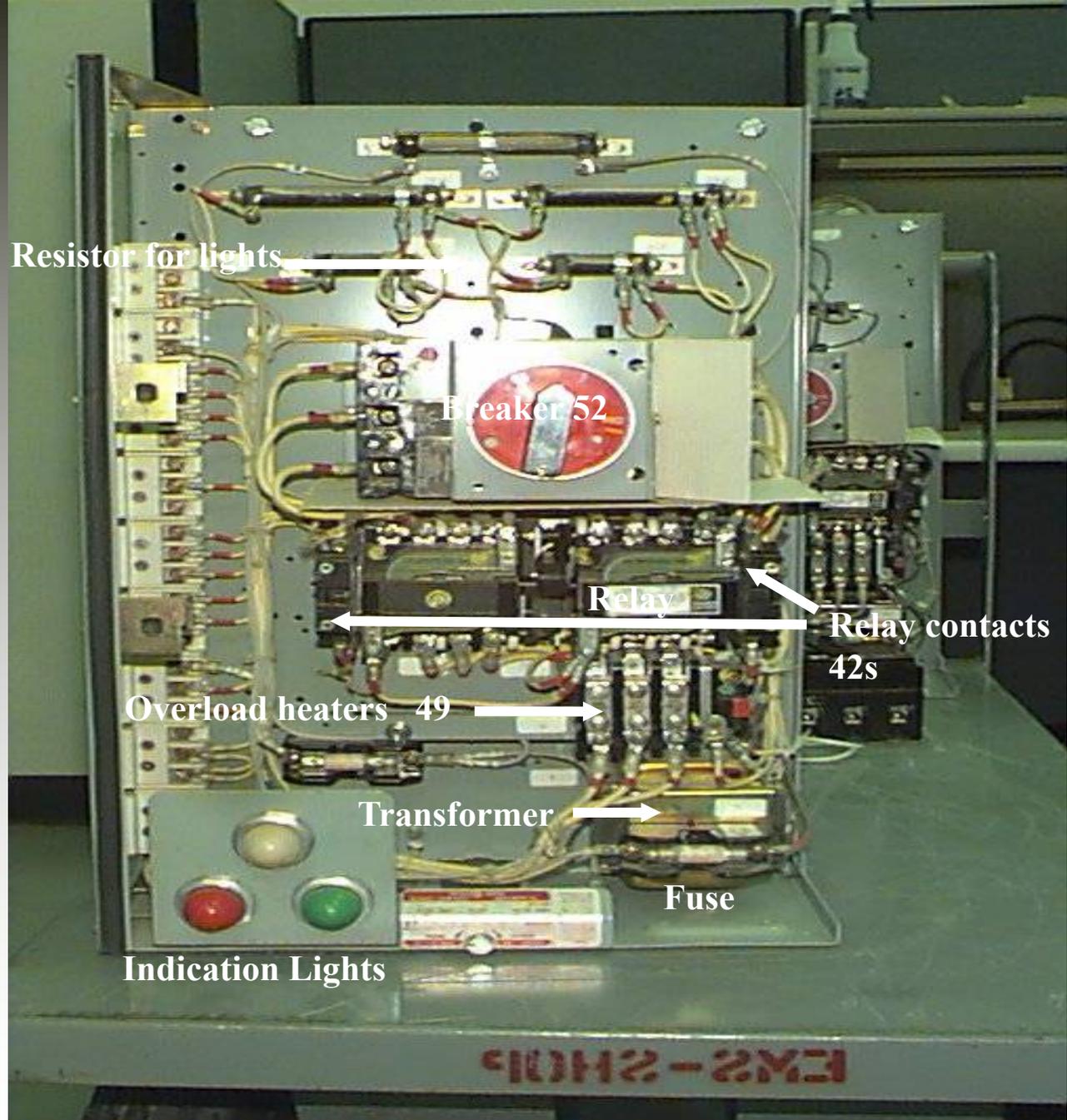
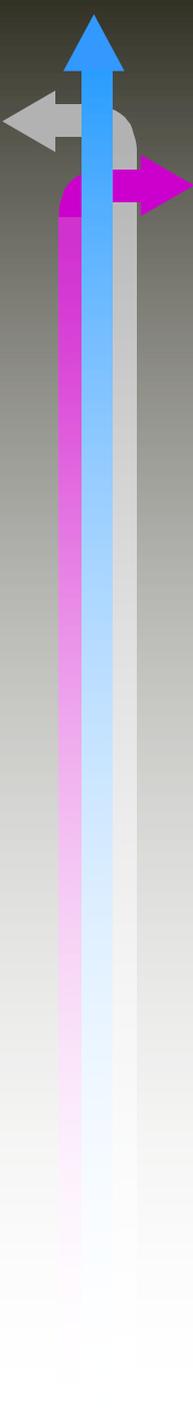
Relay contacts
42s

Overload heaters 49

Transformer

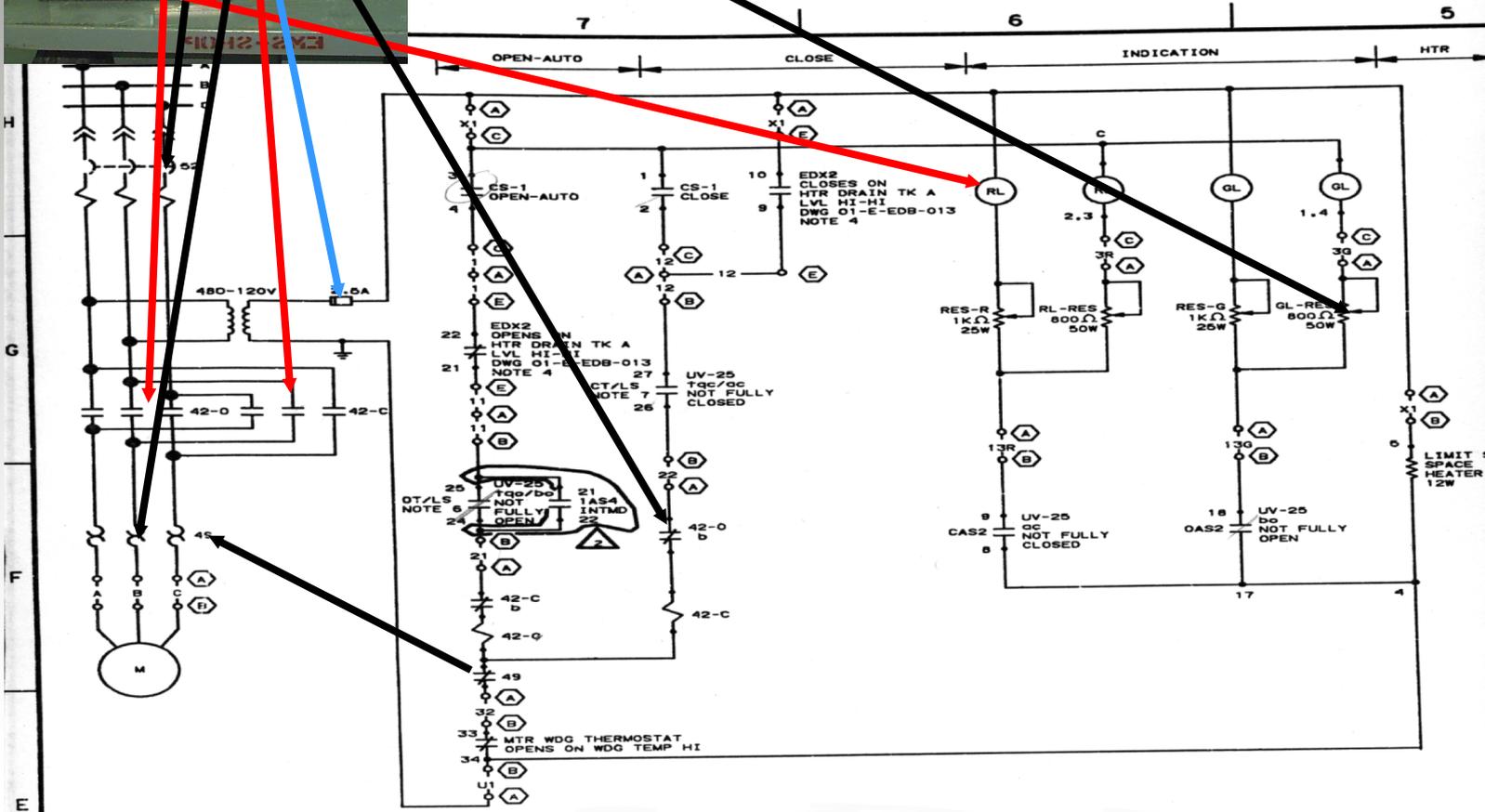
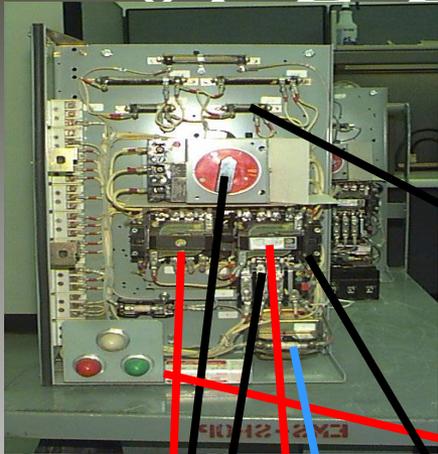
Fuse

Indication Lights

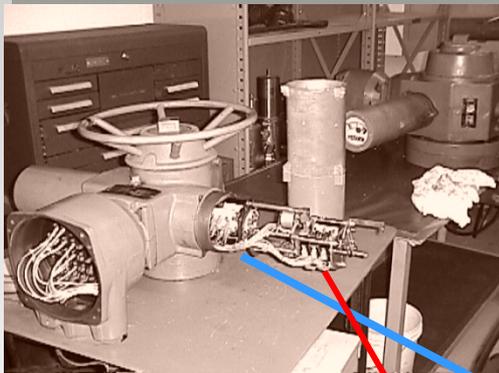


FX2-240P

01-E-EDB-006 Left Side



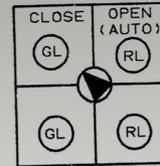
02-E-EDB-006 Switch Contacts



MOTOR OPERATED VALVE SWITCH CONTACT DEVELOPMENT ROTORK				
TORQUE/ POSITION SWITCH	VALVE POSITION		CONTACT	TERMINAL NO
	INTMD			
	CLOSED	OPEN		
tqo/bo	[Solid line from CLOSED to OPEN]		OT/LS	24-25
tqc/ac	[Solid line from CLOSED to OPEN]		CT/LS	26-27
ao	[Solid line from OPEN to CLOSED]		OAS1	15-16
bc	[Solid line from OPEN to CLOSED]		CAS1	6-7
bo	[Solid line from OPEN to CLOSED]		OAS2	17-18
ac	[Solid line from OPEN to CLOSED]		CAS2	8-9
ADD ON PAK 1				
ao	[Solid line from OPEN to CLOSED]		1AS1	10-11
ao	[Solid line from OPEN to CLOSED]		1AS2	12-13
bo	[Solid line from OPEN to CLOSED]		1AS3	19-20
bc	[Solid line from OPEN to CLOSED]		1AS4	21-22
bc	[Solid line from OPEN to CLOSED]		1AS5	28-29
ac	[Solid line from OPEN to CLOSED]		1AS6	30-31

UV-25

SOLID LINE DENOTES CONTACT CLOSED
NOTES 6,7&12

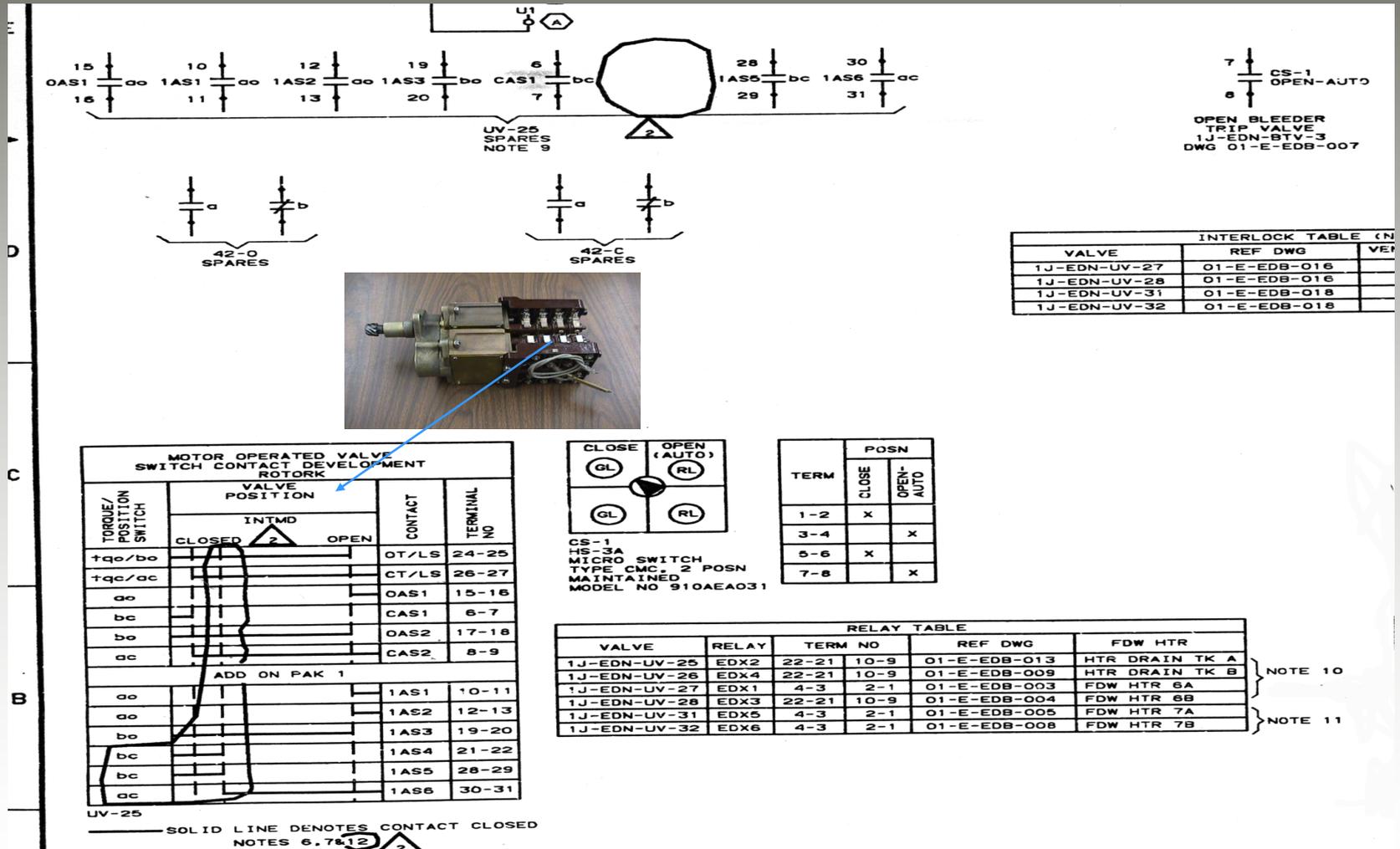


CS-1
HS-3A
MICRO SWITCH
TYPE CMC, 2 POSN
MAINTAINED
MODEL NO 910AEA031

TERM	POSN	
	CLOSE	OPEN-AUTO
1-2	X	
3-4		X
5-6	X	
7-8		X

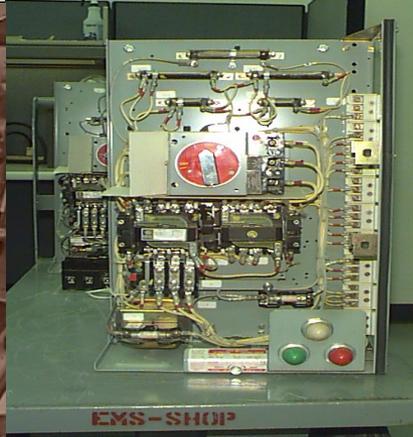
RELAY TABLE					
VALVE	RELAY	TERM NO		REF DWG	FDW HTR
2J-EDN-UV-25	EDX2	22-21	10-9	02-E-EDB-013	HTR DRAIN TK A
2J-EDN-UV-26	EDX4	22-21	10-9	02-E-EDB-009	HTR DRAIN TK B
2J-EDN-UV-27	EDX1	4-3	2-1	02-E-EDB-003	FDW HTR 6A
2J-EDN-UV-28	EDX3	22-21	10-9	02-E-EDB-004	FDW HTR 6B
2J-EDN-UV-31	EDX5	4-3	2-1	02-E-EDB-005	FDW HTR 7A
2J-EDN-UV-32	EDX6	4-3	2-1	02-E-EDB-008	FDW HTR 7B

01-E-EDB-006 Switch Contacts



EO13 Given an elementary electrical drawing, locate and trace the following

- Protection and Indication Paths
- Steps to Energize or De-energize a load



Look at 01-E-EDB-006

1. Most control circuits provide breaker control, local, and remote indication, and breaker/load protection.
2. Above the control circuit diagram are markers showing the function of each portion of the control circuit.
3. Looking at the drawing on the left, the first part shows the load (In this case the load is a Motor Operated Valve) coming from a 480V MCC, the Control Circuit consisting of the Ground Fault Protection, the OPEN-AUTO function, the CLOSE function, the INDICATION, and the Heater (HTR)
4. The control circuit is usually made up of sets of relays and contacts, which operate, energize, and de-energize the load.
5. The actual relays and contacts may be in more than one location. To identify the locations, the hexes from the cabling block diagram are used with the wire letters written between the hexes.

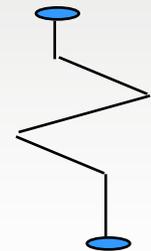
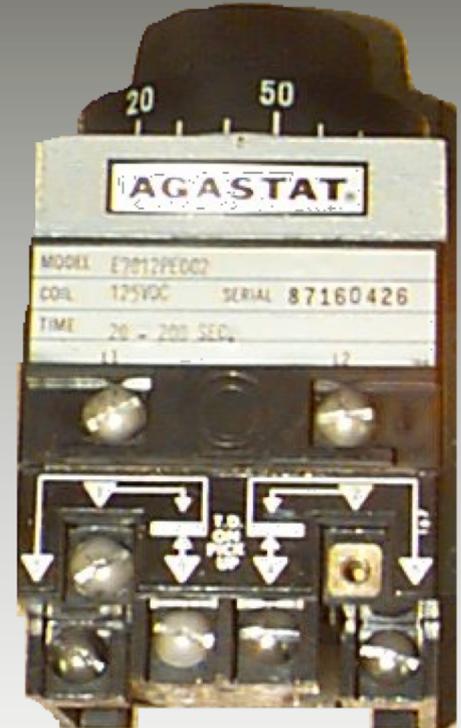
E014 Given an elementary electrical drawing, identify the Components and Symbols located on the drawing.

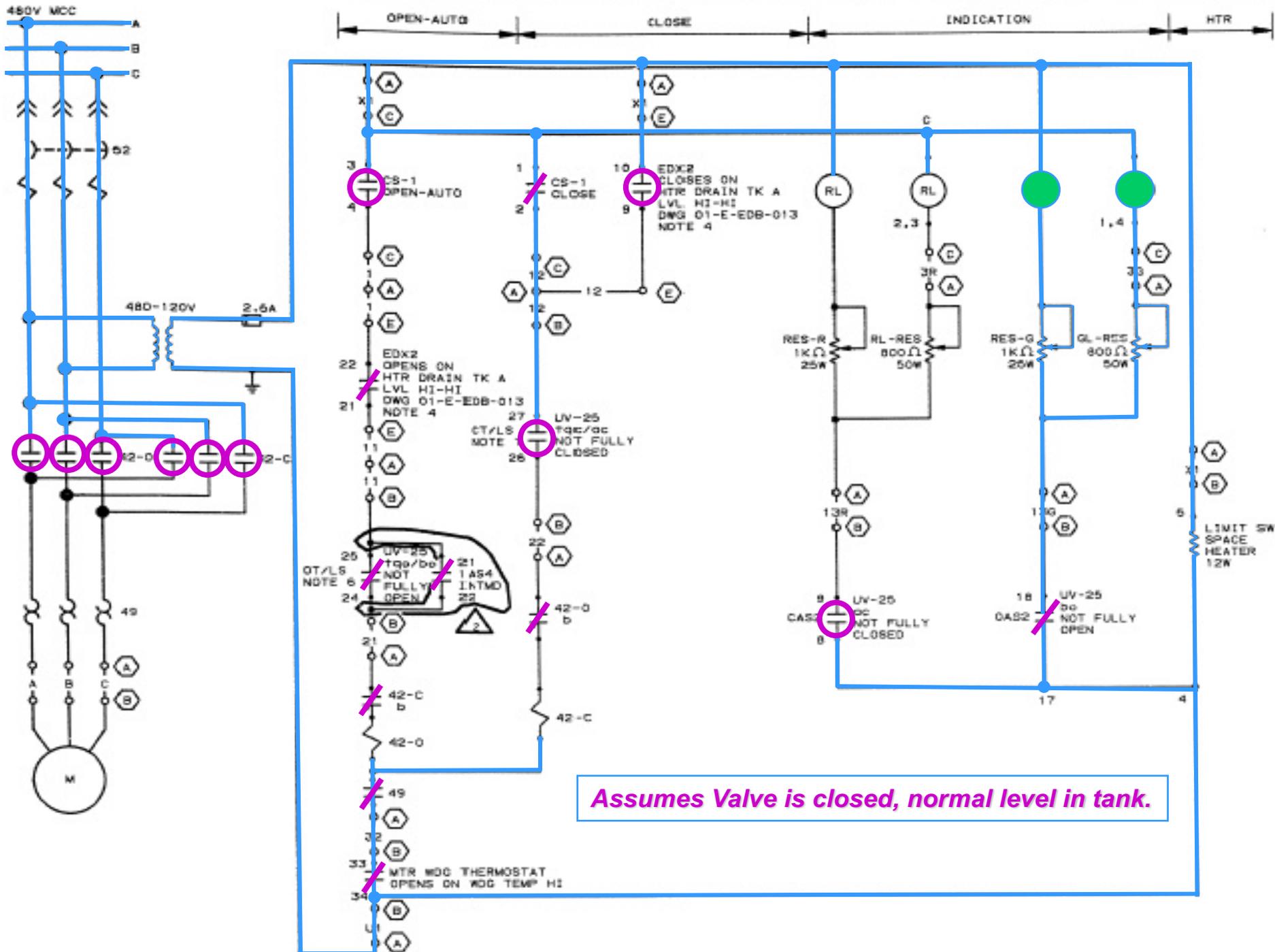
General:

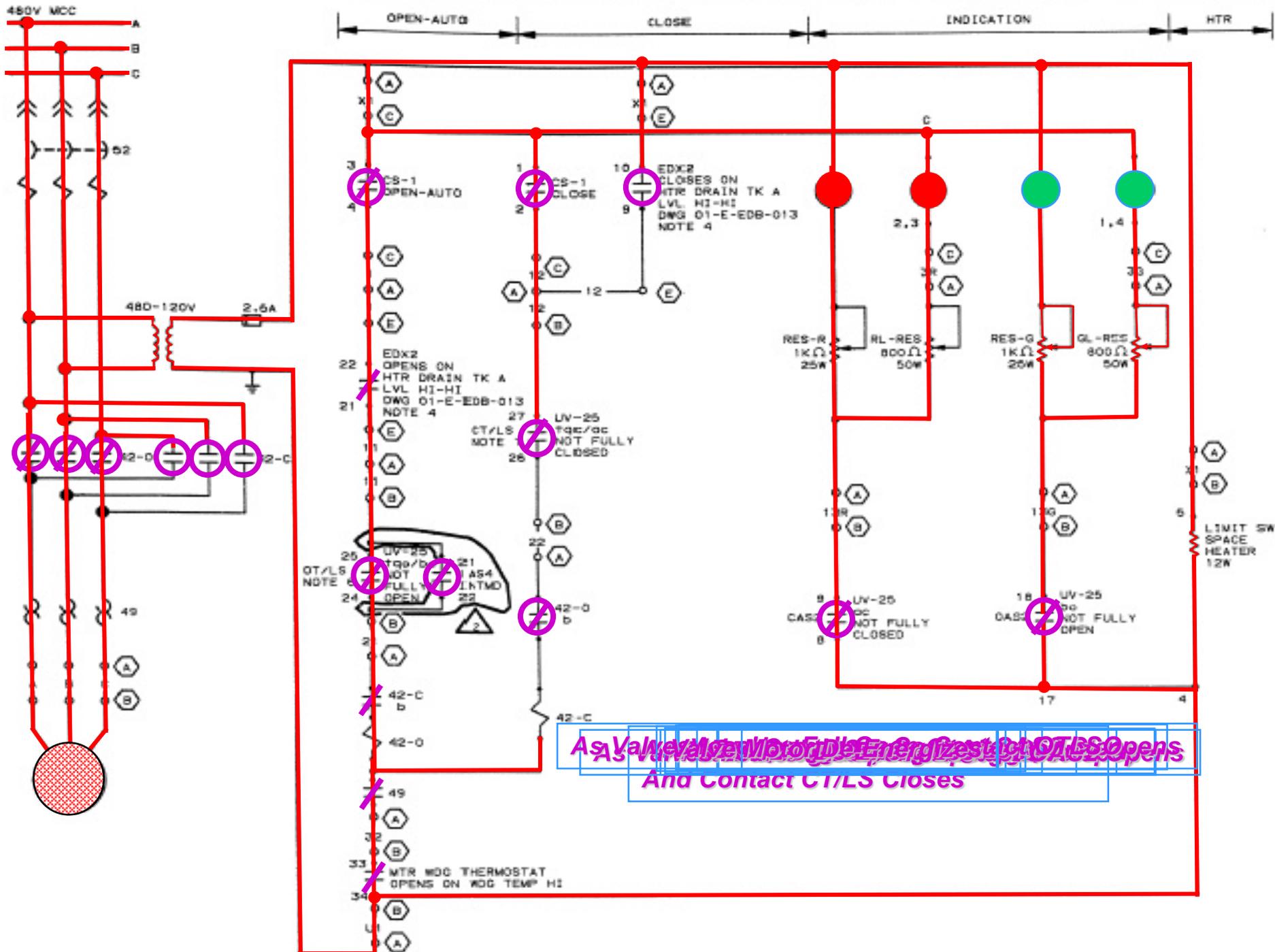
Relays:

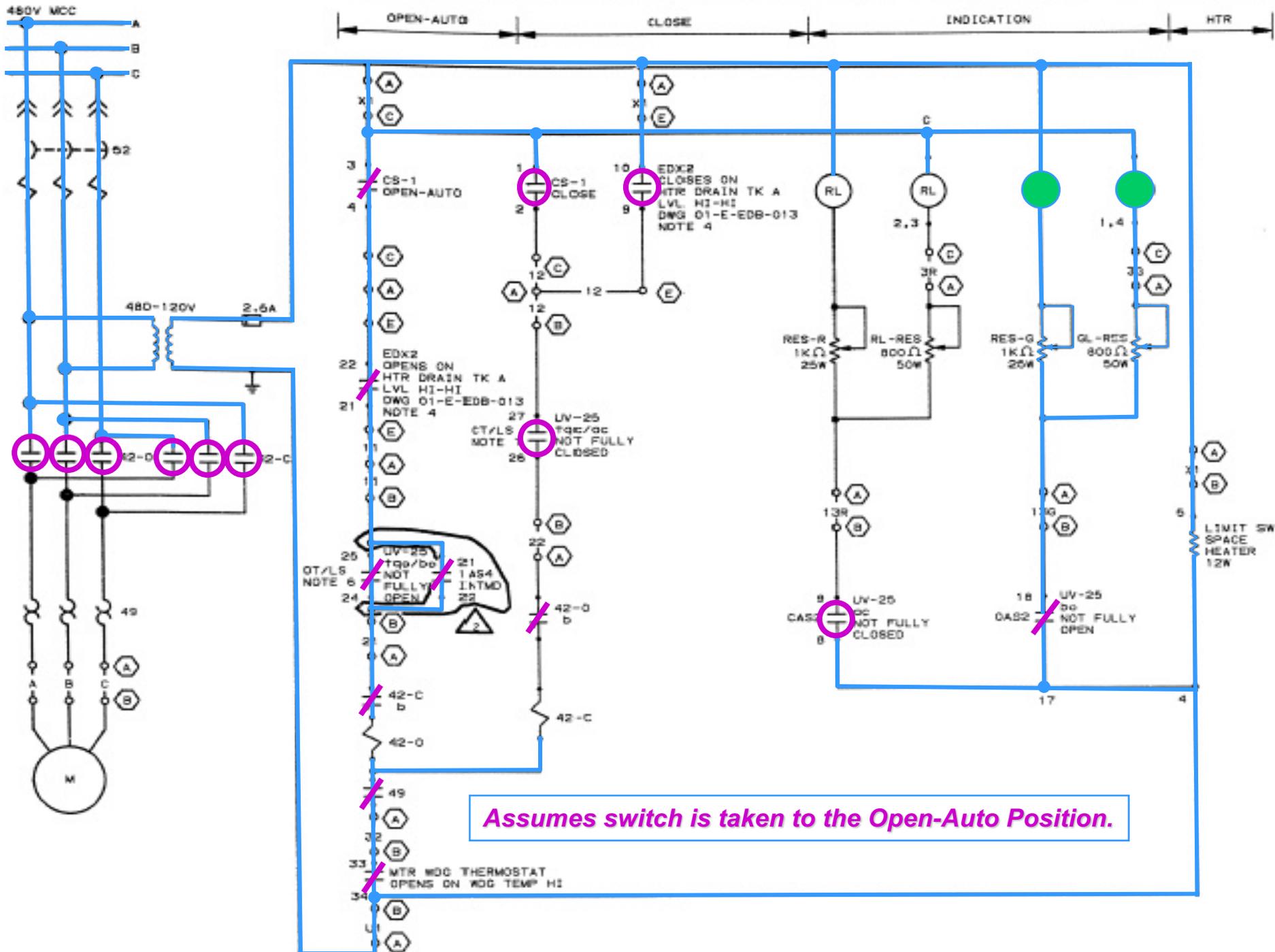
1. Relays are electromagnets made from a coil, which act to move contacts. When the contacts move they either open or close, depending on their type.
2. There are some relays which have a time delay associated with it. The delay is in the energizing or de-energizing of the relay or opening and closing of the contacts.
3. The time delay contacts/relays are indicated by:
 - TDC -Time delay to Close
 - TDD -Time delay to De-energize
 - TDE -Time delay to Energize
 - TDO -Time delay to Open

Some relays have what is called a "seal in" feature associated with them. This feature allows a relay to remain energized if the parameter, which

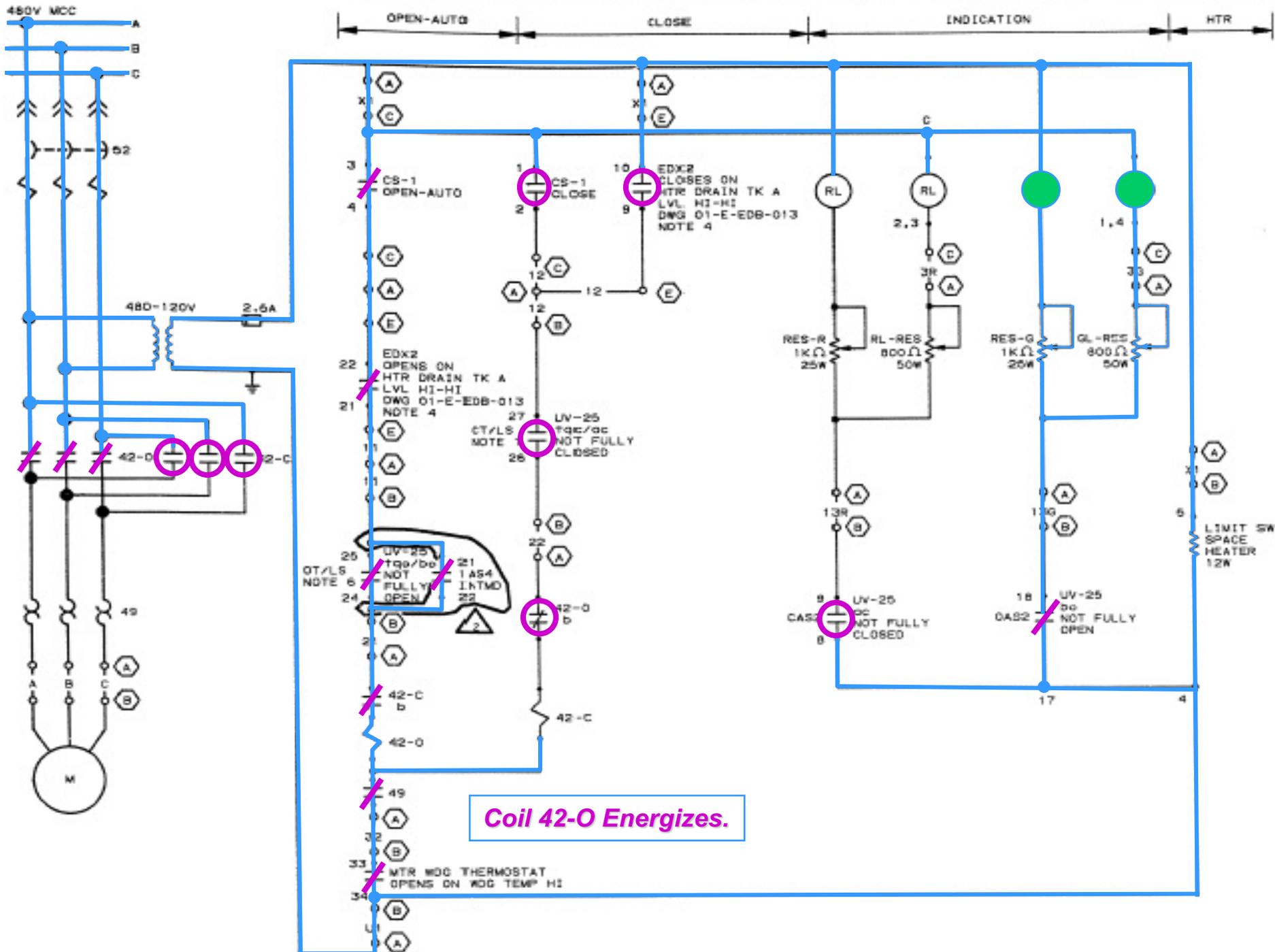




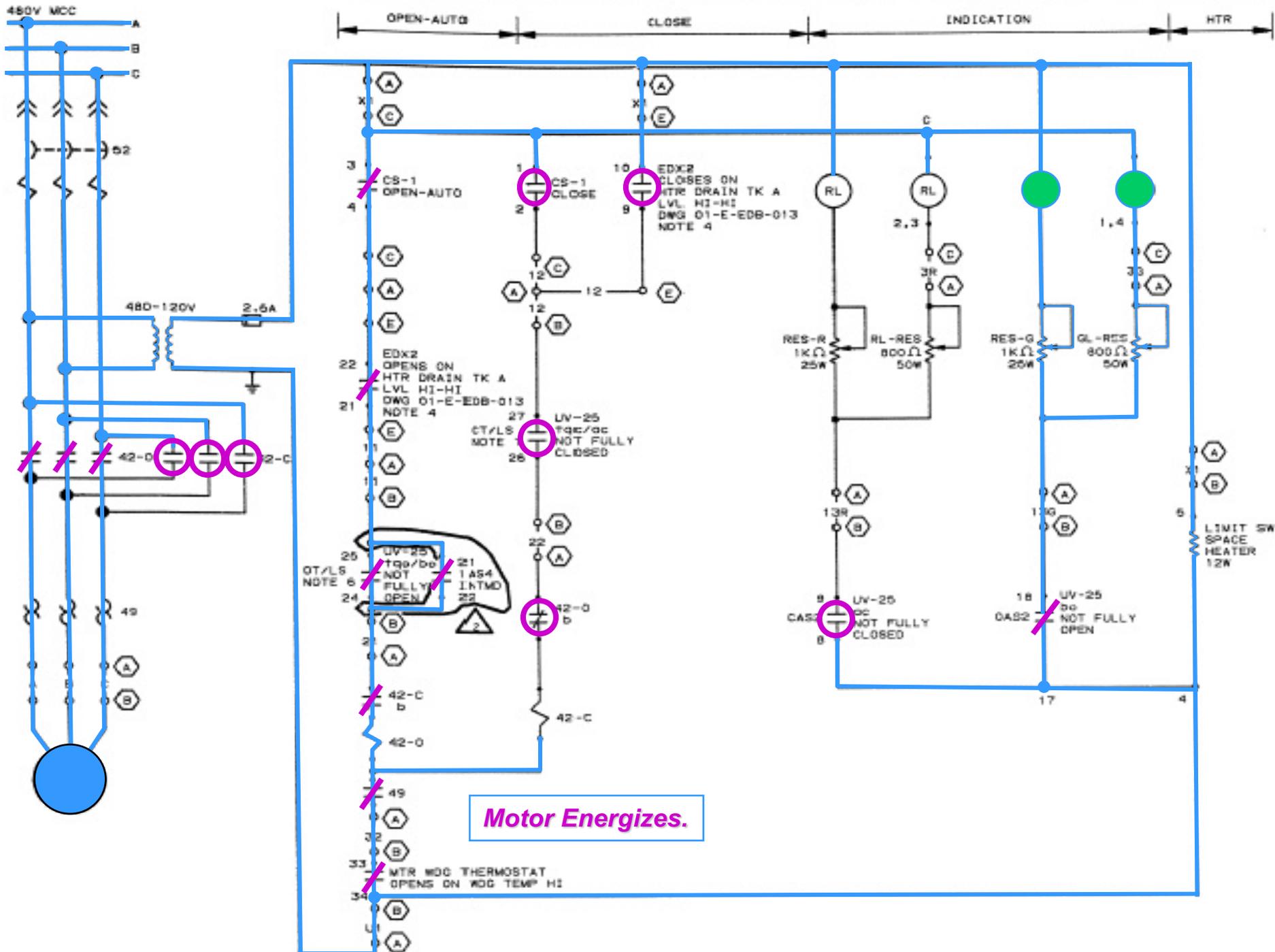


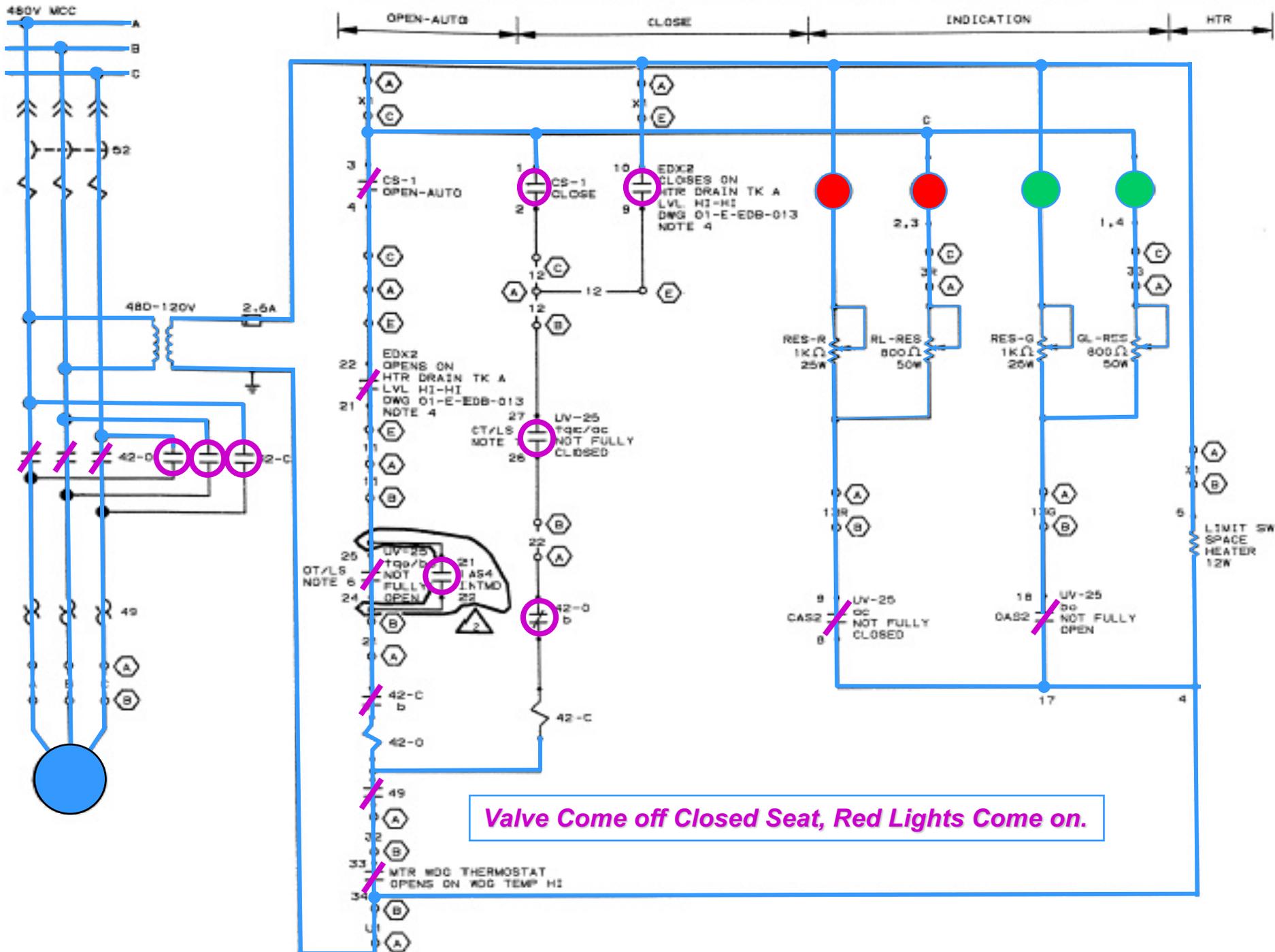


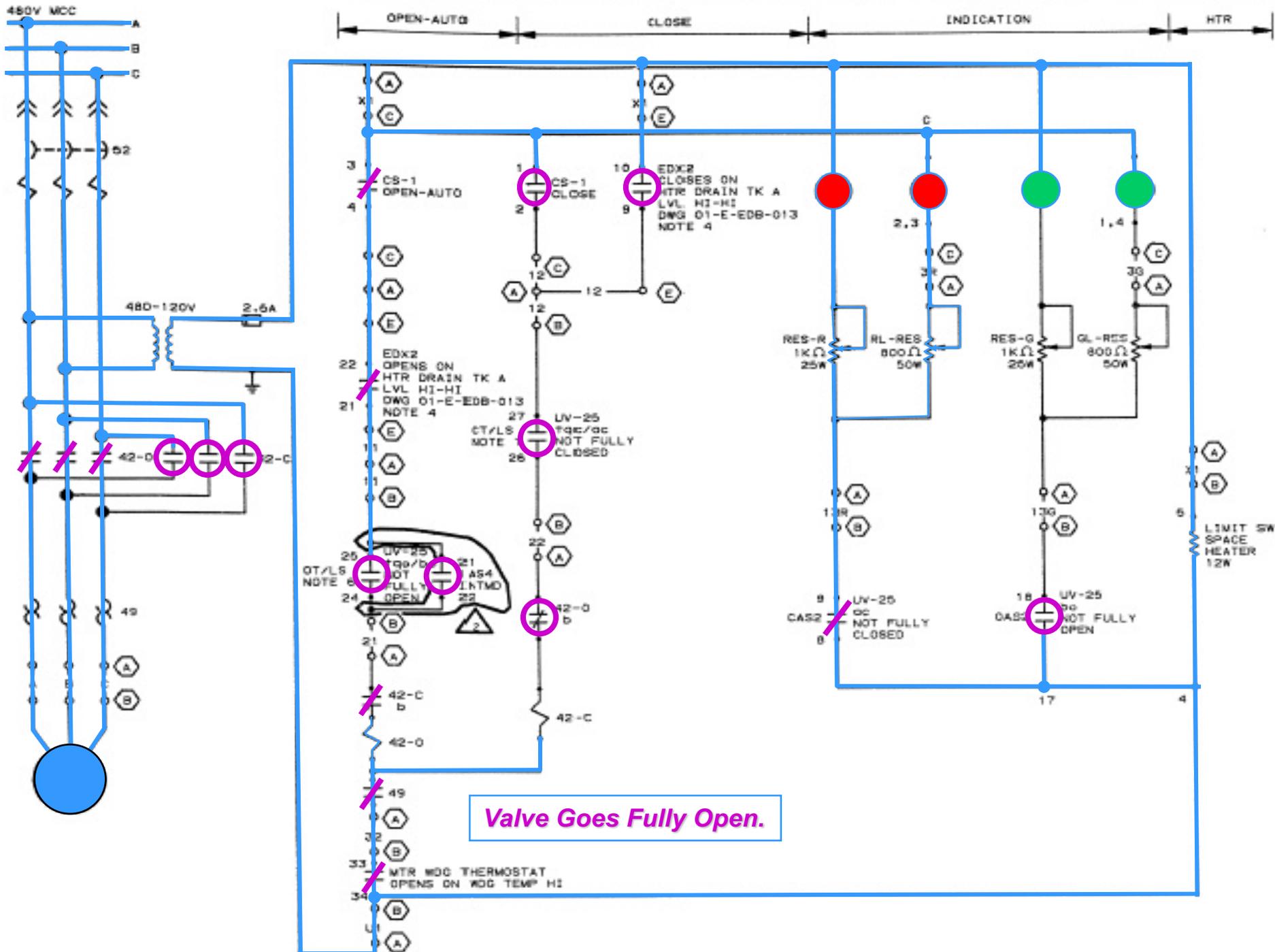
Assumes switch is taken to the Open-Auto Position.

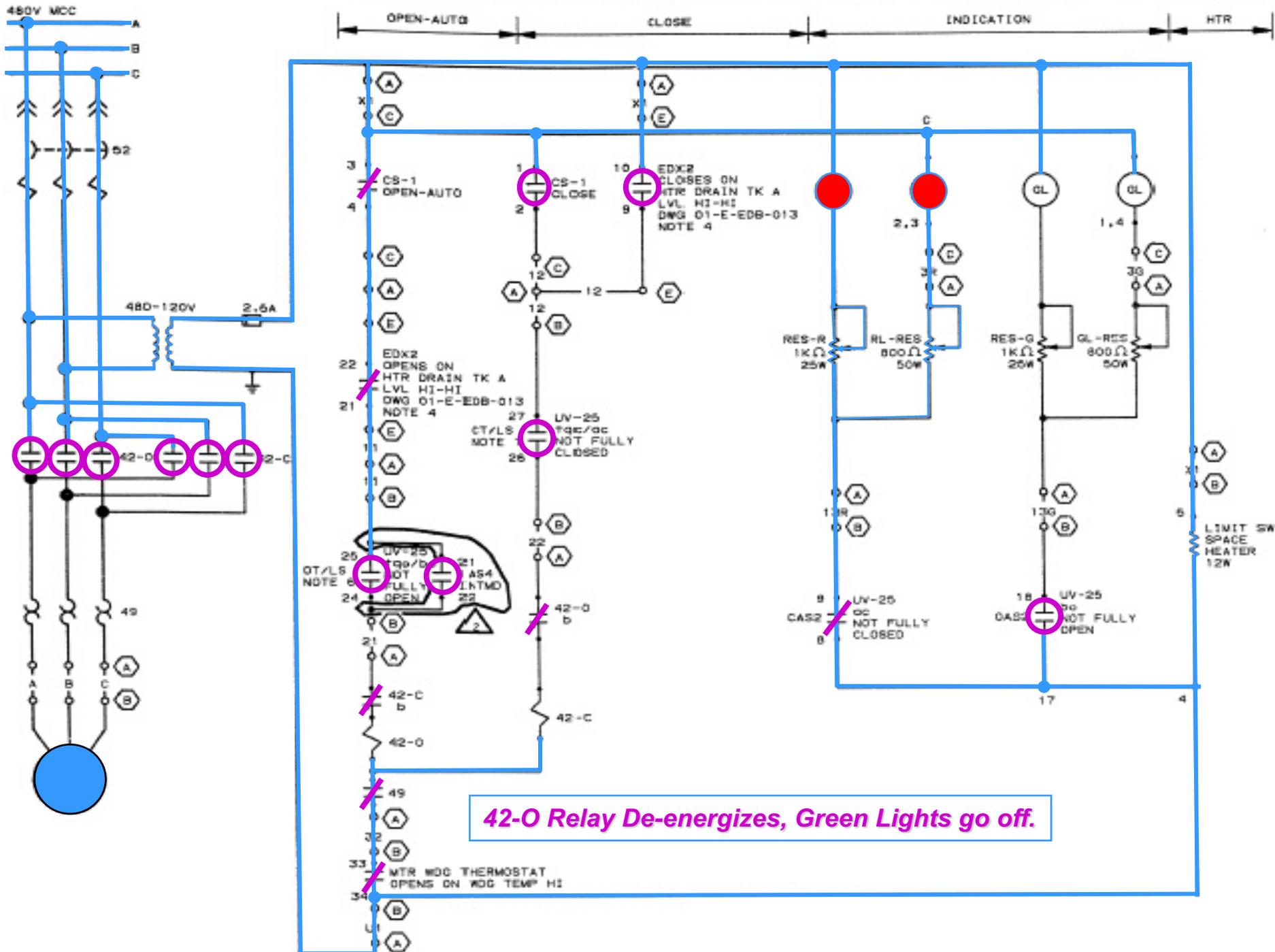


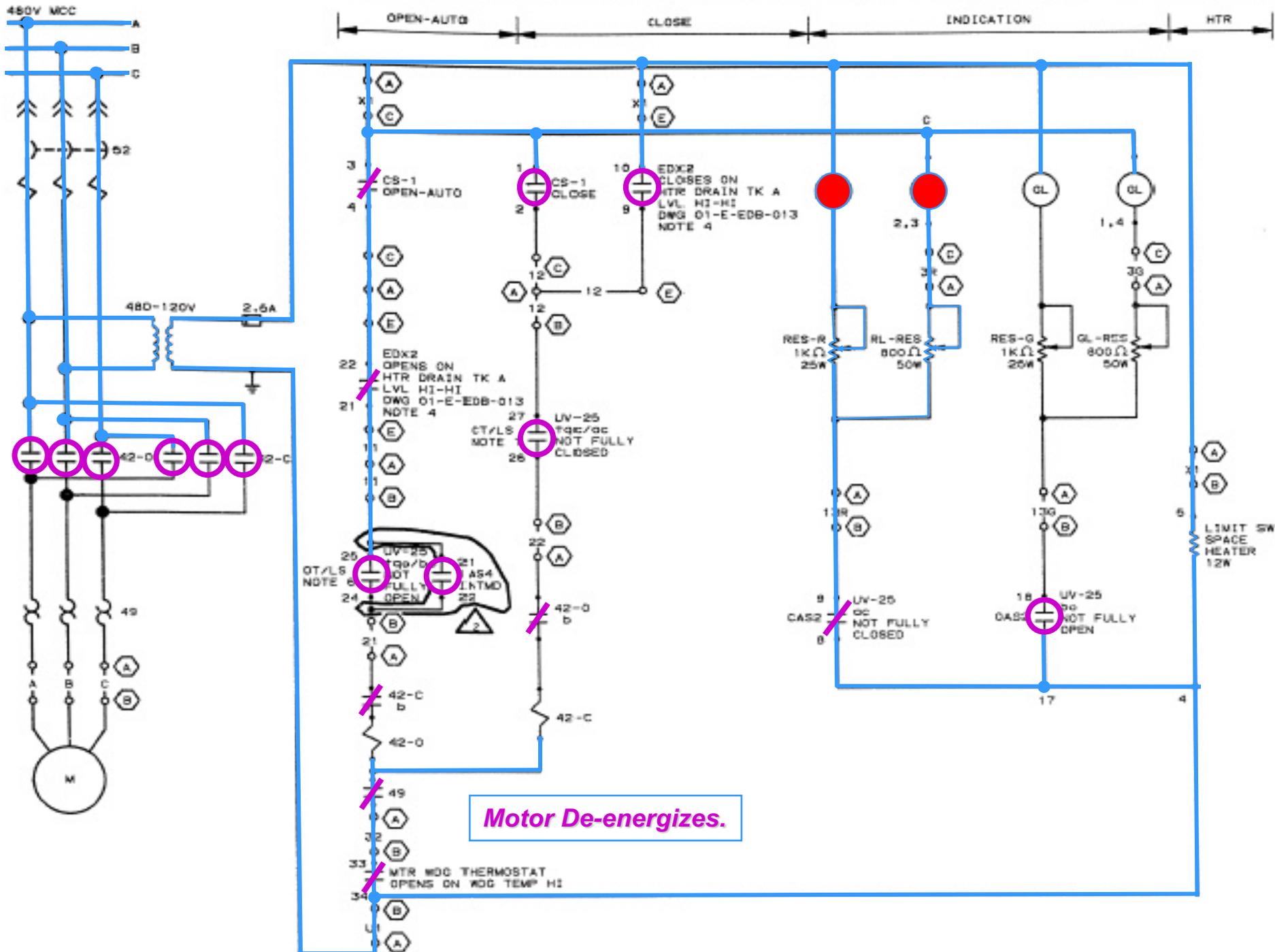
Coil 42-0 Energizes.







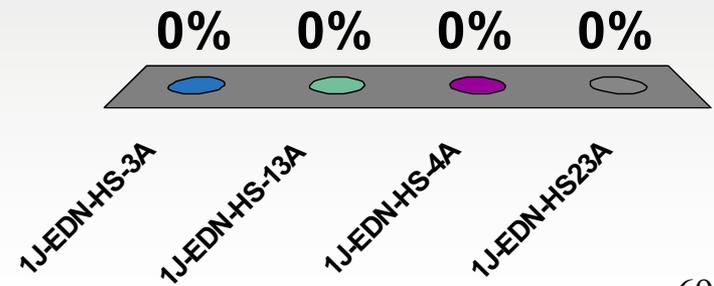




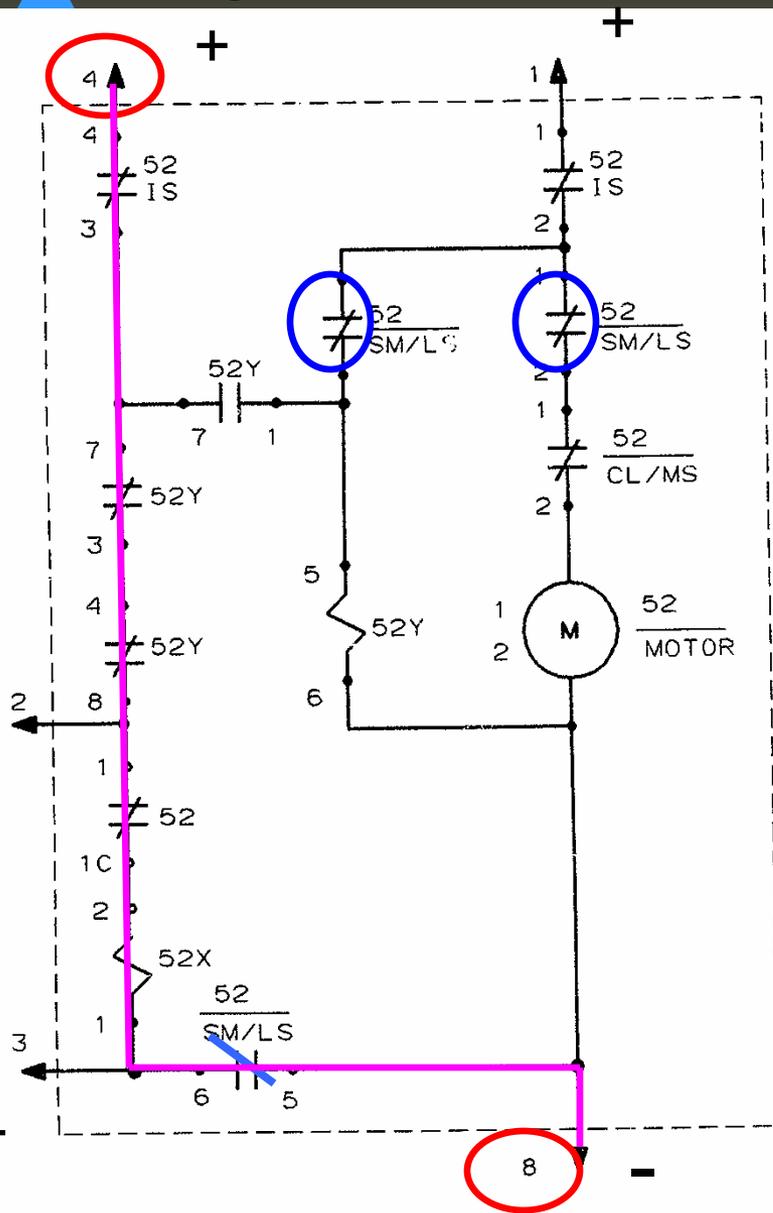
Which one of the following is the handswitch designation for 1J-EDN-UV-26?

1. 1J-EDN-HS-3A
2. 1J-EDN-HS-13A
3. 1J-EDN-HS-4A
4. 1J-EDN-HS23A

0
of
28



Closing Springs charged, pump started

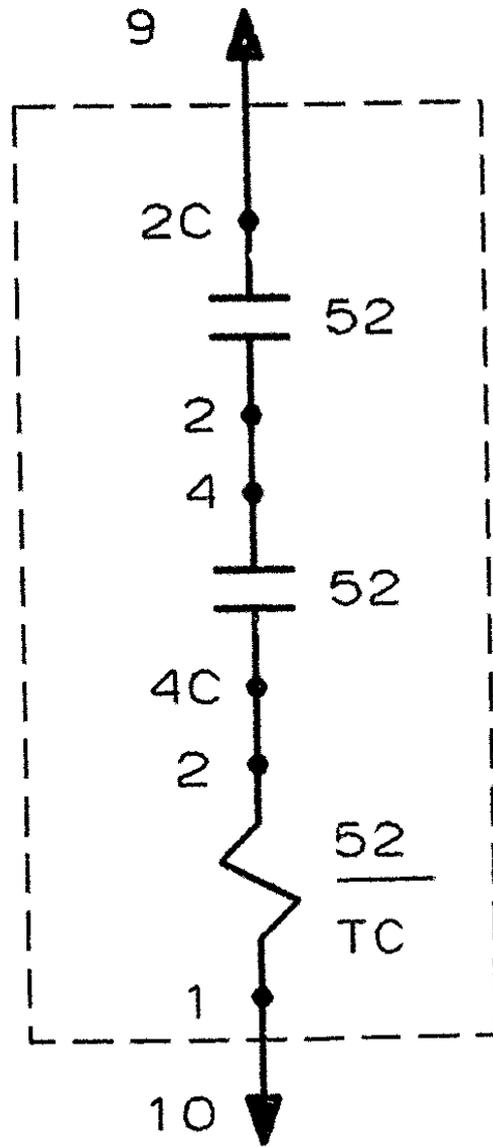
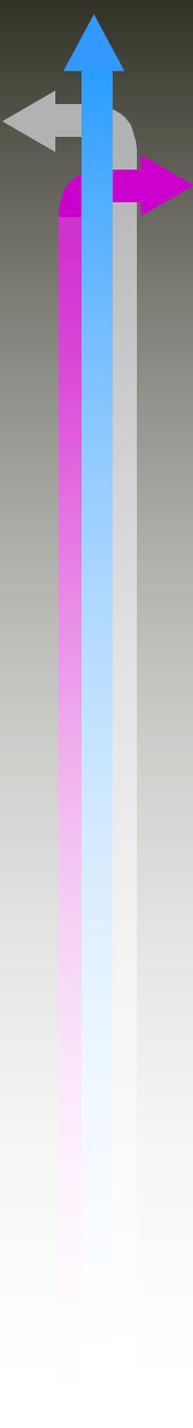


ACB CLOSE

V.P. DWG E009-30 & 152

DEVICE DESIGNATION

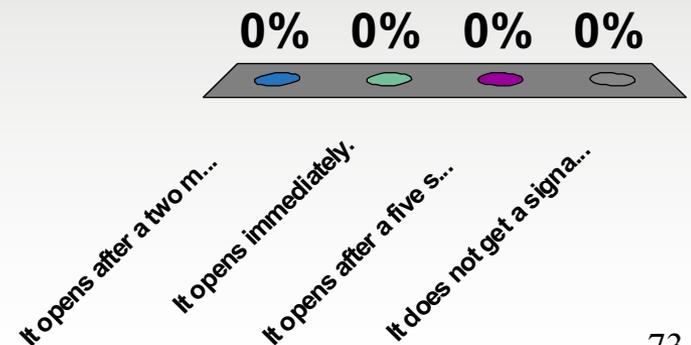
- 52X — SPRING RELEASE COIL OPERATES LATCH WHICH RELEASES CLOSING SPRING TO CLOSE 52.
- 52/IS -- INTERLOCK SWITCH CLOSED WHEN 52 IS IN FULLY RAISED OR FULLY LOWERED POSITION.
- 52Y — ANTI PUMP RELAY.
- 52 — AUXILIARY DRAWOUT SWITCH CONTACTS.
- $\frac{52}{SM/LS}$ — LIMIT SWITCH FOR SPRING CHARGING MOTOR. CONTACTS 1-2,3-4, OPEN AND CONTACT 5-6 CLOSED WHEN SPRING ARE FULLY CHARGED.
- $\frac{52}{CL/MS}$ — CLOSING LATCH MONITORING SWITCH IS CLOSED WHEN LATCH IS CAPABLE OF BLOCKING FULLY CHARGED CLOSING SPRINGS.
- M — CLOSING SPRING CHARGING MOTOR.
- 52/TC — BREAKER TRIP COIL.
- 75M — ELEVATING MOTOR.
- 75CS — LOCAL SELECTOR SWITCH WITH RAISE, LOWER AND OFF POSITION.
- $\frac{75}{CLUTCH SW}$ — MERCURY CLUTCH SWITCH OPEN IN DISENGAGED POSITION.
- $\frac{52H}{UP}$ — MERCURY POSITION SWITCH OPEN, ONLY IN EXTREME RAISED POSITION OF ACB.
- $\frac{52H}{DOWN}$ — MERCURY POSITION SWITCH OPEN, ONLY IN EXTREME LOWER POSITION OF ACB.



ACB TRIP

When the Heater Drain Pump breaker closes what happens to the Heater Drain Pump Normal Discharge Valve?

1. It opens after a two minute delay.
2. It opens immediately.
3. It opens after a five second delay.
4. It does not get a signal from the pump breaker.





THE END