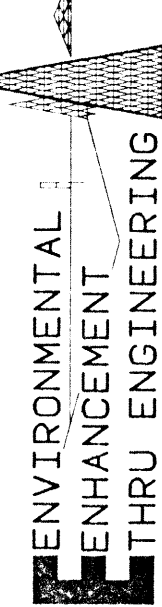
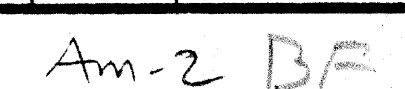


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24

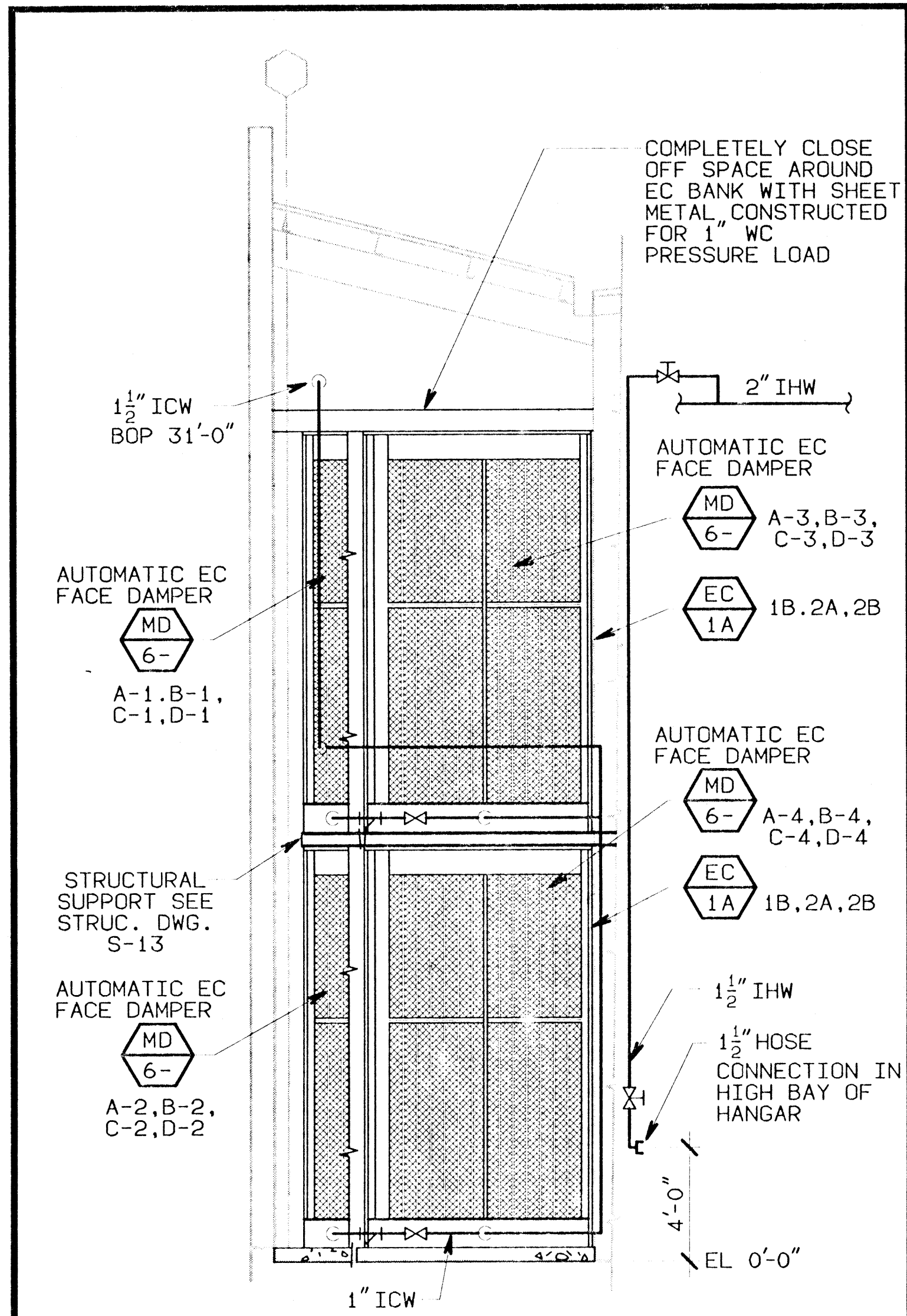




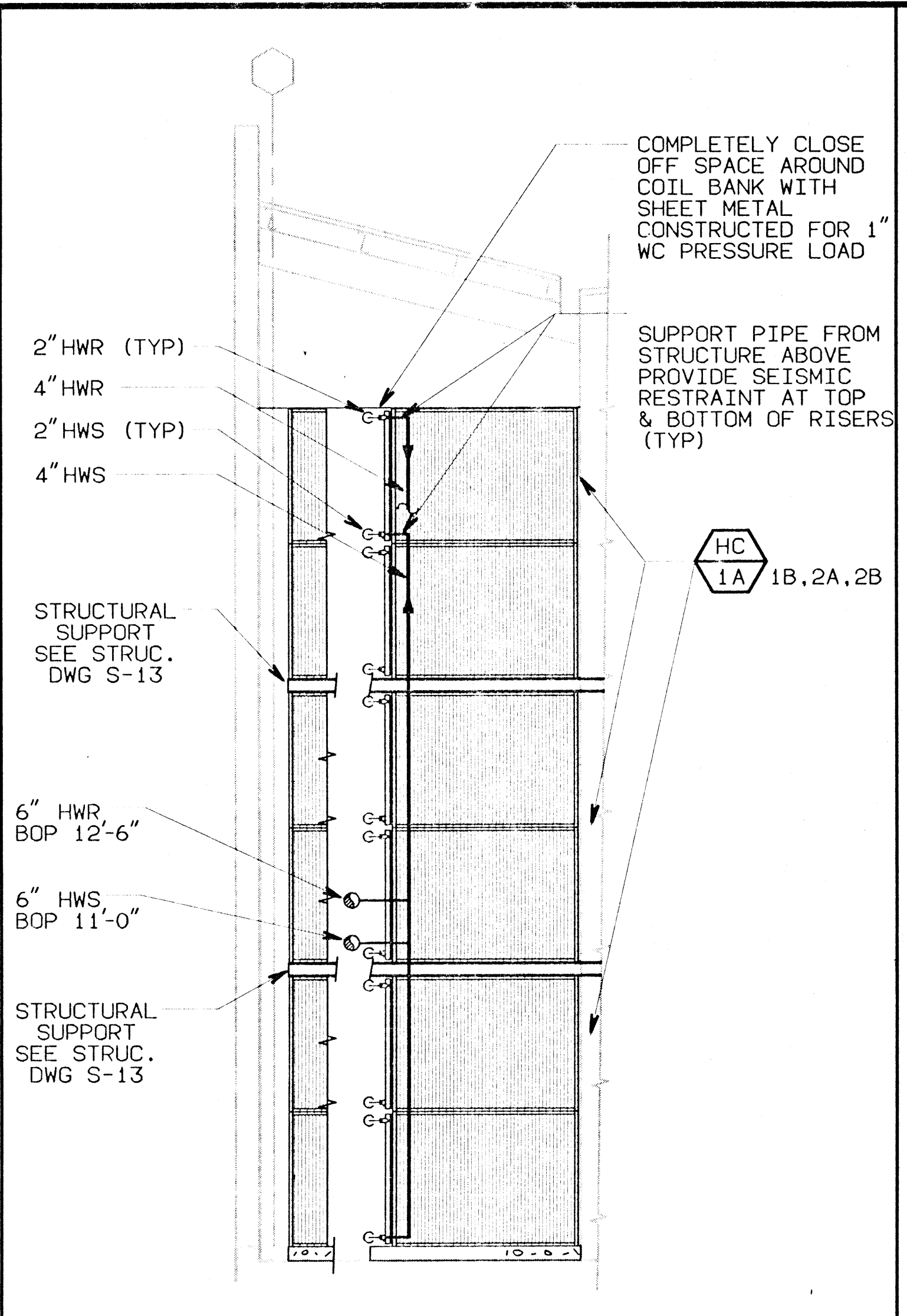




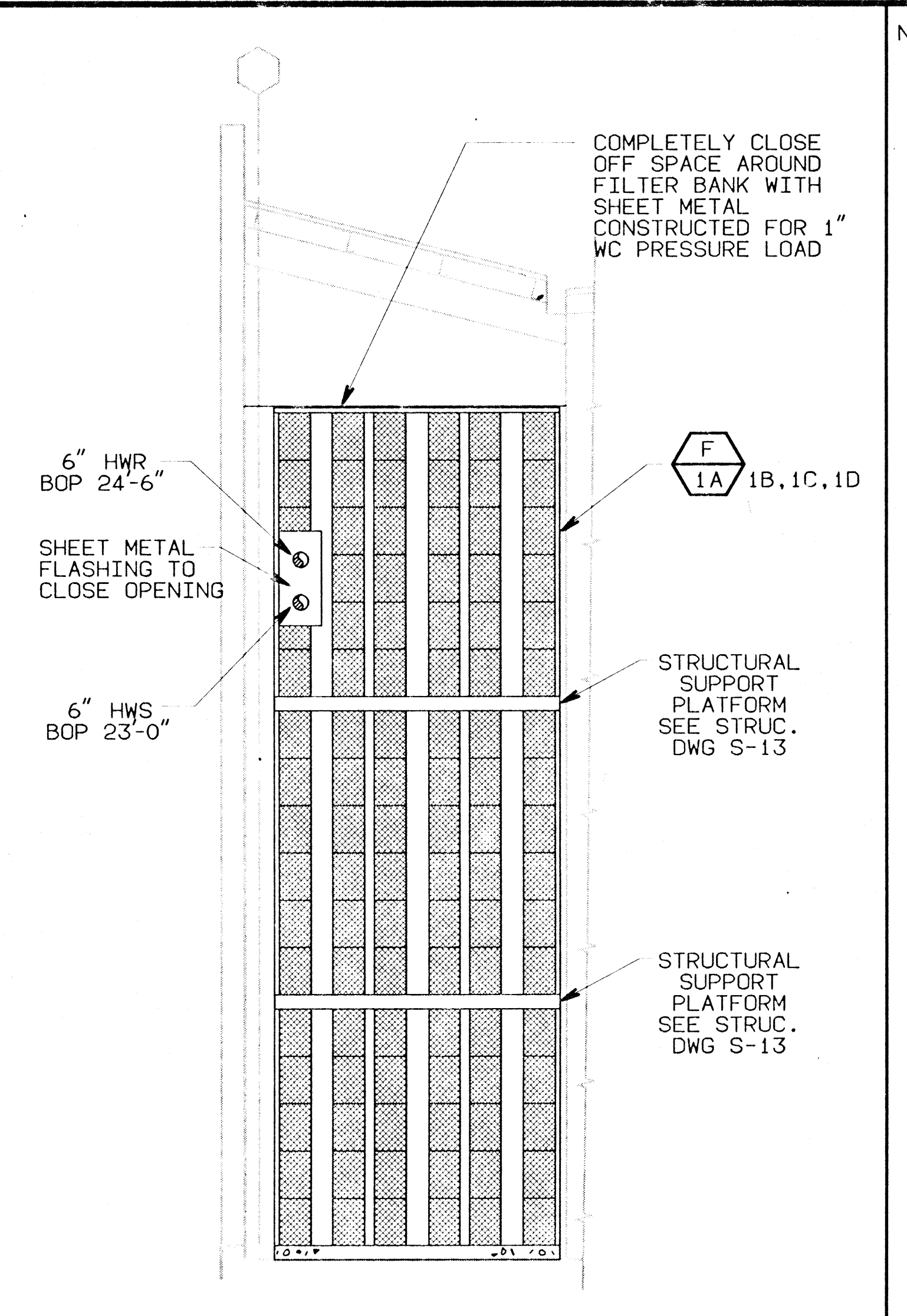
# FUNCTIONAL ANALYSIS - VE PAYS



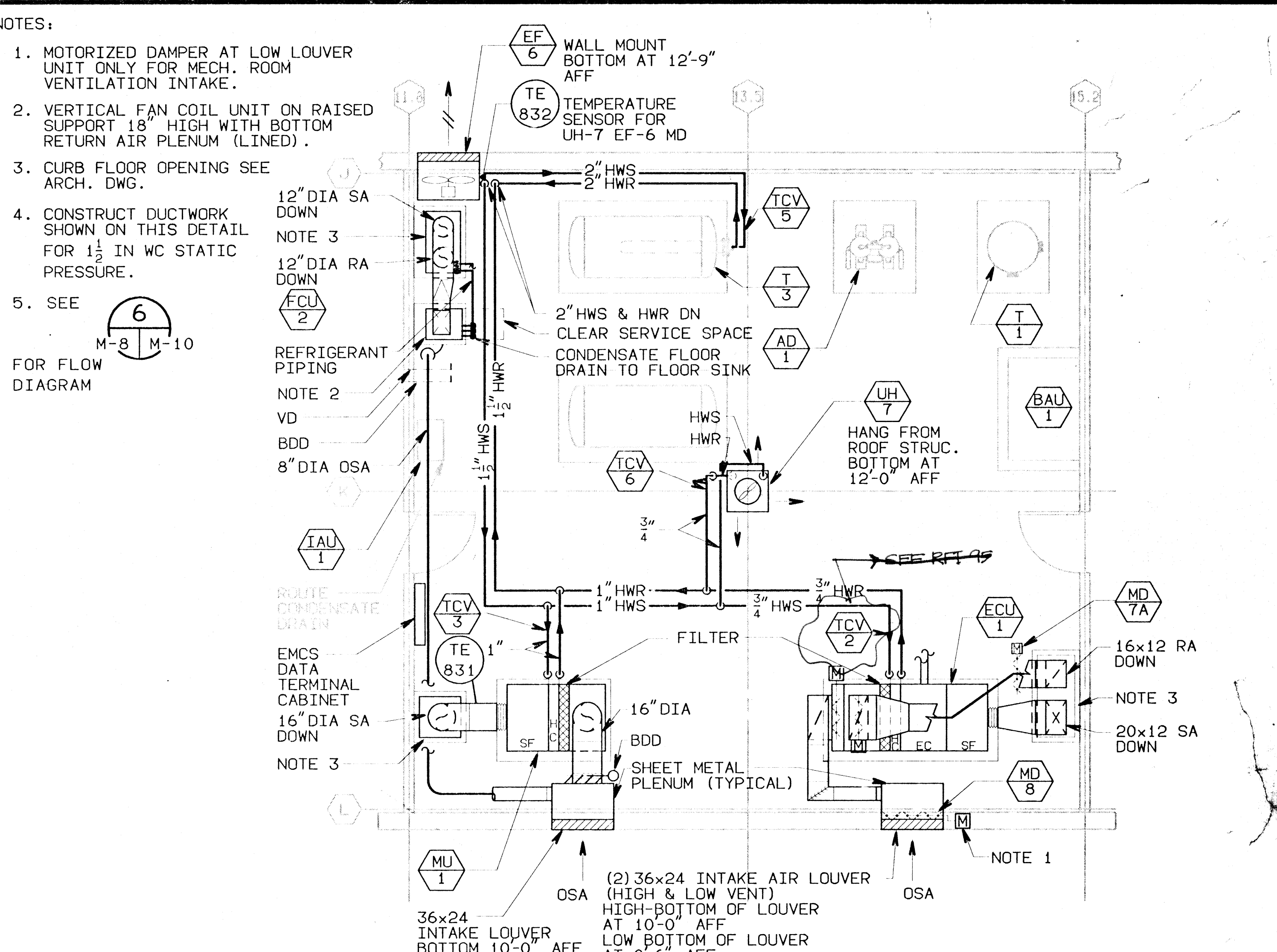
SECTION SUPPLY PLENUM AT EC (A) SCALE: 1/4" = 1'-0" M-8 M-8



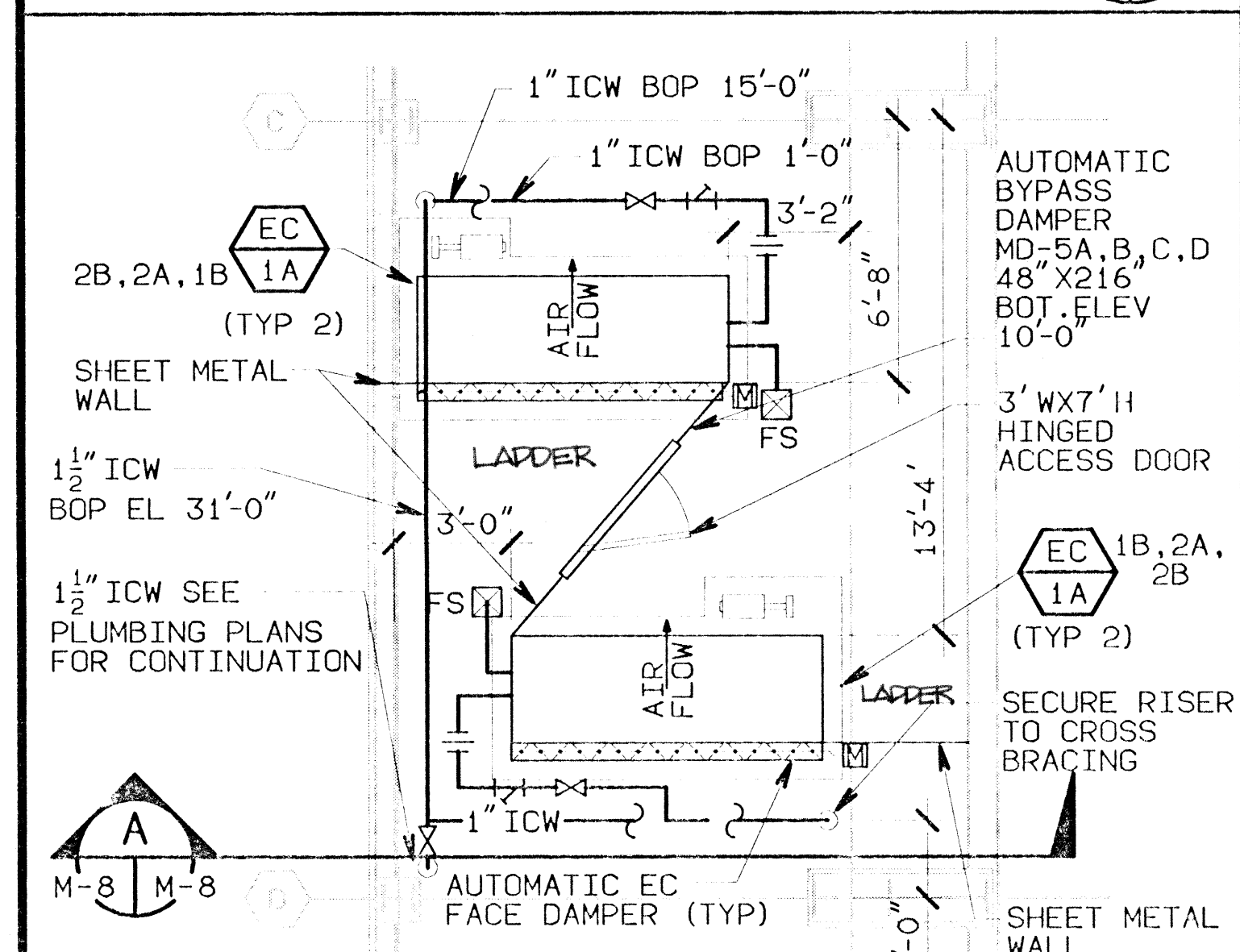
SECTION SUPPLY PLENUM AT HEATING COIL BANK (B) SCALE: 1/4" = 1'-0" M-8 M-8



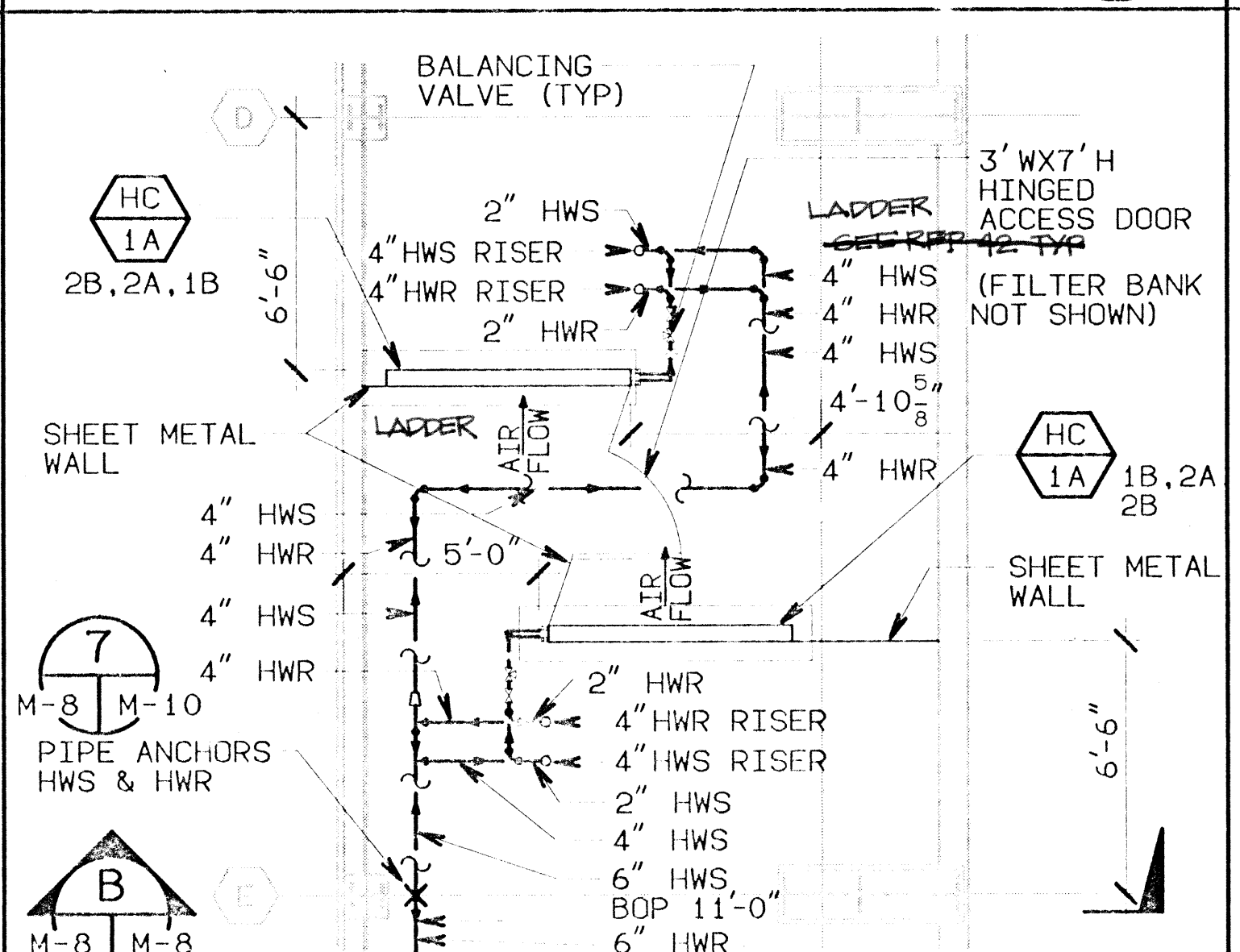
SECTION SUPPLY PLENUM AT FILTER BANK (C) SCALE: 1/4" = 1'-0" M-8 M-8



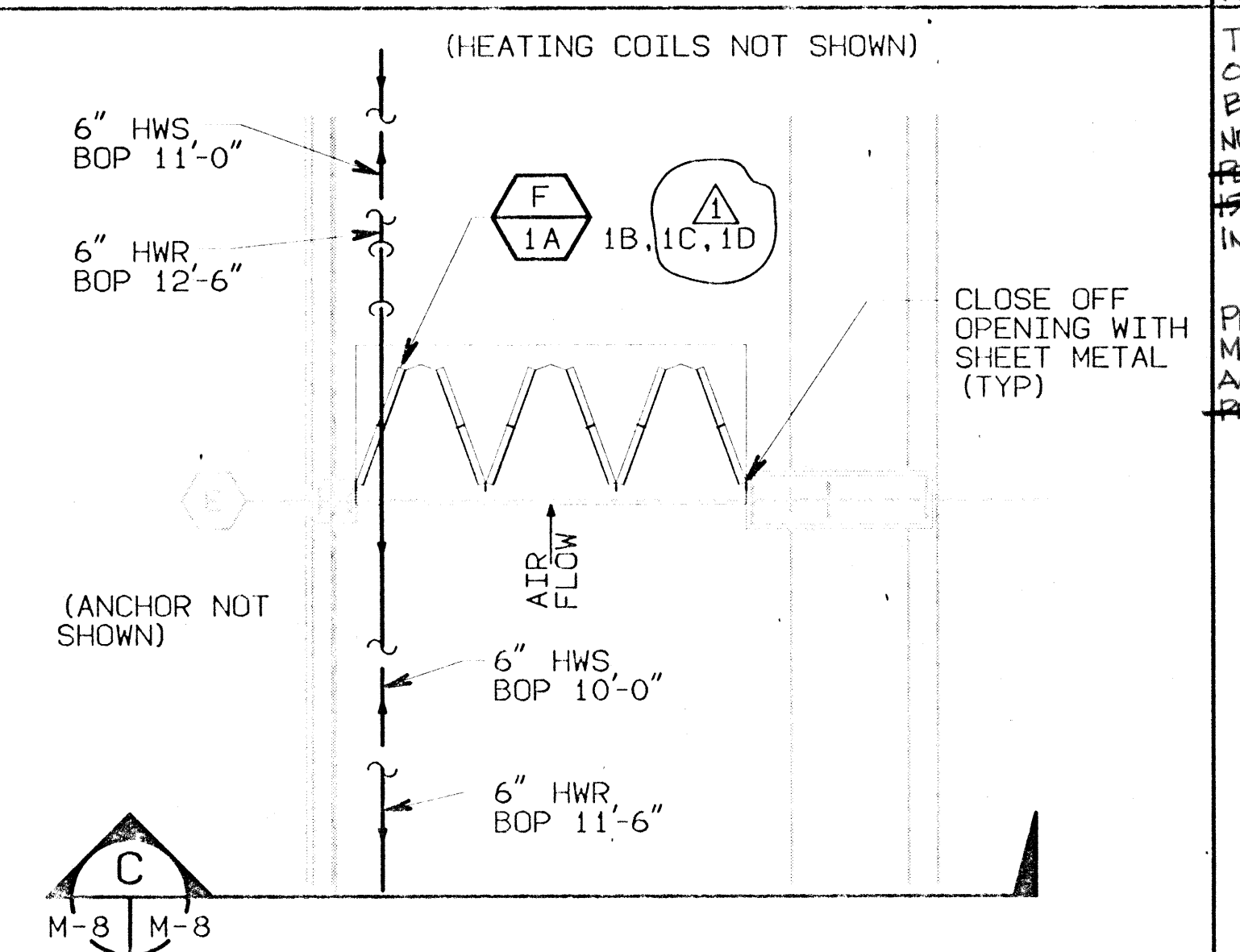
MECHANICAL EQUIPMENT AREA ABOVE SERVICE BLDG. (7) SCALE: 1/4" = 1'-0" M-8 M-8



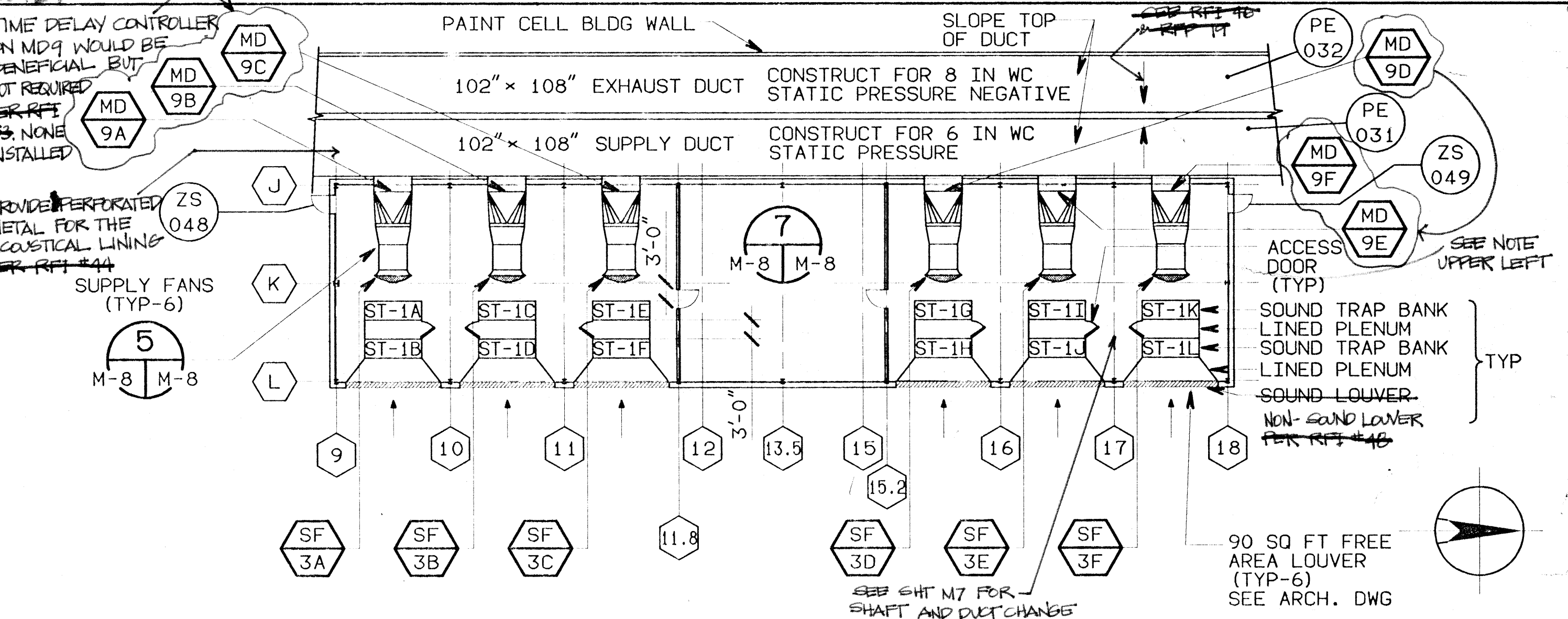
SUPPLY PLENUM EC PLAN (1) SCALE: 1/4" = 1'-0" M-8 M-8



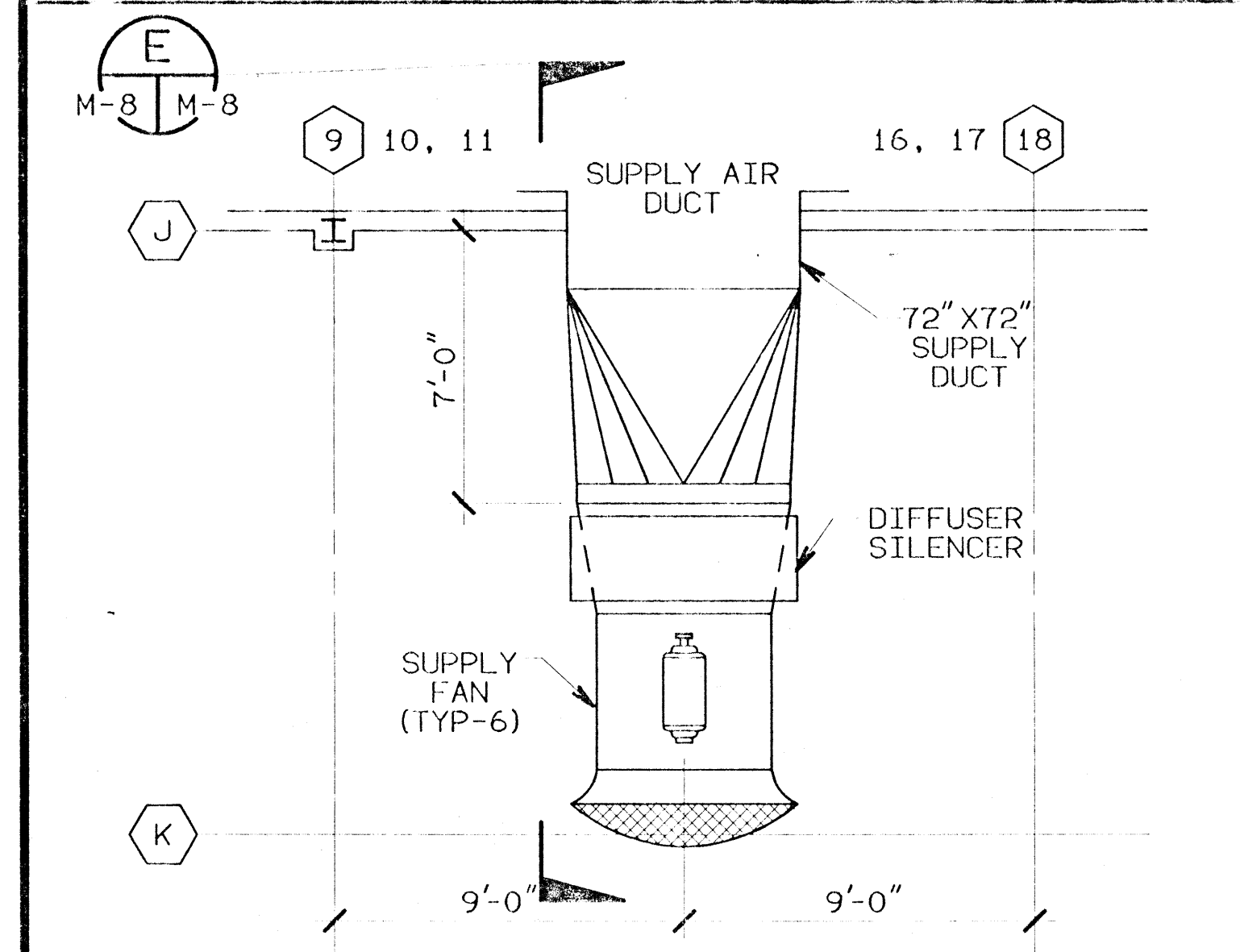
SUPPLY PLENUM HEATING COIL BANK PLAN (2) SCALE: 1/4" = 1'-0" M-8 M-8



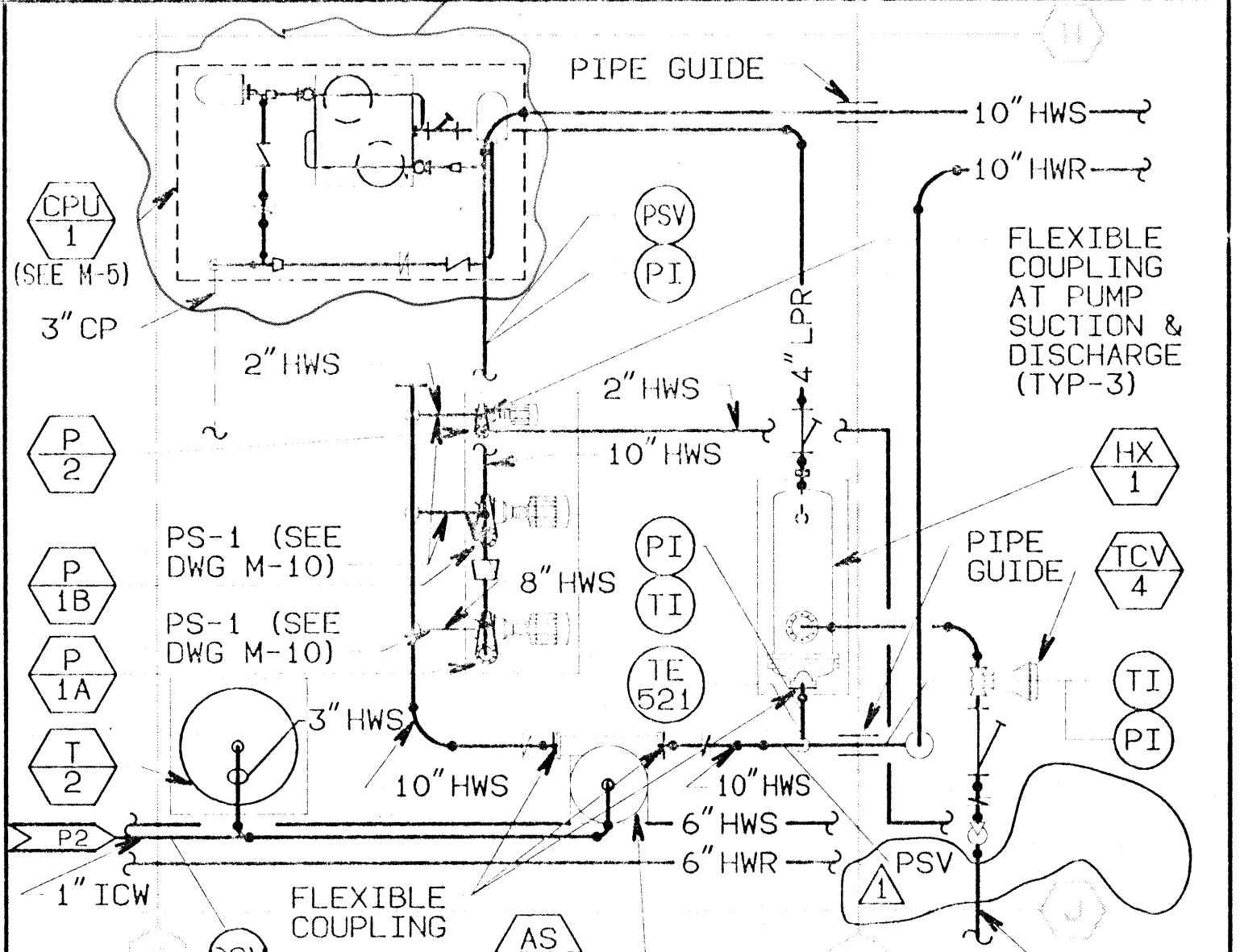
SUPPLY FILTER BANK PLAN (3) SCALE: 1/4" = 1'-0" M-8 M-8



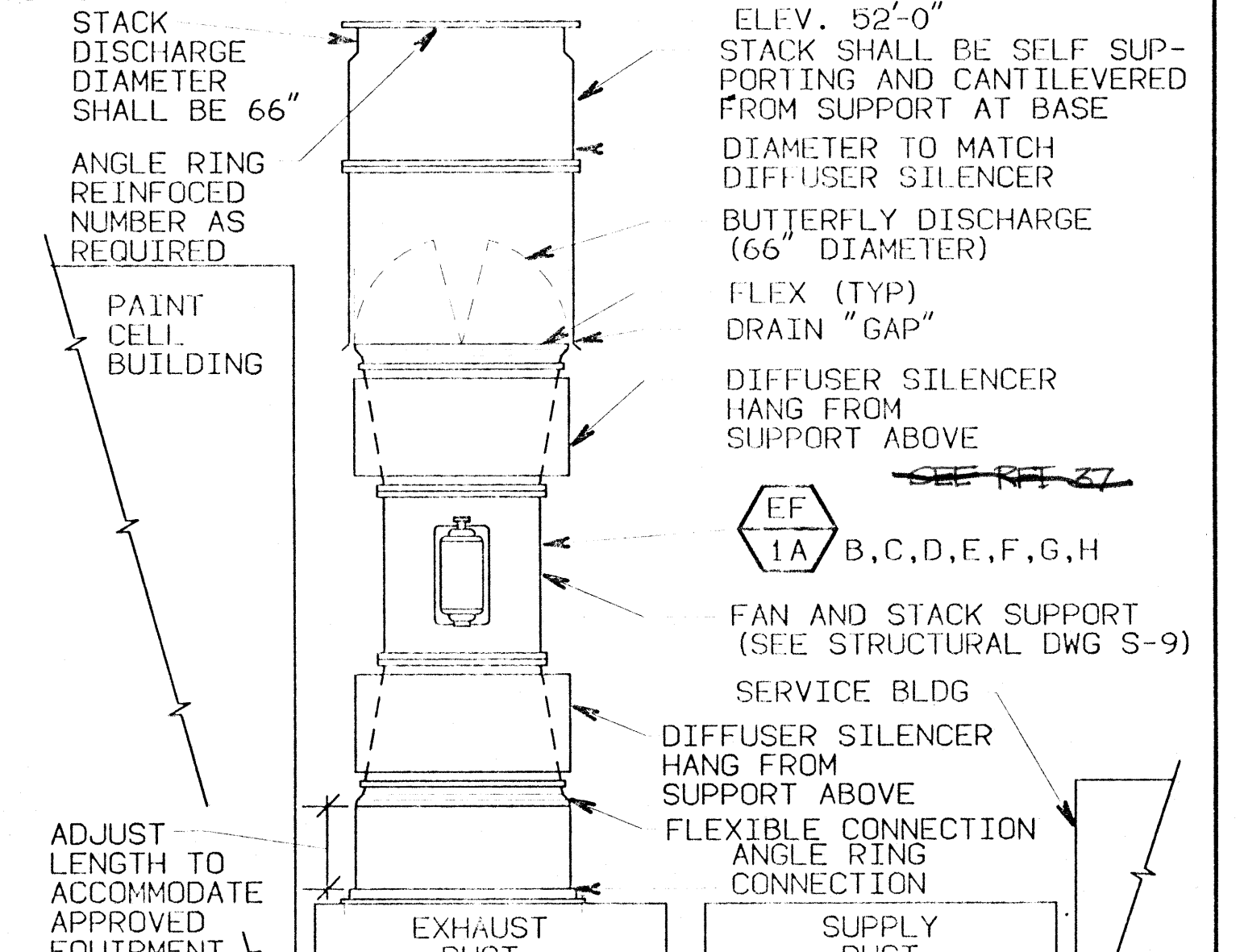
SUPPLY FAN LOCATION PLAN (4) SCALE: 1/16" = 1'-0" M-8 M-8



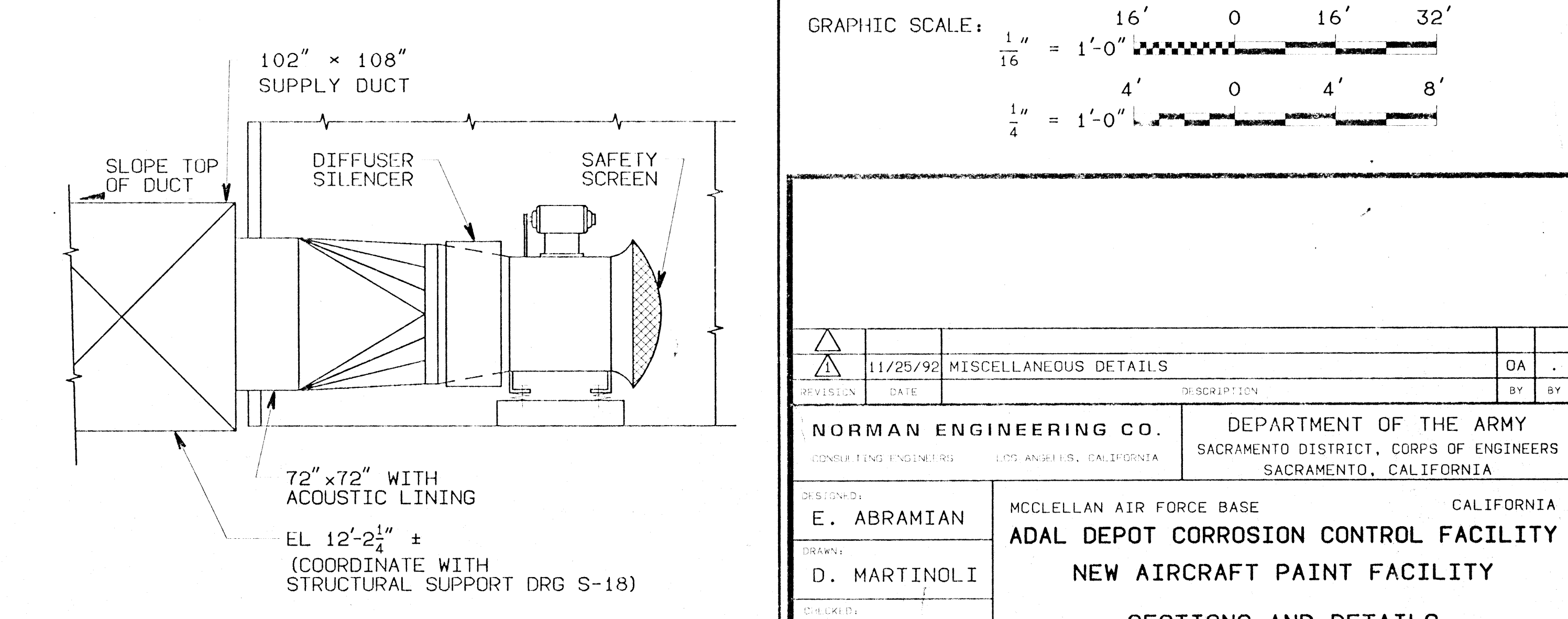
TYPICAL SUPPLY FANS SF3A THRU F (5) SCALE: 1/4" = 1'-0" M-8 M-8



EXPANDED HOT WATER GENERATION PLAN (6) SCALE: 1/4" = 1'-0" M-8 M-8



EXHAUST FAN INSTALLATION SECTION (D) SCALE: 1/4" = 1'-0" M-8 M-8



SUPPLY FAN INSTALLATION SECTION (E) SCALE: 1/4" = 1'-0" M-8 M-8

GRAPHIC SCALE: 1/16" = 1'-0" 0 16' 32'

1/4" = 1'-0" 0 4' 8'

REVISION	DATE	DESCRIPTION	BY
1	11/25/92	MISCELLANEOUS DETAILS	DA

**NORMAN ENGINEERING CO.**  
CONSULTING ENGINEERS  
LOS ANGELES, CALIFORNIA

**DEPARTMENT OF THE ARMY**  
SACRAMENTO DISTRICT, CORPS OF ENGINEERS  
SACRAMENTO, CALIFORNIA

**E. ABRAMIAN**  
DESIGNED BY

**D. MARTINOLI**  
DRAWN BY

**K. GOODWIN**  
CHECKED BY

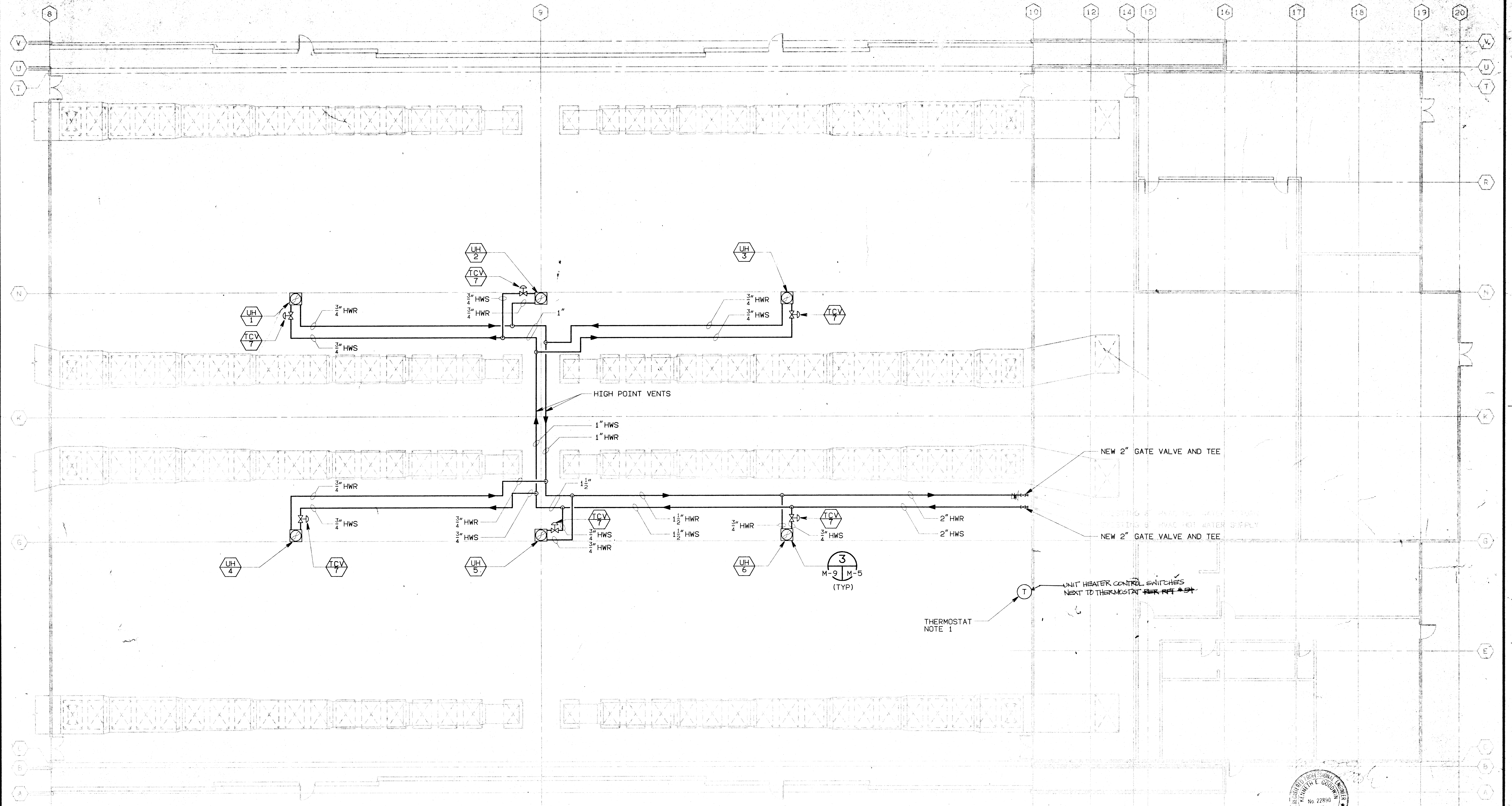
**ADAL DEPOT CORROSION CONTROL FACILITY**  
NEW AIRCRAFT PAINT FACILITY

**SECTIONS AND DETAILS**

DATE: 9/30/92  
SCALE: 1/4" = 1'-0"  
SHEET: M-8  
TOTAL SHEETS: 62 OF 95  
SPEC NO.: 8529  
FILE NO.: 100-25-2051



# FUNCTIONAL ANALYSIS - VE PAYS



## MECHANICAL FLOOR PLAN

SCALE: 1/8" = 1'-0"

NOTE:  
NO AS-BUILTS FOR BLDG 692 CONTROLS  
ARE NEEDED PER RFI #125

NOTE:  
NEW THERMOSTAT TO BE MOUNTED  
@ APPROX. 60" AFF. PER RFI #125

Reference your RFI #105, dated April 12, 1994, regarding the EMCS panel at Building 692 being non-operational.

We concur that the present EMCS panel is not functioning, therefore the new hot water unit heaters at Building 692 will not be required to be tied into the EMCS system.

Reference your RFI #104, dated April 11, 1994, regarding HVAC panels at Building 692.

The existing HVAC panel in Building 692 has been determined to be inadequate in size to accommodate the old and new HVAC controls. Therefore a new panel will need to be sized and installed to hold the existing and new controls.

## NOTES:

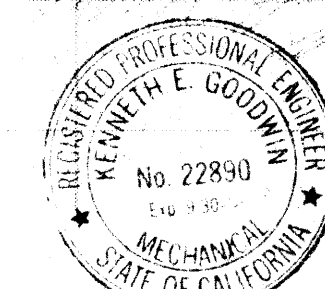
- HVAC CONTROL:  
INTERCONNECT HIGH BAY THERMOSTAT TO START UNIT HEATER FANS (UH1-6) AND OPEN TEMPERATURE CONTROL VALVES (TCV-7) WHEN HEATING IS REQUIRED. WHEN HEATING IS NOT REQUIRED THE THERMOSTAT SHALL TURN THE FANS OFF AND CLOSE THE TEMPERATURE CONTROL VALVES. A SELECTOR SWITCH SHALL BE PROVIDED ADJACENT THE NEW THERMOSTAT. THE SELECTOR SWITCH SHALL DISABLE THE FOUR EXISTING BUILDING FANS AND THE AIR WASHER PUMPS IF THE NEW UNIT HEATER SYSTEM IS SELECTED TO OPERATE. IF THE EXISTING HEATING SYSTEM IS SELECTED PREVENT OPERATION OF NEW UNIT HEATER FANS AND OPENING OF HOT WATER TCV SERVING THEM. THE EXISTING VENTILATION EMCS PANEL IS LOCATED IN THE HALLWAY NEAR COLUMN E-15.
- SUPPORT PIPING AND UNIT HEATERS FROM STRUCTURAL BEAMS AND PURLINS OF ROOF. PROVIDE SEISMIC RESTRAINT TO STRUCTURE.

MOUNT CONTROL SWITCHES FOR UNIT HEATERS 1-6 ADJACENT TO THERMOSTATS SHOWN PER RFI #125.

2. Reference is made to RFI #104, 105, 106, 125 and RFI #125. The control of UH1 through UH6 is to be per drawing M-9, note 1, and Section 15950, paragraph 1.3.2. The EMCS is to monitor the heating system controls only, and is required for both buildings, per drawing M-14, Schedule 4. All control for UH1 through UH7 is to be accomplished with local controls. Operation is called out on drawing M-10 (Sequence of Operation). For Units UH1 through UH6, one thermostat only is required for control. All units 1-6 shall turn on and off at the same time.

SEE ALSO RFI 104, 105, 106, 125 AND RFI #125

8' 0 8' 16'

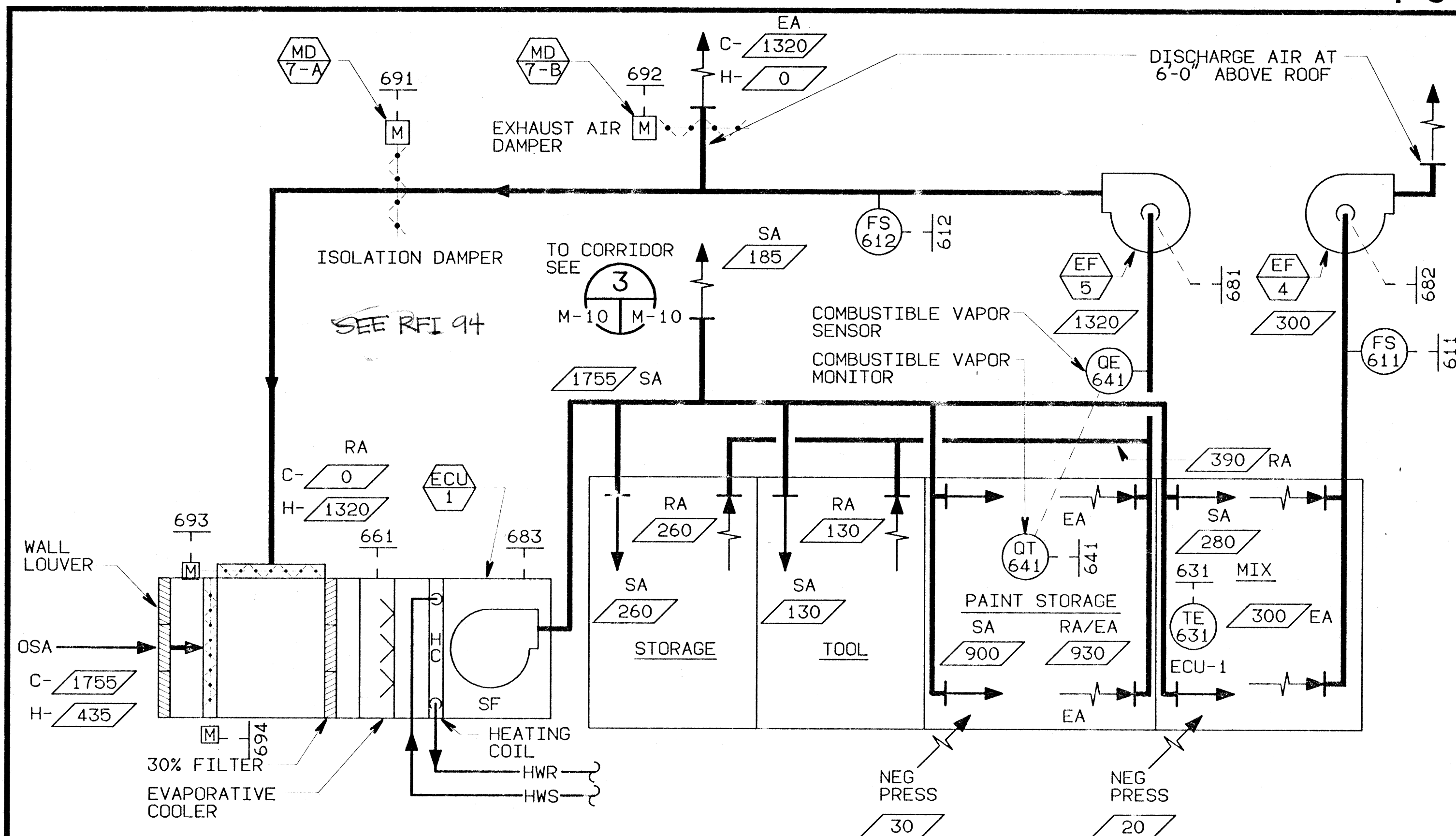


<b>NORMAN ENGINEERING CO.</b> CONSULTING ENGINEERS LOS ANGELES, CALIFORNIA		<b>DEPARTMENT OF THE ARMY</b> SACRAMENTO DISTRICT, CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA	
DESIGNED BY:	E. ABRAMIAN	MCCLELLAN AIR FORCE BASE CALIFORNIA	
DRAWN BY:	G. NAKAMOTO	ADAL DEPOT CORROSION CONTROL FACILITY	
CHECKED BY:	K. GOODWIN	EXISTING BUILDING 692	
SUBMITTED:		DATE APPROVED: 9/30/92	
SCALE: 1/8" = 1'-0" SHEET: M-9 63 OF 95		SPEC NO.: 8629 FILE NO.: 100-25-2051	

SAFETY PAYS



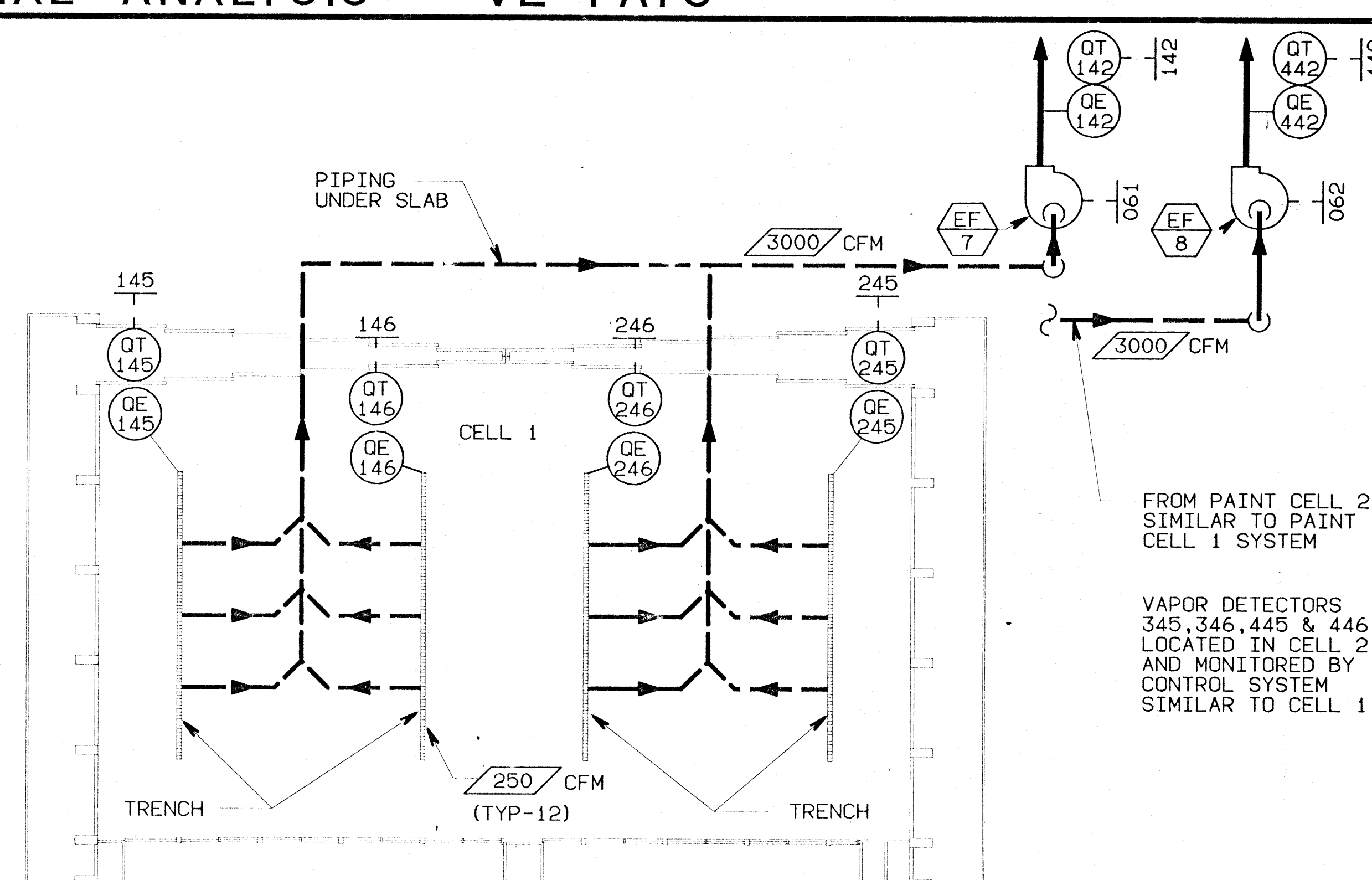
# FUNCTIONAL ANALYSIS - VE PAYS



PAINT MIX AREA HVAC FLOW DIAGRAM

SCALE: NONE

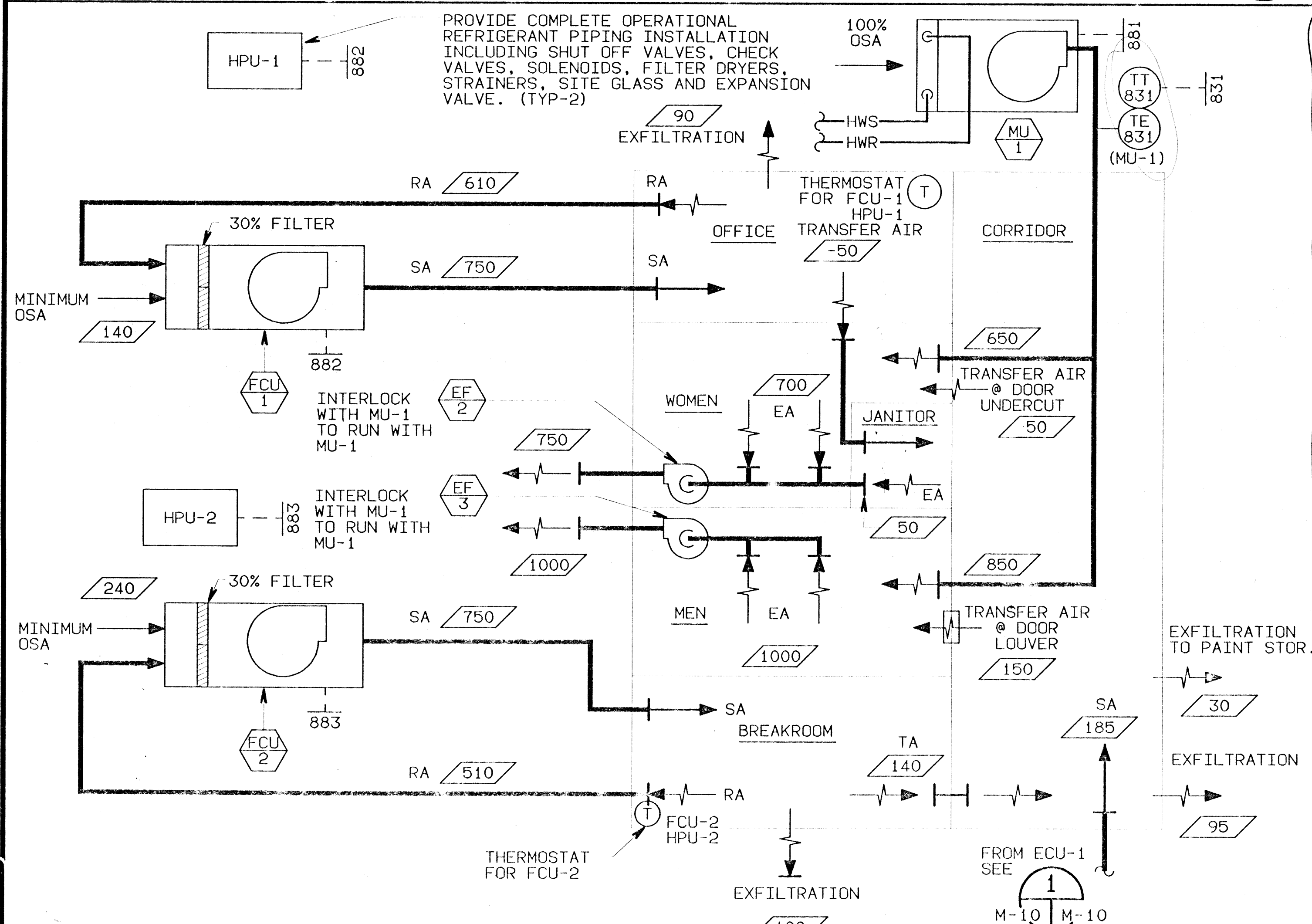
M-6, M-7, M-10



PAINT CELL TRENCH VENTILATION (SIMILAR FOR PAINT CELL 2)

SCALE: NONE

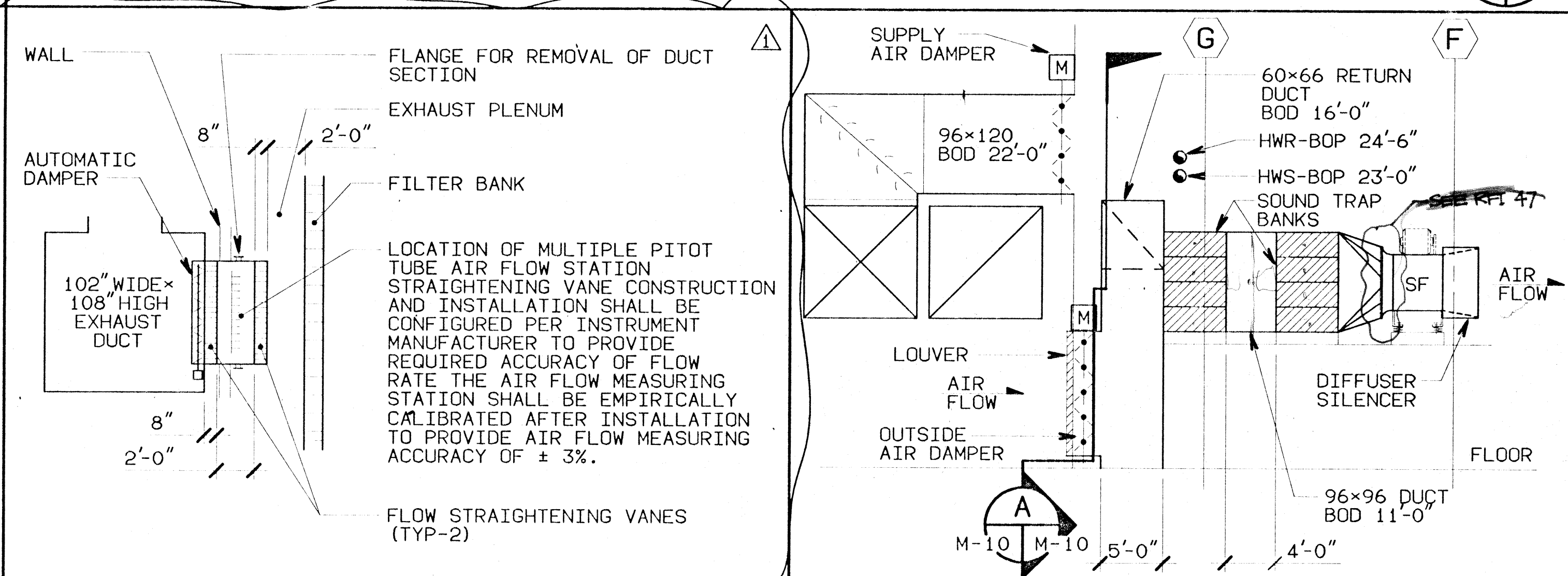
M-4, M-10



CONVENTIONAL AREA HVAC FLOW DIAGRAM

SCALE: NONE

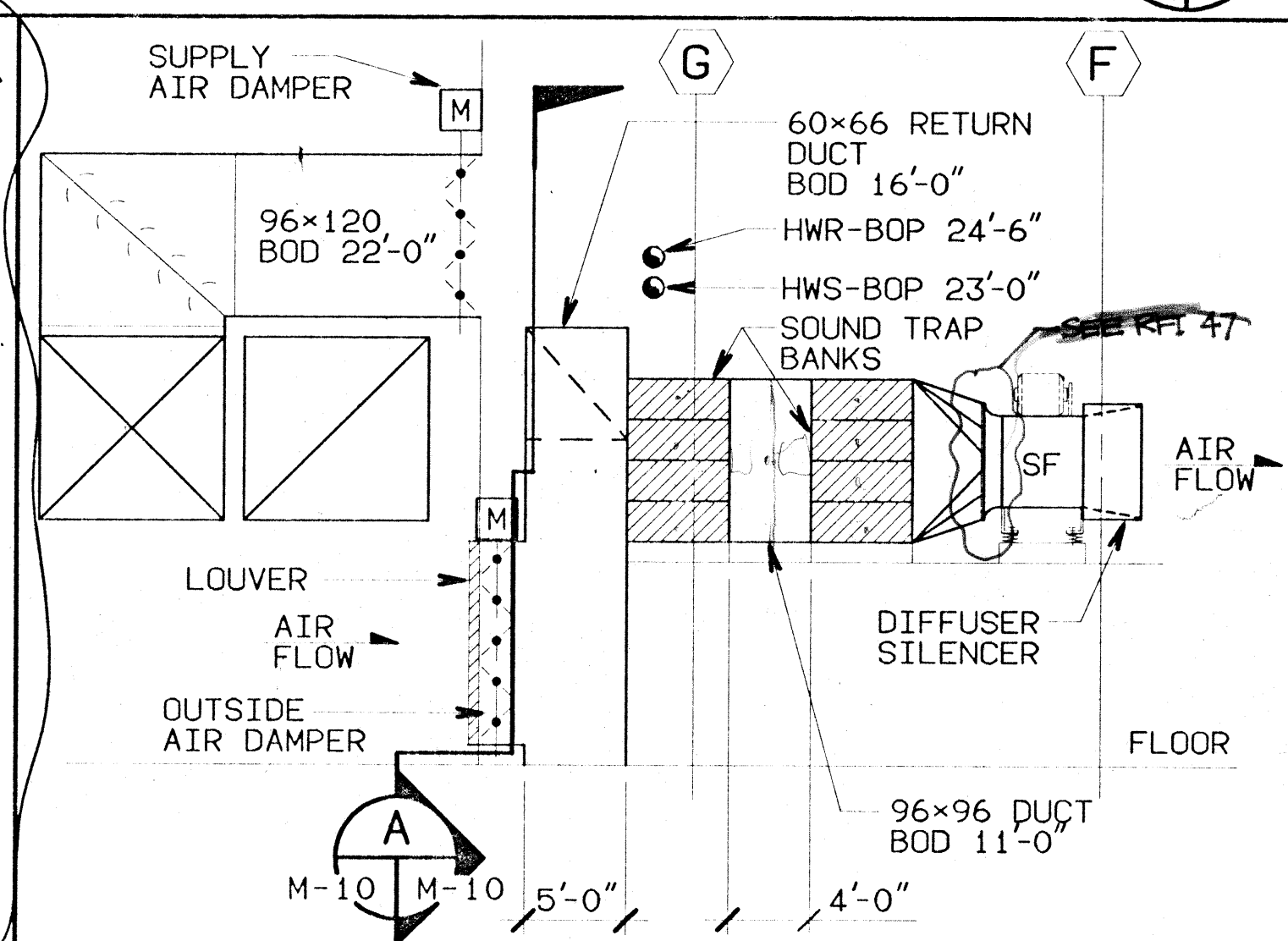
M-6, M-7, M-10, M-10



DETAIL EXHAUST DAMPER & AIR FLOW MEASURING STATION

SCALE: 3/16" = 1'-0"

M-6, M-7, M-10



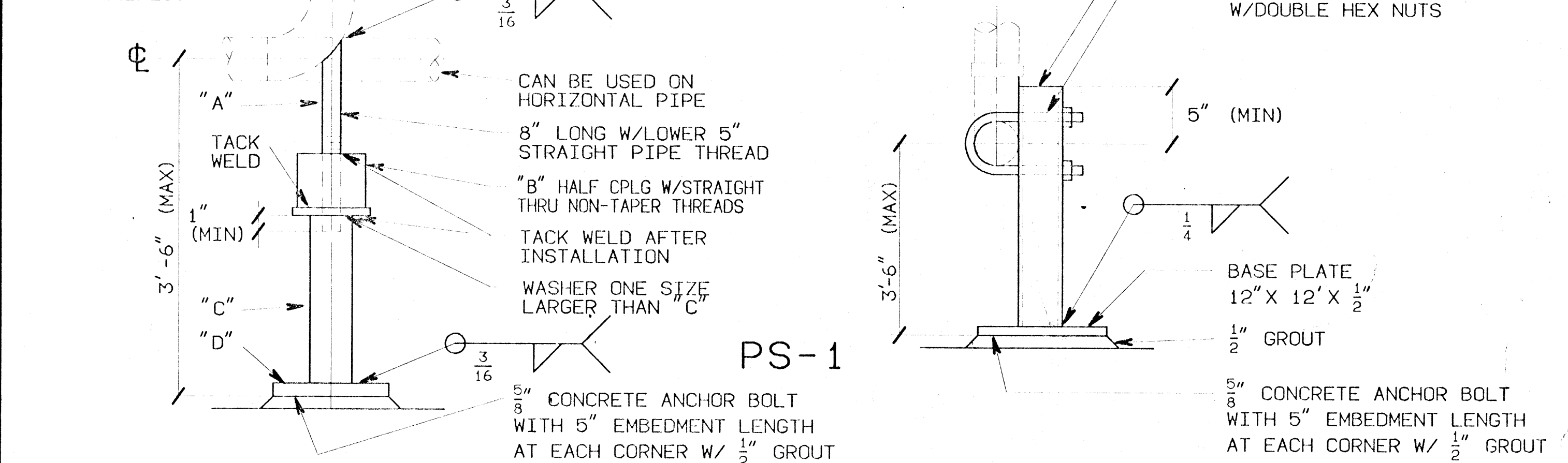
SECTION 5

SCALE: 1/8" = 1'-0"

M-6, M-7, M-10

TABLE 1				
PS-1				
LINE SIZE	A	B	C	D
1 1/2" & SMALLER	3/4" SCH80	3/4"	1 1/2" SCH80	PL 8" X 8" X 1/2"
2", 3" & 4"	1 1/2" SCH80	1 1/2"	2 1/2" SCH80	PL 8" X 8" X 1/2"
6" & 8"	2" SCH80	2"	3" SCH80	PL 10" X 10" X 1/2"
10" & 12"	3" SCH80	3"	4" SCH80	PL 10" X 10" X 1/2"
14"	9" SCH80	4"	6" SCH80	PL 12" X 12" X 1/2"

NOTE: 1. SEE TABLE 1 FOR MATERIALS.



PIPE ANCHOR & GUIDE

SCALE: NONE

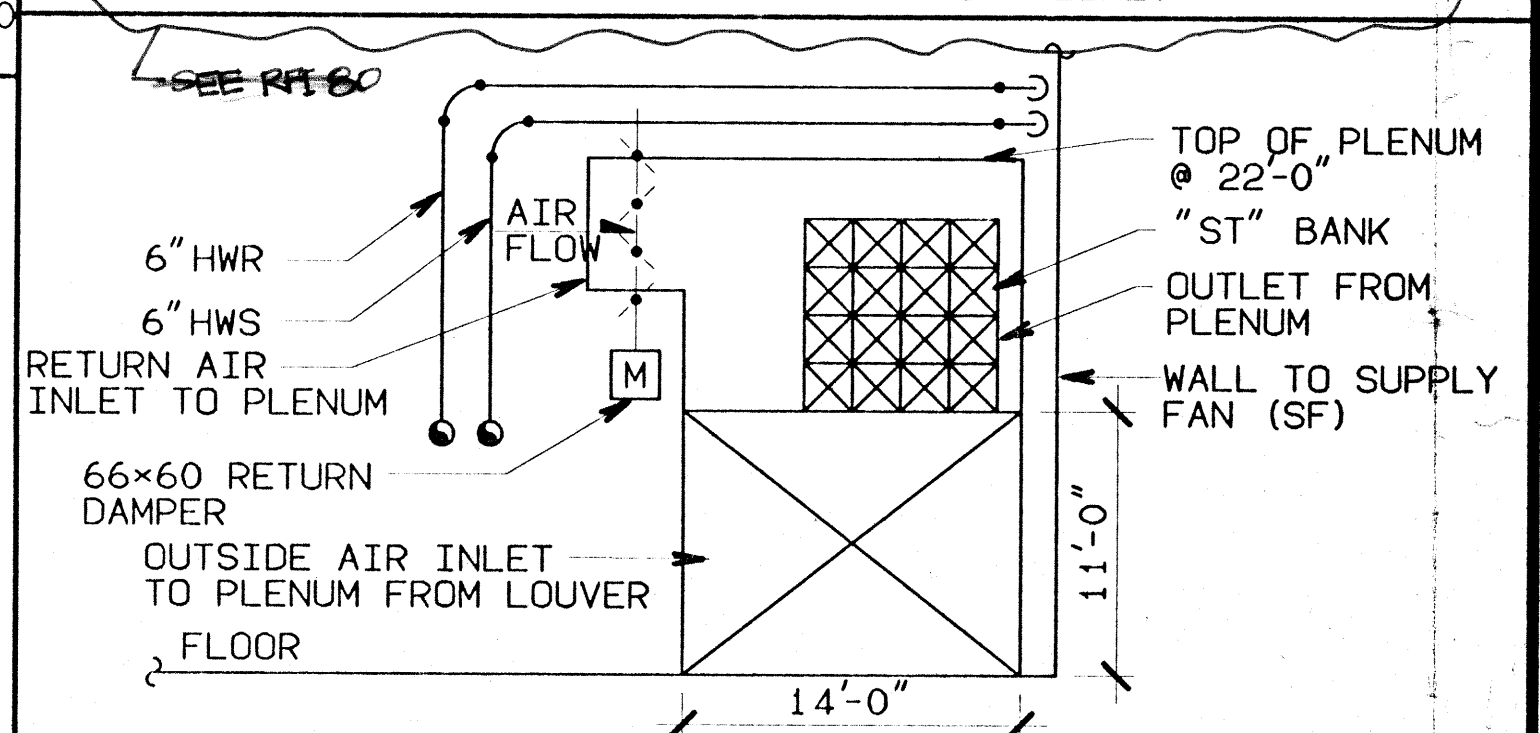
M-6, M-7, M-8, M-10

BASE SUPPORT/ADJUSTABLE PIPE SIZES 2" THRU 14"

BASE SUPPORT/NON-ADJUSTABLE PIPE SIZES 4" & SMALLER

## SEQUENCE OF OPERATION

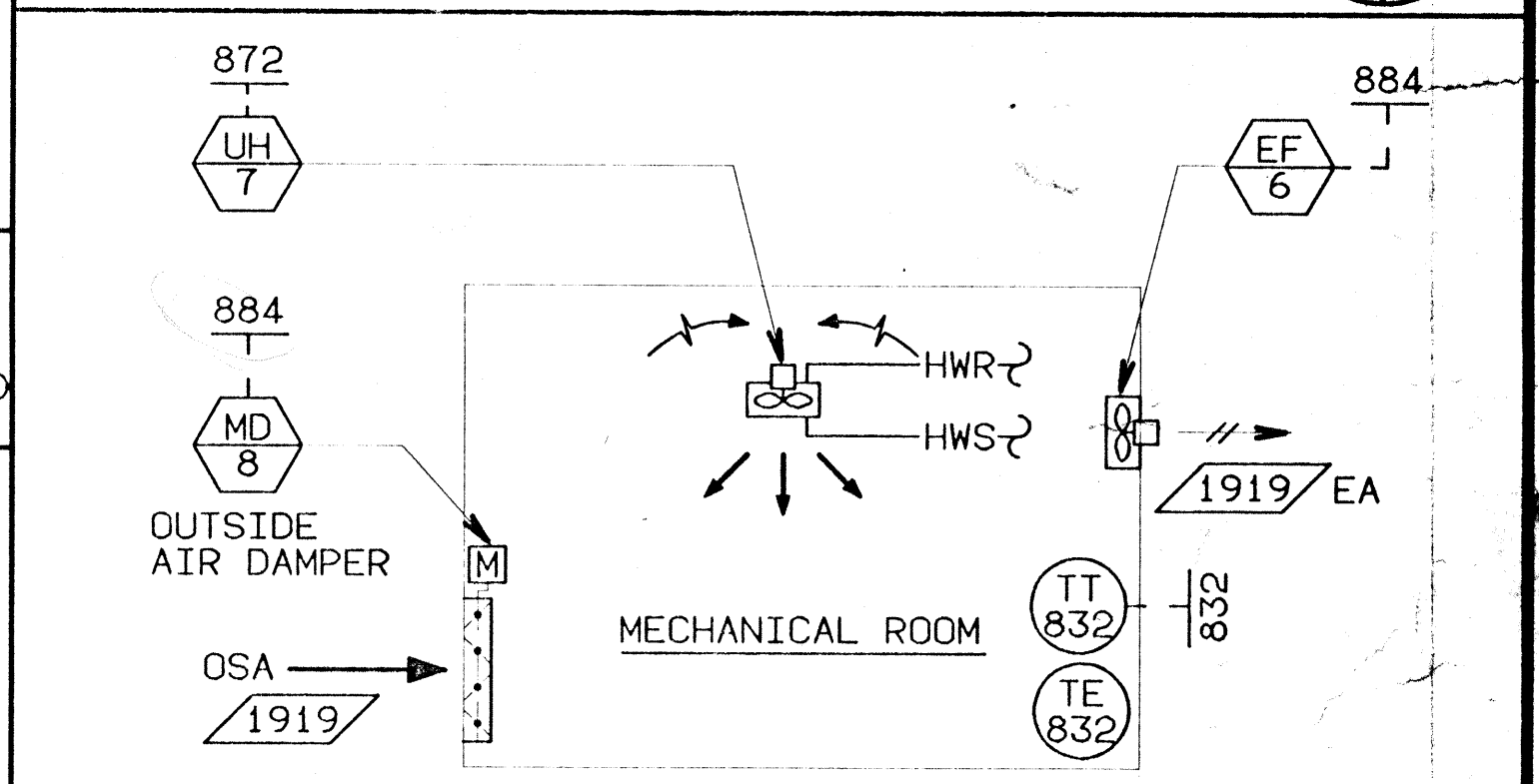
- CONVENTIONAL OFFICE & BREAK ROOM:
    - HEAT PUMP SYSTEM-AIR TO AIR PACKAGED SPLIT SYSTEM
    - HPU-1 - HPU-2
    - FCU-1 - FCU-2
  - CONVENTIONAL MISCELLANEOUS HVAC:
    - TOILET EXHAUST FAN (EF-2 AND EF-3)
    - MAKE-UP AIR FAN (MU-1)
  - CONVENTIONAL MECHANICAL ROOM HVAC:
    - EXHAUST FAN EF-6
    - OUTSIDE AIR DAMPER AT INTAKE AIR LOUVER
    - UNIT HEATER UH-7
- MONITOR ROOM TEMPERATURE THRU TEMPERATURE SENSOR (832). CONTROL EF-6, (884) OUTSIDE AIR DAMPER (884) AND UH-7 (872).
- EF-6 SHALL BE SET TO OPERATE AT 85°F ON TEMPERATURE RISE.
- OUTSIDE AIR DAMPER AT AIR INTAKE LOUVER SHALL BE NORMALLY OPEN AND SET TO CLOSE WHEN EF-6 IS NOT RUNNING.
- UH-7 SHALL BE SET TO OPERATE AT 40°F ON TEMPERATURE DROP, WHICH SHALL INCLUDE SIMULTANEOUSLY OPENING THE CONTROL VALVE (TCV-6) AT THE HOT WATER RETURN LINE.



SECTION A

SCALE: 1/8" = 1'-0"

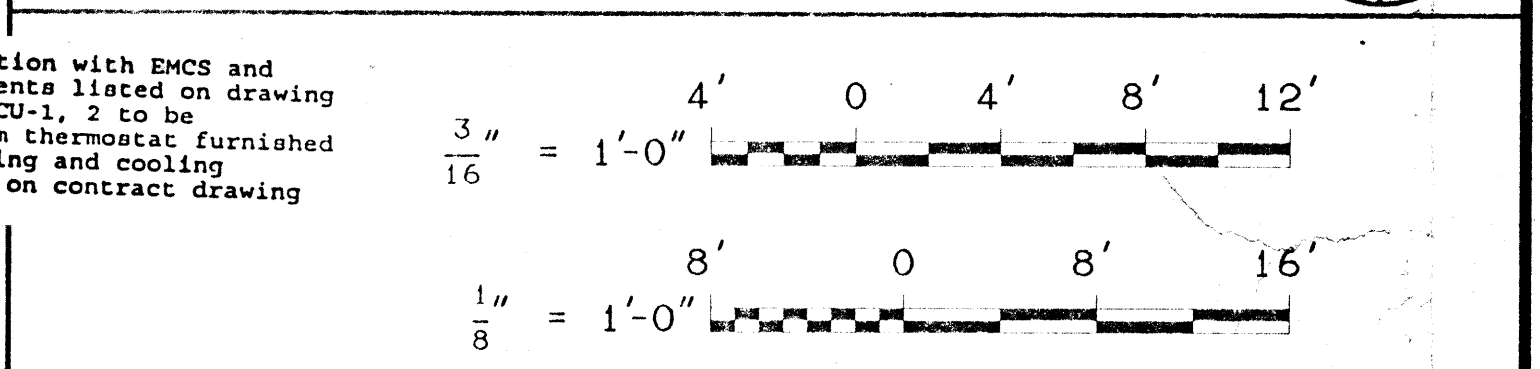
M-10, M-10



MECH. EQUIP. AREA FLOW DIAGRAM

SCALE: NONE

M-8, M-10



a. Reference is made to your RFI #80 states conflicts exist between unit heater and water heater sequence. The control of UH-1 through UH-4 is to be per drawing M-9, note 1, and Section 1555, paragraph 3.3.2. The EDCS is to monitor the heating system controls only, and is required for both buildings, per drawing M-14, Schematic 4. All control for UH-1 through UH-4 is to be accomplished with local controls. Operation is called out on drawing M-10 (Sequence of Operation). For units UH-1 through UH-4, one thermostat only is required for control. All units 1-6 shall turn on and off at the same time.	
11/25/92 REVISIONS DATE DESCRIPTION BY APPROVED	11/25/92 REVISIONS DATE DESCRIPTION BY APPROVED
NORMAN ENGINEERING CO. 1000 10TH AVENUE LOS ANGELES, CALIFORNIA 90015	DEPARTMENT OF THE ARMY SACRAMENTO DISTRICT, CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA
DESIGNER: E. ABRAMIAN	CHECKED: D. LOPEZ
DRAWN: K. GOODWIN	SUBMITTED: 9/30/92
DATE APPROVED: 9/30/92	SCALE: 1/8" = 1'-0" SHEET: M-10 64 OF 96
SPEC. NO.: 8529	FILE NO.: 100-25-2051



FUNCTIONAL ANALYSIS - VE PAYS  
SEQUENCE OF OPERATION FOR PROGRAMMABLE PROCESS CONTROL SYSTEM

NOTES: 1. SYMBOLS USED IN SEQUENCE OF OPERATION TEXT:

# INPUT/OUTPUT OR MESSAGE SIGNAL NUMBER.

Δ SEE DRAWING M-4.

- TAG NUMBER OR INPUT/OUTPUT NUMBER PROVIDED FOR CELL 1 / BAY 1 SIMILAR NUMBERS FOR OTHER 3 BAYS ARE REFERENCED HEREIN.

1. BAY OPERATIONAL ACTIVITY MANUAL SELECTION & AUTOMATIC EVALUATION

A) THE OPERATIONAL ACTIVITY OF THE BAY IS SET MANUALLY (HS-150) •. THE OPERATOR MAY SELECT ONE OF FOUR ACTIVITIES:

- "CONVENTIONAL" # (151) •
- "SOLVENT" # (152) •
- "PAINTING" # (153) •
- "DRYING" # (154) •

B) DETERMINE NEW "CELL HVAC OPERATING MODES"

WHEN A CHANGE IN BAY ACTIVITY IS REQUESTED FOR A BAY IN A CELL, THE CONTROL SYSTEM SHALL DETERMINE WHICH OF SEVEN MODES THE CELL WOULD BE PLACED IN, (TABLE 1) Δ, IF THE MANUAL SELECTION OF BAY ACTIVITY WERE EXECUTED.

C) DETERMINE "SHARED SUPPLY & EXHAUST FAN STATUS":

THE CONTROL SYSTEM SHALL DETERMINE THE REQUIRED "SHARED SUPPLY & EXHAUST FAN STATUS" REQUIRED TO SATISFY A SELECTED CHANGE IN BAY OPERATIONAL MODE (TABLE 3) Δ.

D) REQUIRED NEW SHARED SUPPLY & EXHAUST FAN STATUS EXCEEDING CAPABILITY OF SYSTEM:

IF A SELECTED CHANGE IN BAY OPERATION WOULD REQUIRE A CELL 1 & 2 MODE COMBINATION SELECTION NOT POSSIBLE" (SEE TABLE 3) Δ THEN DO NOT CHANGE THE CURRENT HVAC SERVICE TO THE BAYS AND ISSUE A MESSAGE "UNACCEPTABLE MODE COMBINATION" USING A LIGHTED INDICATOR # (105) • AT THE BAY HAND SWITCH # (151-154) • AND ISSUE A MESSAGE # (2051) •.

E) REQUIRED NEW SHARED SUPPLY & EXHAUST FAN STATUS DOES NOT EXCEED SYSTEM CAPABILITY:

IF THE "SHARED SUPPLY & EXHAUST FAN STATUS" REQUIRED TO MEET THE NEW REQUESTED BAY OPERATION IS NOT LISTED AS NOT POSSIBLE (TABLE 3) Δ THEN EXECUTE THE "BAY & CELL OPERATIONAL MODE CONVERSION SEQUENCE" AND CHANGE MODE INDICATOR LIGHT AT THE BAY LOCATED MANUAL CONTROL STATION # (150) • TO INDICATE THE NEW OPERATIONAL ACTIVITY SELECTED # (101, 102, 103, 104) •.

F) DRY ACTIVITY SELECTED:

IF ONE BAY IN A CELL IS PLACED IN THE DRY ACTIVITY, THE OTHER BAY IN THAT CELL SHALL ALSO BE MOVED TO THE DRY ACTIVITY. THE CONTROL SYSTEM SHALL ONLY ALLOW CONVERSION AFTER THE DRY ACTIVITY TO THE CONV. ACTIVITY. BOTH BAYS IN THE CELL UNDER THE DRY ACTIVITY WILL BE MOVED TO CONV. ACTIVITY IF THE OPERATOR SELECTS CONV. ACTIVITY IN EITHER BAY. IF OTHER THAN CONV. ACTIVITY IS SELECTED, ISSUE A MESSAGE AND ALARMS AS FOR #D. ABOVE.

G) ONLY ONE REQUEST FOR BAY ACTIVITY CHANGE ACCEPTED AT ONE TIME.

IF A REQUEST FOR BAY ACTIVITY CHANGE IS ISSUED # (151,152,153,154) • WHILE A PREVIOUS ACTIVITY CHANGE REQUEST IS UNDER EVALUATION OR WHILE IN THE "BAY & CELL OPERATIONAL MODE CONVERSION SEQUENCE", ISSUE A MESSAGE, AND LIGHTED INDICATOR AS IN "D" ABOVE.

2. BAY & CELL OPERATIONAL MODE CONVERSION SEQUENCE

CONVERSION FROM A CURRENT OPERATIONAL MODE TO A NEW MODE MUST BE ACCOMPLISHED IN A GRADUAL ORGANIZED STAGED SEQUENCE TO MAINTAIN SERVICE TO BAYS NOT CHANGING OPERATIONAL MODE.

THE CONTROL SYSTEM MUST NOT ALLOW ADJUSTMENT OF SUPPLY FAN SPEED TO RESULT IN "UNDER" OR "OVER" PRESSURIZATION OF THE BUILDING AND DUCTWORK. THEREFORE, FOR EACH SUPPLY FAN WHICH SHALL REQUIRE A CHANGE IN FAN SPEED, AN ADJUSTMENT IN DAMPER POSITION IS FIRST REQUIRED. (FAN "SPEED" REFERS TO HIGH OR LOW RPM)

A) STAGE 1 SUPPLY FAN STATUS (SF-1A,1B,2A,2B):

DETERMINE THE REQUIRED SPEED OF EACH OF THE FOUR SUPPLY FANS (TABLE 2) Δ.

DETERMINE WHICH SUPPLY FANS SHALL BE REQUIRED TO CHANGE SPEED FROM THE CURRENT SETTING.

B) STAGE 2 ADJUSTMENT OF SUPPLY FANS (SF-1A,1B,2A,2B):

IF A SUPPLY FAN SPEED MUST BE ADJUSTED FROM HALF TO FULL SPEED PLACE THE SET POINT FOR THE RETURN DAMPER IN THAT BAY TO 67350 CFM, AND THE SET POINT FOR THE OUTSIDE AIR DAMPER IN THAT BAY TO 67350 CFM, IN THAT BAY.

IF A SUPPLY FAN SPEED MUST BE ADJUSTED FROM FULL SPEED TO HALF SPEED, PLACE THE SET POINT FOR THE RETURN DAMPER IN THAT BAY AT 33675 CFM.

PLACE THE SET POINT FOR THE EXHAUST AIR DAMPERS FROM THE EFFECTED BAY SO THAT THE TOTAL "EXHAUST CFM FROM THE BAY" EQUALS THE SUPPLY FROM THE "SHARED SUPPLY" (A) Δ. ADJUST THE SUPPLY FAN SPEED UP OR DOWN # (181,182) •.

C) STAGE 3 ADJUSTMENT OF DAMPER FLOW RATE SET POINTS:

ADJUST THE DAMPER FLOW RATE SET POINTS FOR THE SUPPLY AIR FLOW RATE (A) Δ, RETURN AIR FLOW RATE (C) Δ OUTSIDE AIR FLOW RATE (I) Δ AND EXHAUST CFM (TABLE 2) Δ. MAKE THE ADJUSTMENT IN 10 EQUAL STEPS WITH AN ADJUSTABLE TIME DELAY BETWEEN STEPS OF 30 SECONDS TO 60 SECONDS. THE CONVERSION SEQUENCE IS SUCCESSFUL WHEN ALL MEASURED FLOWS ARE WITHIN ±10% OF THEIR SET POINTS.

3. SHARED SUPPLY FANS (SF-3A,B,C,D,E,F)

A) SF-3A & F:

IF THE "MODE OF THE TWO CELLS" (TABLE 3) Δ FOR THE CURRENT OR FOR NEXT REQUIRED MODE REQUIRES MORE THAN ZERO SUPPLY FANS, SF-3A AND SF-3F SHALL RUN # (081,086) MODULATE THE VIV (VARIABLE INLET VANES) ON THESE FANS # (091,096) IN UNISON TO MAINTAIN THE SUPPLY DUCT PRESSURE # (032) •. IF THE DUCT PRESSURE IS LOW, INCREASE THE AIR FLOW RATE AND IF HIGH, DECREASE THE FLOW RATE.

B) STAGING OF SUPPLY FANS (SF-3B,C,D,E.):

IF THE VARIABLE INLET VANES ON SF-3A AND SF-3F ARE DRIVEN TO 80% FULL FLOW, START AN ADDITIONAL FAN. IF THESE VARIABLE INLET VANES ARE DRIVEN TO 20% FULL FLOW, SHUT DOWN AN ADDITIONAL FAN.

PROVIDE AN ADJUSTABLE TIME DELAY (ABOUT 20 SECONDS) BETWEEN START UP & SHUT DOWN OF FANS.

4. SHARED EXHAUST FANS (EF-1A,B,C,D,E,F,G,H)

THE EXHAUST FANS SHALL BE CONTROLLED IN A MANNER SIMILAR TO THE SHARED SUPPLY FANS.

A) EF-1A & H:

EF-1A & 1H # (071,078) SHALL RUN AT ALL TIMES IF THE "MODE OF THE TWO CELLS" (TABLE 2) Δ INDICATES THE NUMBER OF EXHAUST FANS TO BE OTHER THAN ZERO.

VARIABLE INLET VANES ON EF-1A & 1H SHALL BE CONTROLLED IN UNISON # (092,098) TO SATISFY DUCT PRESSURE # (032) AIR FLOW SHALL BE INCREASED IF DUCT PRESSURE IS TOO HIGH AND DECREASED IF DUCT PRESSURE IS TOO LOW.

B) STAGING OF EXHAUST FANS (EF-1B,C,D,E,F,G):

THESE FANS SHALL BE STAGED, IF THE VARIABLE INLET VANES (EF-1A & 1H) OPEN TO 80% FULL FLOW, START AN ADDITIONAL FAN. IF THE VANES CLOSE TO 20% FULL FLOW SHUT DOWN ONE FAN.

PROVIDE AN ADJUSTABLE TIME DELAY (ABOUT 20 SECONDS) BETWEEN START-UP & SHUT-OFF FANS.

5. SEQUENCE OF SHARED SUPPLY FAN START-UP & SHUT-DOWN

PRECEDENCE OF FAN STARTING ORDER SHALL BE ROTATED BETWEEN SF-3B,C,D, & E # (082,083,084,085) TO PROVIDE APPROXIMATELY EQUAL TOTAL RUN TIMES FOR EACH FAN. CHANGE THE ORDER OF PRECEDENCE WHEN ANY ONE FAN ACCUMULATES AN ADJUSTABLE ADDITIONAL RUN TIME OF ABOUT 24 HRS.

6. SEQUENCE OF EXHAUST FAN START-UP & SHUT DOWN

PRECEDENCE OF EXHAUST FAN (EF-1B,C,D,E,F,G) STARTING ORDER # (072,073,074,075,076,077) SHALL BE ROTATED IN A MANNER SIMILAR TO SUPPLY FANS (SF-3B,C,D,E).

7. HYDROCARBON VAPOR DETECTION & REMOVAL

A) DETECTION:

IF COMBUSTIBLE VAPOR CONCENTRATIONS ARE MEASURED AT OR ABOVE 50 PARTS PER MILLION DURING THE DRY ACTIVITY IN ANY BAY, THE CONTROL SYSTEM IN THAT BAY SHALL ATTEMPT TO SWITCH THE BAY TO SOL ACTIVITY, AS IF THE SOL ACTIVITY WERE SELECTED MANUALLY (SEE 1.A. ABOVE). IF THIS CONVERSION IS DETERMINED TO BE "NOT POSSIBLE" (SEE 1.E ABOVE) THEN WAIT FIVE MINUTES AND ATTEMPT THE ABOVE CONVERSION (SEE 1.A.ABOVE) IF AFTER THREE ATTEMPTS THE SOLVENT CONCENTRATION FOR THE BAY IS STILL ABOVE 50 PARTS PER MILLION AND CONVERSION TO THE SOL ACTIVITY IS NOT ACCOMPLISHED, SOUND AN ALARM # (2000, 2002). ACTIVATE THE STROBE # (2001) AND ISSUE A MESSAGE # (2145) •. IF THE COMBUSTIBLE VAPOR CONCENTRATION EXCEEDS 100 PARTS PER MILLION DURING ANY ACTIVITY, INCLUDING THE SOL ACTIVITY, SOUND ALARMS # (2000, 2002) ACTIVATE THE STROBE # (2001) AND ISSUE A MESSAGE # (2146) AND ATTEMPT THE CONVERSION TO THE SOL ACTIVITY. IF NOT CURRENTLY OPERATING IN THE SOL ACTIVITY) AS DESCRIBED ABOVE FOR 50 PPM, IF THIS CONVERSION TO THE SOL ACTIVITY IS NOT ACCOMPLISHED AFTER THREE ATTEMPTS, THE ALARMS, STROBE AND MESSAGE # (2000, 2001, 2002) AND (2146) • WILL HAVE BEEN PREVIOUSLY ISSUED AND SO THE NOTIFICATION LISTED FOR 50 PPM DETECTED WOULD NOT BE REQUIRED. CONTINUE TO ATTEMPT CONVERSION TO THE SOL ACTIVITY. IF THE COMBUSTIBLE VAPOR CONCENTRATION EXCEEDS 100 PARTS PER MILLION AND THE SEQUENCE INITIATED BY DETECTION AT OR ABOVE 25% OF THE LOWER EXPLOSIVE LIMIT HAS NOT BEEN INITIATED.

IF COMBUSTIBLE VAPOR CONCENTRATION IS MEASURED AT OR ABOVE 25% THE LOWER EXPLOSIVE LIMIT IN ANY BAY # (151,143,144) • OR IN THE TRENCH EXHAUST SYSTEM # (142) 442 OR ANY OF THE BAY TRENCHES # (145,146) • THEN THE HVAC SYSTEM FOR ALL FOUR BAYS SHALL SWITCH INTO THE "EMERGENCY VAPOR EXHAUST MODE".

B) EMERGENCY VAPOR EXHAUST MODE:

A MESSAGE INDICATING LOCATION OF VAPOR DETECTION SHALL BE ISSUED EXAMPLE: "COMBUSTIBLE VAPOR IN EXHAUST EXCEEDS 25% LEL EXHAUST CELL 2, BAY A" # (2144,2141,2143,2142) • # (2041, 2042) A TROUBLE ALARM SHALL BE ISSUED # (2000) PAINTING COMPRESSED AIR SHALL BE SHUT OFF BY CLOSING SOLENOID # (591) • A STROBE # (2001) AND ALARM # (2002) IN EACH BAY SHALL BE ACTIVATED.

C) HVAC SYSTEM OPERATION DURING EMERGENCY VAPOR EXHAUST MODE:

ALL OUTSIDE AIR DAMPERS SHALL BE OPENED FULL # (198) • ALL SUPPLY AIR DAMPERS SHALL BE OPENED FULL # (197) • ALL EXHAUST AIR DAMPERS SHALL BE OPENED FULL # (191,192,193,194,195) • ALL RETURN AIR DAMPERS SHALL BE OPENED FULL # (196) • ALL FOUR OF THE SUPPLY FAN (SF-1A,B & 2A,B) SHALL BE MOVED TO FULL SPEED # (181,182) •.

FIVE OF THE SIX SHARED SUPPLY FANS (SF-3A,B,C,D,E,F) SHALL BE STARTED UP # (081,082,083,084,085,086) WITH THE VARIABLE INLET VANES AT FULL FLOW # (091,096) •.

ALL EIGHT EXHAUST FANS (EF-1A,B,C,D,E,F,G,H) SHALL BE STARTED # (071,072,073,074,075,076,077,078) WITH THE VARIABLE INLET VANES AT FULL FLOW # (092,098) •.

BOTH TRENCH EXHAUST FANS (EF-7,8) SHALL BE STARTED IF NOT ALREADY RUNNING # (061,062) •.

8. BAY HEATING

IF THE PUMP SERVING THE EC (EC-1A) • IS NOT RUNNING OR IF THE EC IS UNDER CONTROL OF THE HUMIDITY SENSOR # (122) •, THE HEATING COIL (HC-1A) • SHALL BE USED FOR SPACE TEMPERATURE CONTROL. IF BAY ROOM TEMPERATURE # (121) IS ABOVE THE SET POINT, # (001,002,003) FOR THE CURRENT BAY ACTIVITY, THE HEATING COIL BANK TEMPERATURE CONTROL VALVE (TCV-1A) • SHALL BE MODULATED TO REDUCE FLOW OF HOT WATER # (171) •. THE TCV SHALL SIMILARLY BE MODULATED TO INCREASE FLOW OF HOT WATER THROUGH THE COIL BANK IF THE ROOM TEMPERATURE IS BELOW SET POINT.

9. BAY COOLING

IF THE EC (EC-1A) • IS NOT UNDER CONTROL OF THE HUMIDITY SENSOR # (122) • AND THE TEMPERATURE CONTROL VALVE (TCV-1A) • IS SET AT MINIMUM FLOW THROUGH THE HEATING COIL THEN THE PUMP SERVING THE EC SHALL BE STARTED IF NOT RUNNING # (161) • AND THE FACE AND BYPASS DAMPERS SERVING THE EC (MD-5A,MD-6A-1,2,3,4) • SHALL BE MODULATED # (163,162) • TO SATISFY ROOM TEMPERATURE # (121) •. MORE AIR SHALL BE ALLOWED TO FLOW THROUGH THE EC IF BAY ROOM TEMPERATURE IS HIGH AND LESS IF TEMPERATURE IS LOW.

IF ONE BAY OF A CELL IS USED FOR PAINTING AND THE EC SERVING THAT BAY IS UNDER THE CONTROL OF THE HUMIDITY SENSOR, THE EC SERVING OTHER BAY SHALL ALSO BE UNDER CONTROL OF ITS HUMIDITY SENSOR, TO AVOID INTERFERENCE WITH PAINTING HUMIDITY CONTROL.

THE CONVENTIONAL HVAC CONFIGURATION INCLUDES A HIGH VOLUME OF RECIRCULATED AIR WHEN A BAY IN A CELL IS "CONV." AND THE OTHER BAY IN THAT CELL IS OTHER THAN "CONV." (MODES 1 & 5) THE EC SERVING THE CONV BAY SHALL NOT BE USED, AND COOLING SHALL BE ACCOMPLISHED BY THE EC SERVING THE OTHER BAY. IF A CELL IS IN MODE 4 (BOTH BAYS "CONV") AND COOLING IS REQUIRED OF THE EC UNITS SERVING THAT CELL, CLOSE THE RETURN AIR DAMPER # (196) •, AND PLACE THE SET POINT FOR ONE OF THE BAY EXHAUST DAMPERS IN EACH BAY AT 30250 CFM.

10. BAY HUMIDIFICATION

A) HUMIDITY CONTROL REQUIRED:

IF THE BAY IS IN USE FOR PAINTING (HS-150) • AND THE BAY HUMIDITY SENSOR # (122) • INDICATES HUMIDITY IS ABOVE THE HIGH SET POINT # (004) • OR BELOW THE LOW SET POINT # (005) • THE EC (EC-1A) • SHALL OPERATE UNDER THE CONTROL OF THE HUMIDITY SENSOR.

B) EC OPERATION UNDER "CONTROL OF BAY HUMIDITY SENSOR":

IF BAY HUMIDITY IS ABOVE THE HIGH SET POINT # (004) REDUCE FLOW OF AIR THROUGH THE EC BY MODULATING THE FACE AND BYPASS DAMPERS # (162,163) •.

IF BAY HUMIDITY IS BELOW THE LOW SET POINT # (005) •, POWER THE EC PUMP # (161) • AND INCREASE FLOW THROUGH THE EC BY MODULATING THE FACE AND BYPASS DAMPERS # (162,163) •.

11. FILTER BANK EXCESSIVE PRESSURE DROP

IF PRESSURE DROP THROUGH A FILTER BANK EXCEEDS THE LEVEL BELOW, SOUND A TROUBLE ALARM # (2000) AND ISSUE A MESSAGE INDICATING THE SUBJECT FILTER BANK AND ITS LOADED CONDITION

EXAMPLE: "HIGH PRESSURE DROP: F-1A" # (2131-2134) •

F-1A,B,C,D	0.80 IN WC	# (134) •
F-2A,B,C,D	0.50 IN WC	# (133) •
F-3A,B,C,D	0.75 IN WC	# (131) •
F-4A,B,C,D	0.75 IN WC	# (131) •
F-5A,B,C,D	3.0 IN WC	# (132) •
F-6A,B,C,D		

HAND MODE OF PROCESS FAN STARTERS SHALL BE DISABLED TO PREVENT OVER PRESSURIZATION PER RFI 146, SEE SHEET E-13

12. EXCESSIVE SUPPLY AIR PRESSURE OR EXHAUST AIR PRESSURE

IF THE SUPPLY AIR DUCT PRESSURE EXCEEDS 6 INCHES WATER COLUMN # (031) SHUT DOWN AIR SUPPLY FANS # (081-086) •. IF THE EXHAUST DUCT NEGATIVE PRESSURE EXCEEDS 8 INCHES WATER COLUMN # (032) SHUT DOWN AIR EXHAUST FANS # (071-078) •. ISSUE A TROUBLE ALARM # (2000) AND ISSUE THE APPROPRIATE MESSAGE # (2031 OR 2032) •.

13. EXCESSIVE PLENUM PRESSURE

IF PLENUM PRESSURE EXCEEDS +20 POUNDS PER SQUARE FOOT FOR THE SUPPLY PLENUM # (135) • OR -25 POUNDS PER SQUARE FOOT FOR THE EXHAUST PLENUM # (136) • OR 3 1/2 POUNDS PER SQUARE FOOT # (133) • FOR THE DOOR PLENUM, OR ±2.5 POUNDS PER SQUARE FOOT # (137) • FOR THE PAINT CELL, THEN SHUT DOWN ALL PROCESS FANS # (181) •, 081-086,071-078) SOUND AN ALARM # (2000) AND DISPLAY A MESSAGE INDICATING EXCESSIVE PLENUM OR BUILDING PRESSURE # (2035) •.

14. BREATHING AIR UNIT TROUBLE (BAU-1)

IF A TROUBLE SIGNAL IS ISSUED BY THE BREATHING AIR UNIT, # (593) •, ISSUE AN ALARM # (2000) AND A MESSAGE # (2091) •. SHUT OFF THE PAINTING COMPRESSED AIR SUPPLY # (591) AND BREATHING AIR SUPPLY # (592) •. ISSUE AN ALARM IN EACH BAY # (2003) AND ACTIVATE A STROBE IN EACH BAY # (2001) •.

15. OPERATING VARIABLE DISPLAY

PROVIDE DISPLAY OF OPERATING VARIABLES (NUMBERS FROM 1000 TO 1999) AS LISTED IN THE "OPERATING VARIABLE DISPLAY MESSAGE" TABLE. VARIABLES SHALL BE DISPLAYED BY SCROLLING THE GRAPHIC DISPLAY.

16. VARIABLE SET POINTS

SET POINTS FOR TEMPERATURE, HUMIDITY AND DURATIONS SHALL BE RE-SETTABLE BY THE OPERATOR WITHOUT ALTERING SOFTWARE. # (001,002,003,004,005, 011,012,013,014,015,016,017,018) •.

17. SMOKE DETECTION

IF SMOKE IS DETECTED IN THE RETURN AIR # (147) • OR SUPPLY AIR # (148) •, SHUT DOWN THE SUPPLY FAN # (181) • AND ISSUE A TROUBLE ALARM # (2000) AND TROUBLE MESSAGE # (2147) •.

18. FIRE ALARM CONDITION

IF THE BUILDING FIRE SYSTEMS RELAY A FIRE DETECTED SIGNAL INDICATING A FIRE IN CELL 1 OR CELL 2 # (710,720) •, THE SUPPLY FANS AND EXHAUST FANS SERVING THE PAINT CELLS SHALL BE SHUT DOWN (SF-1A,B,2A,B,3A,B,C,D,E,F) (EF-1A,B,C,D,E,F,G,H) # (081,082,083,084,085,086) # (071,072,073,074,075,076,077,078) # (181,182) •.

SHUT DOWN OF THE AIR FLOW WILL ALLOW RISING HOT AIR FROM A FIRE TO OPEN SPRINKLERS DIRECTLY ABOVE THE FIRE. ISSUE MESSAGE # (2500)

19. SYSTEM "RE-START"

(START-UP OR FOLLOWING POWER FAILURE, OR EMERGENCY SHUT DOWN CONDITION)

IF THE SYSTEM IS OPERATING IN A MODE COMBINATION NOT LISTED (TABLE 3) Δ, THE SYSTEM MAY ONLY BE MOVED TO MODE 4 IN BOTH CELLS. AFTER THE SUCCESSFUL COMPLETION OF THE CONVERSION TO THIS MODE COMBINATION, THE OPERATOR MAY SELECT ANOTHER BAY ACTIVITY.

20. FAILURE OF "BAY & CELL OPERATIONAL MODE CONVERSION SEQUENCE"

IF THE "CONVERSION SEQUENCE" EXTENDS OVER A PERIOD OF TEN MINUTES AND IS NOT YET SUCCESSFUL SOUND AN ALARM # (2000) AND ISSUE A MESSAGE # (2092) •. UNSUCCESSFUL PROCESS AIR MODE CONVERSION, CONTINUE TO ATTEMPT THE CONVERSION SEQUENCE UNTIL IT IS SUCCESSFUL OR UNTIL A NEW ACTIVITY SELECTION IS MADE # (151,152,153,154) •, UNDER THIS CONDITION ONLY A CONVERSION TO THE CONVENTIONAL MODE IS ACCEPTABLE. ALL OTHER SELECTIONS WILL ISSUE AN "UNACCEPTABLE MODE COMBINATION" MESSAGE # (2051) •.

21. ALARMS & STROBE DURATION

ALARMS AND STROBES WILL CONTINUE AFTER INITIATED, UNTIL SILENCED BY OPERATOR CONTROLLED SILENCE SWITCH # (006) • LOCATED IN THE OFFICE NEAR THE GRAPHIC DISPLAY. ALL ALARMS FOR SEPARATE CONDITIONS SHALL BE UNIQUE AND AUDIBLY DISTINGUISHABLE FROM EACH OTHER AND FROM THE FIRE ALARMS # (2000, 2002, 2003) •.

22. HOT WATER GENERATION CONTROLS

A. HX CAPACITY SHALL BE MODULATED BY CONTROLLING # (571) THE STEAM TCV VALVE (TCV-4) TO MAINTAIN HWS TEMPERATURE LEAVING THE HX AT THE SPECIFIED SUPPLY TEMPERATURE WHEN HOT WATER IS FLOWING # (521) •.

B. IF HEATING IS REQUIRED FOR ONE OR MORE BAYS, START BOTH OF THE LARGE PUMPS (P-1A/B) # (561,562) •.

C. OUTDOOR AIR TEMPERATURE BELOW 40°F (FREEZE HAZARD) # (021) •, SHALL CAUSE INITIATION OF FLOW THROUGH THE PROCESS HWS PUMPS (P-1A/B) AND THE CONVENTIONAL HWS PUMP (P-2) (IF NOT OPERATING FOR BUILDING HEATING AT THAT TIME) TO PREVENT FREEZING # (561,562,563) •, ISSUE A MESSAGE INDICATING FREEZE PREVENTION OPERATIONAL MODE # (2551) •.

D. THE PROCESS HWS PUMPS SHALL OPERATE AS LONG AS THE PROCESS AIR (CELL HVAC SYSTEM) DEMANDS HEATING OR OUTDOOR TEMPERATURE IS BELOW 40°F. THE CONVENTIONAL HWS PUMP SHALL RUN AT ALL TIMES.

23. PAINT MIX AREA PROCESS VENTILATION:

EVAPORATIVE COOLING UNIT (ECU-1) SHALL BE CONTROLLED FOR CONTINUOUS OPERATION. RETURN/EXHAUST FAN (EF-5) SHALL BE INTERLOCKED WITH ECU-1 TO OPERATE SIMULTANEOUSLY. A TEMPERATURE SENSOR SENSING OUTSIDE AIR TEMPERATURE # (021) AND ROOM TEMPERATURE # (631) SHALL BE IN SEQUENCE START/STOP RECIRCULATING WATER PUMP # (661) AND MODULATE # (671) HOT WATER VALVE (TCV-2) •.

COOLING MODE IS DEFINED AS OUTDOOR AIR TEMPERATURE GREATER THAN 75°F. OUTSIDE AIR DAMPER SHALL BE 100% OPEN # (693) •, RETURN AIR DAMPER CLOSED # (693) AND EXHAUST AIR DAMPER OPEN # (692) •.

ECONOMIZER MODE IS DEFINED AS OUTDOOR AIR TEMPERATURE LESS THAN 75°F AND GREATER THAN 60°F. OUTSIDE AIR DAMPER, RETURN AIR DAMPER AND EXHAUST AIR DAMPER SHALL BE MODULATED # (694,693,692) BY ROOM TEMPERATURE SENSOR # (631) •.

HEATING MODE IS DEFINED AS OUTDOOR AIR TEMPERATURE LESS THAN 60°F. OUTSIDE AIR DAMPER SHALL BE SET AT MINIMUM OPEN POSITION # (694) •, RETURN AIR DAMPER OPEN # (693) AND EXHAUST AIR DAMPER CLOSED # (692) •.

EMERGENCY MODE IS DEFINED AS COMBUSTIBLE GAS MONITOR # (641) TRU SENSOR # (641) IN RETURN/EXHAUST AIR DUCT, INDICATES LEVELS OF COMBUSTIBLE GAS ABOVE 25% OF THE LOWER EXPLOSIVE LIMIT. ISOLATION DAMPER IN RETURN AIR DUCT SHALL CLOSE # (691) •, EXHAUST DAMPER OPEN # (692) •, OUTSIDE AIR DAMPER OPEN # (694) AND RETURN AIR DAMPER CLOSED # (693) •. SOUND A TROUBLE ALARM # (2000) WITH A MESSAGE "COMBUSTIBLE VAPOR EXCEEDING 25% LEL IN PAINT STORAGE ROOM" # (2641) •.

EXHAUST AIR FAN EF-4 IN MIX ROOM SHALL BE CONTROLLED FOR CONTINUOUS OPERATION # (682) •. AIR FLOW SWITCH SHALL MONITOR EF-4 AND EF-5 FOR REMOTE ALARM UPON FAILURE # (611,612) •, # (2000) •. A TROUBLE MESSAGE SHALL BE PROVIDED # (2611) OR # (2612) •.

24. DAMPER CONTROL & "SET POINTS"

DAMPERS SHALL BE MODULATED TO SATISFY THE CURRENT "SET POINT". AIR FLOW SHALL BE MEASURED AT THE DAMPER THROUGH THE FLOW ELEMENT LOCATED AT THE DAMPER. DAMPER ACTUATORS SHALL BE MODULATED MORE OPEN OR CLOSED AS REQUIRED TO DRIVE THE MEASURED FLOW TO THE "SET POINT". THE AIR FLOW (CFM) MEASURED SHALL BE DETERMINED BY MULTIPLYING THE MEASURED AIR VELOCITY BY ACTUAL FLOW AREA AT THAT LOCATION. OUTSIDE AIR THROUGH MD-3A,B,C,D SHALL BE DETERMINED BY DEDUCTING THE RETURN AIR FLOW # (FE116) • FROM THE MIXED RETURN AND OUTSIDE AIR # (FE118) •.

25. PROCESS AIR VENTILATION SYSTEM ACCESS SAFETY INTERLOCK

PROVIDE POSITION SWITCHES # (038,039) AND LIGHTED INDICATOR ON EACH OF THE TWO EXTERIOR ACCESS DOORS TO THE MECHANICAL EQUIPMENT SPACE ABOVE THE SUPPORT BUILDING. IF ANY OF THE FANS (SF-3A,B,C,D,E,F) ARE IN OPERATION (RUNNING) THEN POWER THE LIGHTED INDICATORS # (2035) •. PROVIDE AN ENGRAVED PLASTIC SIGN NEXT TO BOTH INDICATORS READING "DO NOT ENTER WHEN LIGHT IS ON, INDICATING SUPPLY FANS ARE RUNNING". IF THE DOOR MOUNTED POSITION SWITCH INDICATES THE DOORS ARE AJAR, DEACTIVATE THE SHARED SUPPLY FANS (SF-3A,B,C,D,E,F) AND ISSUE AN ALARM # (2000) AND A TROUBLE MESSAGE # (2036) •.

26. OPERATION OF CONTROL SYSTEM DURING AIR BALANCE AT SYSTEM START-UP

AIR FLOW RATES LISTED IN (TABLE 2) Δ MAY REQUIRE ADJUSTMENT TO ACCOMMODATE ACTUAL CONSTRUCTED CONDITIONS (EXAMPLE PLENUM LEAKAGE OF AIR, DUCTWORK PRESSURE LOSS) THE LISTED AIR FLOW RATES SHALL BE ADJUSTABLE USING A PORTABLE PROGRAMMING STATION. THE SEQUENCE REQUIRED SHALL BE CONVENIENT AND SHALL REQUIRE NO MORE THAN ONE INPUT FOR ONE VARIABLE LISTED (TABLE 2) Δ.

27. AUTOMATIC MODE

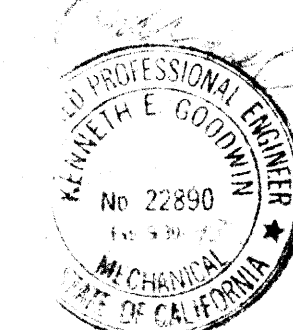
DURING THE PAINT AND DRY ACTIVITIES, A TIME CLOCK WILL ATTEMPT TO SWITCH THE SYSTEM TO THE NEXT ACTIVITY AS IF A MANUAL SELECTION WERE MADE (SEE 1.A. ABOVE). THE TIME DURATION SHALL BE OPERATOR ADJUSTABLE FOR EACH BAY AND BOTH ACTIVITIES # (011, 012, 013, 014, 015, 016, 017, 018) •. IF THE REQUESTED CONVERSION IS "NOT POSSIBLE" (SEE 1.E ABOVE) THEN REQUEST THE CONVERSION AT TEN MINUTES INTERVALS UNTIL IT IS POSSIBLE. THE SYSTEM WILL CONVERT FROM THE PAINT ACTIVITY TO THE DRY ACTIVITY (OR TO THE SOL ACTIVITY IF HYDROCARBON VAPOR IN THE BAY EXCEED 50 PARTS PER MILLION) AND FROM THE DRY CYCLE WILL CONVERT TO THE CONVENTIONAL CYCLE.

A. Reference is made to company RFI 880 states conflicts exist between unit heater and water heater sequence. The control of Unit-1 through Unit-4 is to be per drawing M-9, note 1, and Section 1550, paragraph 1.1.2. The 2003 is to monitor the heating system controls only, and is required for both buildings, per drawing M-14, through Unit-1 through Unit-4. The control of Unit-1 through Unit-4 is to be accomplished with local controls. Operation is called out on drawing M-10 (Sequence of Operation). For Unit-1 through Unit-4, one thermostat only is required for control. All units 1-6 shall turn on and off at the same time.

-NO ADDITIONAL OFF BUTTON FOR THE BUILDING HVAC IS REQUIRED

SEE RFI-130

ADDITIONAL TEMPERATURE SENSORS WILL BE NEEDED TO AVOID CREATING LARGE TEMPERATURE SPINGS DURING THE HEATING SEQUENCES PER RFI 126



NORMAN ENGINEERING CO. CONSULTING ENGINEERS LOS ANGELES, CALIFORNIA		DEPARTMENT OF THE ARMY SACRAMENTO DISTRICT, CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA	
DESIGNED BY E. ABRAMIAN	MCCLELLAN AIR FORCE BASE CALIFORNIA		
DRAWN BY D. LOPEZ	ADAL DEPOT CORROSION CONTROL FACILITY NEW AIRCRAFT PAINT FACILITY		
CHECKED BY K. GOODWIN	SEQUENCE OF OPERATION		
SUBMITTED BY <i>[Signature]</i>	DATE 9/30/92	SCALE 1" = 1'-0"	SHEET M-11 65 OF 95
		FILE NO. 100-25-2051	8529



# FUNCTIONAL ANALYSIS - VE PAYS

## PROCESS CONTROL I/O LISTING FOR PROGRAMMABLE PROCESS CONTROL SYSTEM

TAG NUMBERS	TYPE	FUNCTION	REF	REMARK
111-115, 211-215 311-315, 411-415	AI	EXHAUST AIR FLOW	M-4	1000 TO 3000 FPM
116, 216, 316, 416	AI	RETURN AIR FLOW	M-4	500 TO 3000 FPM
117, 217, 317, 417	AI	SUPPLY AIR FLOW	M-4	500 TO 3000 FPM
118, 218, 318, 418	AI	OUTSIDE AIR FLOW	M-4	0 TO 600 FPM
121, 221, 321, 421	AI	BAY ROOM AIR TEMPERATURE	M-4	0 TO 150°F
122, 222, 322, 422	AI	BAY ROOM AIR HUMIDITY	M-4	0 TO 100% RELATIVE HUMIDITY @ 40 TO 150°F
131, 431	AI	AIR PRESSURE DROP ACROSS FILTER	M-4	0-5 INCHES WC
132, 432	AI	AIR PRESSURE DROP ACROSS FILTER	M-4	0-5 INCHES WC
133, 233, 333, 433	AI	PRESSURE DROP ACROSS FILTER	M-4	0-5 INCHES WC
134, 234, 334, 434	AI	PRESSURE DROP ACROSS FILTER	M-4	0-5 INCHES WC
135, 235, 335, 435	DI	PLENUM PRESSURE	M-4	RELATIVE TO BUILDING EXTERIOR
136, 436	DI	PLENUM PRESSURE	M-4	RELATIVE TO BUILDING EXTERIOR
137, 437	DI	PAINT CELL PRESSURE	M-4	RELATIVE TO BUILDING EXTERIOR
141, 241, 341, 441	AI	MONITOR COMBUSTIBLE VAPORS	M-4	0 TO 100% LOWER EXPLOSIVE LIMIT
142, 442	AI	MONITOR COMBUSTIBLE VAPORS	M-10	0 TO 100% LOWER EXPLOSIVE LIMIT
143, 243, 343, 443	AI	MONITOR COMBUSTIBLE VAPORS	M-4	0 TO 100% LOWER EXPLOSIVE LIMIT
144, 244, 344, 444	AI	MONITOR COMBUSTIBLE VAPORS	M-4	0 TO 100% LOWER EXPLOSIVE LIMIT
145, 146, 245, 246 345, 346, 445, 446	AI	MONITOR COMBUSTIBLE VAPORS	M-10	0 TO 100% LOWER EXPLOSIVE LIMIT
147, 247, 347, 447	DI	DETECT SMOKE IN RETURN AIR	M-4	CONNECT TO FIRE ALARM SYSTEM FOR RPT TO ROOMS, RPT 14
148, 248, 348, 448	DI	DETECT SMOKE IN SUPPLY AIR	M-4	
611	DI	FLOW SWITCH AT EF-4	M-10	
612	DI	FLOW SWITCH AT EF-5	M-10	
631	AI	ROOM TEMPERATURE	M-10	0-110°F 0-110°F
641	DI	MONITOR COMBUSTIBLE VAPORS	M-10	0 TO 100% LOWER EXPLOSIVE LIMIT
031	AI	SUPPLY DUCT PRESSURE	M-4	0-10 IN WC ADJUSTABLE
032	AI	EXHAUST DUCT PRESSURE	M-4	0-10 IN WC (NEGATIVE) ADJUSTABLE
021	AI	OUTDOOR AIR TEMPERATURE	M-5	-20-120°F
022	AI	OUTDOOR HUMIDITY	M-5	0-100% RH @ 0-120°F
521	AI	WATER TEMPERATURE LEAVING HX-1	M-5	0-250°F
710, 720, 730	DI	FIRE DETECTED SIGNAL FROM FIRE PROTECTION SYSTEM	FP-1	
151, 251, 351, 451	DI	BAY IN CONV. MODE	M-4	SENSOR SWITCHES LOCATED INSIDE BAY CONTROLLED
152, 252, 352, 452	DI	BAY IN SOL. MODE	M-4	SENSOR SWITCHES LOCATED INSIDE BAY CONTROLLED
153, 253, 353, 453	DI	BAY IN PAINT MODE	M-4	SENSOR SWITCHES LOCATED INSIDE BAY CONTROLLED
154, 254, 354, 454	DI	BAY IN DRY MODE	M-4	SENSOR SWITCHES LOCATED INSIDE BAY CONTROLLED
593	DI	BREATHING AIR UNIT TROUBLE	M-5	(DRY CONTACT ON BAU-1)
161, 261, 361, 461	DO	EC PUMP MOTOR STARTER ON/OFF	M-4	
162, 262, 362, 462	AO	EC FACE DAMPER ACTUATOR MODULATION	M-4	
163, 263, 363, 463	AO	EC BY-PASS DAMPER ACTUATOR MODULATION	M-4	
171, 271, 371, 471	AO	TCV ACTUATOR MODULATION SERVING BAY HEATING	M-5	
191 TO 195, 291 TO 295 391 TO 395, 491 TO 495	AO	EXHAUST DAMPER ACTUATOR MODULATION	M-4	
196, 296, 396, 496	AO	RETURN AIR DAMPER ACTUATOR MODULATION	M-4	
197, 297, 397, 497	AO	SUPPLY AIR DAMPER ACTUATOR MODULATION	M-4	
198, 298, 398, 498	AO	OUTSIDE AIR DAMPER ACTUATOR MODULATION	M-4	
181, 281, 381, 481	DO	SUPPLY FAN MOTOR STARTER LOW SPEED	M-4	
182, 282, 382, 482	DO	SUPPLY FAN MOTOR STARTER HIGH SPEED	M-4	
081 TO 086	DO	SUPPLY FAN MOTOR STARTER OFF/ON	M-4	
091, 096	AO	VARIABLE INLET VANE ACTUATOR MODULATION	M-4	
071 TO 078	DO	EXHAUST FAN MOTOR STARTER OFF/ON	M-4	
092, 098	AO	VARIABLE INLET VANE ACTUATOR MODULATION	M-4	
561, 562, 563	DO	HOT WATER PUMP MOTOR STARTER OFF/ON	M-5	
571	AO	STEAM TCV ACTUATOR MODULATION	M-5	
591	DO	PAINT COMPRESSED AIR FLOW CONTROL VALVE SOLENOID OPEN/CLOSE	M-5	FAIL CLOSED
592	DO	BREATHING COMPRESSED AIR FLOW CONTROL VALVE SOLENOID OPEN/CLOSE	M-5	
061, 062	DO	TRENCH EXHAUST FAN MOTOR STARTER ON/OFF	M-10	
681	DO	EF-5 MOTOR STARTER ON/OFF	M-10	
682	DO	EF-4 MOTOR STARTER ON/OFF	M-10	
683	DO	ECU-1 MOTOR STARTER ON/OFF	M-10	
661	DO	ECU-1 PUMP MOTOR ON/OFF	M-10	
691	DO	MD-7-A ACTUATOR OPEN/CLOSE	M-10	
692	AO	MD-7-B ACTUATOR MODULATION	M-10	
693	AO	ECU-1 RETURN DAMPER ACTUATOR MODULATION	M-10	
694	AO	ECU-1 OUTSIDE AIR ACTUATOR MODULATION	M-10	

The outside Humidity Element/Transmitter 022 is to be wired as an override to ECU-1. When the room thermostat calls for cooling and Humidity Element/Transmitter 022 reads an outside humidity value of 75% or greater (relative humidity), the ECU-1 water pump for the cooling pads shall be prevented from running. When the outside humidity falls below 75% (relative humidity) and cooling is required, the ECU-1 water pump will be allowed to activate.

## PROCESS CONTROL I/O LISTING FOR PROGRAMMABLE PROCESS CONTROL SYSTEM

TAG NUMBERS	TYPE	FUNCTION	REF	REMARK
2000	DO	TROUBLE ALARM	M-4	NEAR GRAPHIC DISPLAY IN OFFICE
2001	DO	STROBE	M-4	ONE IN EACH CELL INDICATES TROUBLE CONDITION
2002	DO	ALARM (SOLVENT VAPOR)	M-4	ONE IN EACH CELL INDICATES HIGH SOLVENT VAPOR
2003	DO	ALARM (BREATHING AIR)	M-4	ONE IN EACH CELL INDICATES BREATHING AIR FAILURE
101, 201, 301, 401	DO	INDICATE BAY IN CONV ACTIVITY	M-4	INDICATOR LIGHT
102, 202, 302, 402	DO	INDICATE BAY IN SOL ACTIVITY	M-4	INDICATOR LIGHT
103, 203, 303, 403	DO	INDICATE BAY IN PAINT ACTIVITY	M-4	INDICATOR LIGHT
104, 204, 304, 404	DO	INDICATE BAY IN DRY ACTIVITY	M-4	INDICATOR LIGHT
105, 205, 305, 405	DO	INDICATE REQUESTED ACTIVITY NOT POSSIBLE	M-4	INDICATOR LIGHT
006	DI	ALARM SILENCED	M-4	OPERATOR SELECTION AT SWITCH NEAR GRAPHIC DISPLAY IN OFFICE
037	DO	LIGHTED INDICATOR	M-4	TWO PLACES - NEAR FAN ROOM ACCESS DOOR ABOVE SERVICE BUILDING
038	DI	POSITION SWITCH	M-4	EXTERIOR DOOR TO FAN ROOM ABOVE SERVICE BUILDING
039	DI	POSITION SWITCH	M-4	EXTERIOR DOOR TO FAN ROOM ABOVE SERVICE BUILDING

## OPERATING VARIABLE DISPLAY MESSAGE FOR PROGRAMMABLE PROCESS CONTROL SYSTEM

TAG NUMBERS	FUNCTION	REF	REMARK
1121	DISPLAY BAY ROOM TEMPERATURE	M-4	CELL 1 BAY A (TE-121)
1221	DISPLAY BAY ROOM TEMPERATURE	M-4	CELL 1 BAY B (TE-221)
1321	DISPLAY BAY ROOM TEMPERATURE	M-4	CELL 2 BAY A (TE-321)
1421	DISPLAY BAY ROOM TEMPERATURE	M-4	CELL 2 BAY B (TE-421)
1122	DISPLAY BAY HUMIDITY	M-4	CELL 1 BAY A (HE-122)
1222	DISPLAY BAY HUMIDITY	M-4	CELL 1 BAY B (HE-222)
1322	DISPLAY BAY HUMIDITY	M-4	CELL 2 BAY A (HE-322)
1422	DISPLAY BAY HUMIDITY	M-4	CELL 2 BAY B (HE-422)
1021	DISPLAY OUTDOOR TEMPERATURE	M-5	TE-021
1022	DISPLAY OUTDOOR HUMIDITY	M-5	HE-022
1151	DISPLAY CURRENT BAY OPERATION	M-4	CELL 1 "CONV", "SOL", "PAINT", "DRY"
1251	DISPLAY CURRENT BAY OPERATION	M-4	CELL 1 "CONV", "SOL", "PAINT", "DRY"
1351	DISPLAY CURRENT BAY OPERATION	M-4	CELL 2 "CONV", "SOL", "PAINT", "DRY"
1451	DISPLAY CURRENT BAY OPERATION	M-4	CELL 2 "CONV", "SOL", "PAINT", "DRY"
1117	DISPLAY SUPPLY AIR FLOW (CFM)	M-4	CELL 1 BAY A (FE-117)
1217	DISPLAY SUPPLY AIR FLOW (CFM)	M-4	CELL 1 BAY B (FE-217)
1317	DISPLAY SUPPLY AIR FLOW (CFM)	M-4	CELL 2 BAY A (FE-317)
1417	DISPLAY SUPPLY AIR FLOW (CFM)	M-4	CELL 2 BAY B (FE-417)
1111	DISPLAY EXHAUST AIR FLOW (CFM)	M-4	TOTAL EXHAUST CELL 1 BAY A (FE-111 TO 115)
1211	DISPLAY EXHAUST AIR FLOW (CFM)	M-4	TOTAL EXHAUST CELL 1 BAY B (FE-211 TO 215)
1311	DISPLAY EXHAUST AIR FLOW (CFM)	M-4	TOTAL EXHAUST CELL 2 BAY A (FE-311 TO 315)
1411	DISPLAY EXHAUST AIR FLOW (CFM)	M-4	TOTAL EXHAUST CELL 2 BAY B (FE-411 TO 415)
1116	DISPLAY RETURN AIR FLOW (CFM)	M-4	CELL 1 BAY A (FE-116)
1216	DISPLAY RETURN AIR FLOW (CFM)	M-4	CELL 1 BAY B (FE-216)
1316	DISPLAY RETURN AIR FLOW (CFM)	M-4	CELL 2 BAY A (FE-316)
1416	DISPLAY RETURN AIR FLOW (CFM)	M-4	CELL 2 BAY B (FE-416)
1071 TO 1078	DISPLAY ACCUMULATED RUN TIME FOR EACH EXHAUST FAN	-	EF1A-H
1081 TO 1086 1181, 1281, 1381, 1481	DISPLAY ACCUMULATED RUN TIME FOR EACH SUPPLY FAN	-	SF1A/B, 2A/B, 3A-F

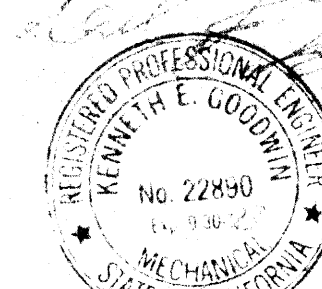
## OPERATOR ADJUSTABLE SET POINTS FOR PROGRAMMABLE PROCESS CONTROL SYSTEM

TAG NUMBERS	ITEMS	ACCEPTABLE RANGE
001	BAY TEMPERATURE SET POINT PAINTING ACTIVITY	0 TO 125°F
002	BAY TEMPERATURE SET POINT CONV & SOL ACTIVITY	0 TO 125°F
003	BAY TEMPERATURE SET POINT DRY ACTIVITY	0 TO 125°F
004	BAY HUMIDITY HIGH SET POINT PAINTING ACTIVITY	0 TO 100% RH
005	BAY HUMIDITY LOW SET POINT PAINTING ACTIVITY	0 TO 100% RH
011	PAINT DURATION CELL 1 BAY A	0 TO 10 HOURS
012	PAINT DURATION CELL 1 BAY B	0 TO 10 HOURS
013	PAINT DURATION CELL 2 BAY A	0 TO 10 HOURS
014	PAINT DURATION CELL 2 BAY B	0 TO 10 HOURS
015	DRY DURATION CELL 1 BAY A	0 TO 10 HOURS
016	DRY DURATION CELL 1 BAY B	0 TO 10 HOURS
017	DRY DURATION CELL 2 BAY A	0 TO 10 HOURS
018	DRY DURATION CELL 2 BAY B	0 TO 10 HOURS

## MESSAGE SCHEDULE FOR PROGRAMMABLE PROCESS CONTROL SYSTEM

TAG NUMBERS	MESSAGE
2051	"UNACCEPTABLE MODE COMBINATION"
2141	"COMBUSTIBLE VAPOR IN RETURN, EXCEEDS 25% LEL CELL 1 BAY A"
2241	"COMBUSTIBLE VAPOR IN RETURN, EXCEEDS 25% LEL CELL 1 BAY B"
2341	"COMBUSTIBLE VAPOR IN RETURN, EXCEEDS 25% LEL CELL 2 BAY A"
2441	"COMBUSTIBLE VAPOR IN RETURN, EXCEEDS 25% LEL CELL 2 BAY B"
2142	"COMBUSTIBLE VAPOR IN TRENCH EXCEEDS 25% LEL CELL 1"
2342	"COMBUSTIBLE VAPOR IN TRENCH EXCEEDS 25% LEL CELL 2"
2143	"COMBUSTIBLE VAPOR IN SUPPLY, EXCEEDS 25% LEL CELL 1 BAY A"
2243	"COMBUSTIBLE VAPOR IN SUPPLY, EXCEEDS 25% LEL CELL 1 BAY B"
2343	"COMBUSTIBLE VAPOR IN SUPPLY, EXCEEDS 25% LEL CELL 2 BAY A"
2443	"COMBUSTIBLE VAPOR IN SUPPLY, EXCEEDS 25% LEL CELL 2 BAY B"
2147	"SMOKE DETECTED IN DUCT WORK CELL 1 BAY A"
2247	"SMOKE DETECTED IN DUCT WORK CELL 1 BAY B"
2347	"SMOKE DETECTED IN DUCT WORK CELL 2 BAY A"
2447	"SMOKE DETECTED IN DUCT WORK CELL 2 BAY B"
2131	"HIGH PRESSURE DROP F-3 & 4, A & B"
2431	"HIGH PRESSURE DROP F-3 & 4, C & D"
2132	"HIGH PRESSURE DROP F-5 & 6, A & B"
2432	"HIGH PRESSURE DROP F-5 & 6, C & D"
2133	"HIGH PRESSURE DROP F-2A"
2233	"HIGH PRESSURE DROP F-2B"
2333	"HIGH PRESSURE DROP F-2C"
2433	"HIGH PRESSURE DROP F-2D"
2134	"HIGH PRESSURE DROP F-1A"
2234	"HIGH PRESSURE DROP F-1B"
2334	"HIGH PRESSURE DROP F-1C"
2434	"HIGH PRESSURE DROP F-1D"
2031	"EXCESSIVE SUPPLY DUCT PRESSURE"
2032	"EXCESSIVE EXHAUST DUCT PRESSURE"
2035	"EXCESSIVE PLENUM OR BUILDING PRESSURE"
2144	"COMBUSTIBLE VAPOR IN EXHAUST EXCEEDS 25% LEL CELL 1 BAY A"
2244	"COMBUSTIBLE VAPOR IN EXHAUST EXCEEDS 25% LEL CELL 1 BAY B"
2344	"COMBUSTIBLE VAPOR IN EXHAUST EXCEEDS 25% LEL CELL 2 BAY A"
2444	"COMBUSTIBLE VAPOR IN EXHAUST EXCEEDS 25% LEL CELL 2 BAY B"
2041	"COMBUSTIBLE VAPOR IN TRENCH EXHAUST EXCEEDS 25% LEL CELL 1"
2042	"COMBUSTIBLE VAPOR IN TRENCH EXHAUST EXCEEDS 25% LEL CELL 2"
2500	"FIRE MODE"
2091	"BREATHING AIR TROUBLE CONDITION"
2611	"PAINT MIX EXHAUST AIR LOW FLOW"
2612	"PAINT STORAGE EXHAUST AIR LOW FLOW"
2641	"COMBUSTIBLE VAPOR EXCEEDS 25% LEL PAINT STORAGE ROOM"
2036	"FAN ROOM DOOR AJAR"
2551	"PLENUM"
2052	"HOT WATER SYSTEM IN FREEZE MODE"
2145	"UNSUCCESSFUL PROCESS AIR MODE CONVERSION"
2245	"COMBUSTIBLE VAPOR EXCEEDS 50 PPM CELL 1 BAY A"
2345	"COMBUSTIBLE VAPOR EXCEEDS 50 PPM CELL 1 BAY B"
2445	"COMBUSTIBLE VAPOR EXCEEDS 50 PPM CELL 2 BAY A"
2146	"COMBUSTIBLE VAPOR EXCEEDS 100 PPM CELL 1 BAY A"
2246	"COMBUSTIBLE VAPOR EXCEEDS 100 PPM CELL 1 BAY B"
2346	"COMBUSTIBLE VAPOR EXCEEDS 100 PPM CELL 2 BAY A"
2446	"COMBUSTIBLE VAPOR EXCEEDS 100 PPM CELL 2 BAY B"

ECU-1 & TCV-2 TO BE CONTROLLED PER SHT. M11 NOTE 237  
CONTROLS TO BE LOCATED IN THE PPGC PANEL



<b>NORMAN ENGINEERING CO.</b> CONSULTING ENGINEERS - LOS ANGELES, CALIFORNIA		<b>DEPARTMENT OF THE ARMY</b> SACRAMENTO DISTRICT, CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA	
DESIGNED BY:	E. ABRAHAMIAN	MCCLELLAN AIR FORCE BASE, CALIFORNIA	
DRAWN BY:	D. MARTINOLI	ADAL DEPOT CORROSION CONTROL FACILITY	
CHECKED BY:	K. GOODWIN	NEW AIRCRAFT PAINT FACILITY	
SUBMITTED:		PROCESS CONTROL I/O LISTING	
DATE:	9/30/92	SCALE:	1"=0'
SHEET:	M-12	FILE NO.:	8529
66 OF 95			100-25-2051







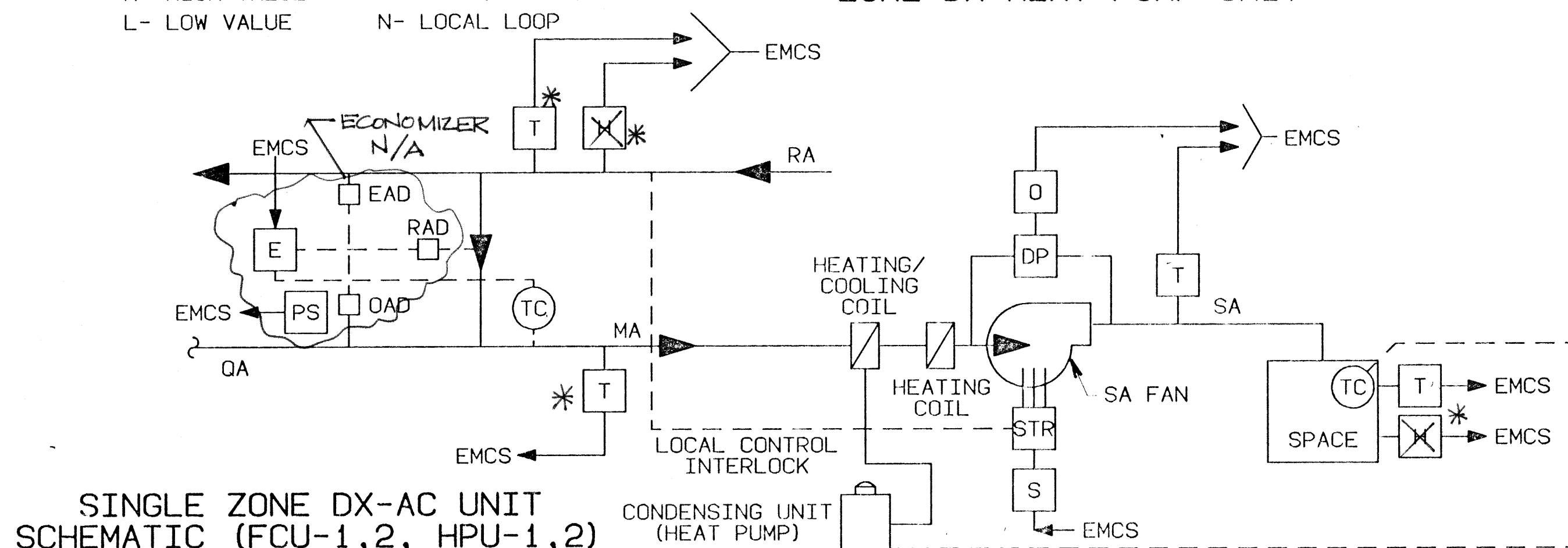
# FUNCTIONAL ANALYSIS - VE PAYS

10

BUILDING	HARDWARE				SOFTWARE (INFO ONLY)											
	OUTPUT		INPUT		ALARMS		APPLICATION PROGRAMS									
	DIGITAL	ANALOG	DIGITAL	ANALOG	DIGITAL	ANALOG										
SYSTEM(S) OFFICE & BREAK ROOM HVAC																
OCCUPANCY TIME																
GRAPHIC DISPLAY																
POINT DESCRIPTION																
SINGLE ZONE DX AHU																
SUPPLY FAN																
O. A. DAMPER																
MIXED AIR																
SUPPLY AIR																
RETURN AIR																
SPACE																
OUTSIDE AIR *																

- ONE MEASUREMENT FOR ENTIRE SYSTEM
- C- LAST COMMAND O- ON (OPEN)
- H- HIGH VALUE F- OFF (CLOSED)
- L- LOW VALUE N- LOCAL LOOP

I/O SUMMARY TABLE FOR SINGLE ZONE DX-HEAT PUMP UNIT



SINGLE ZONE DX-AC UNIT SCHEMATIC (FCU-1,2, HPU-1,2)

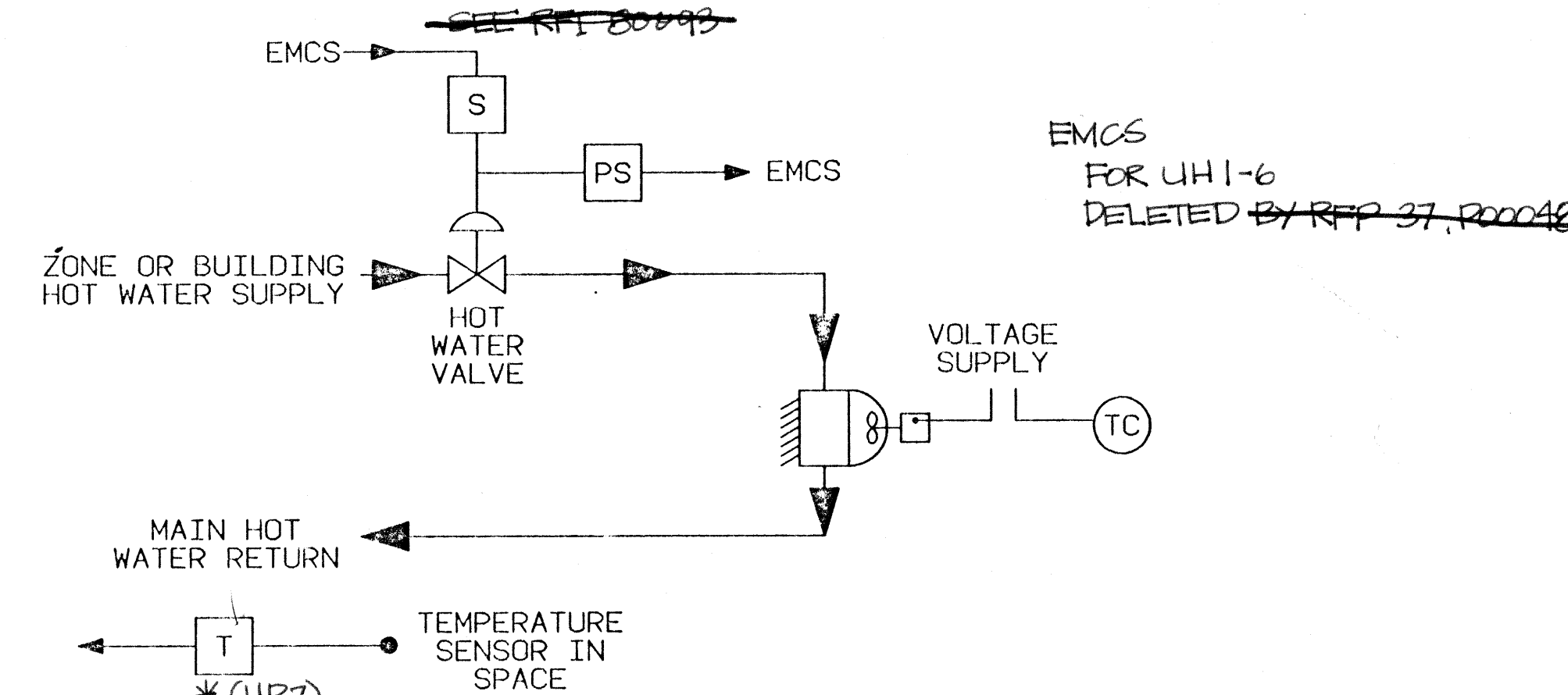
EMCS SCHEMATIC - 3

SCALE: NONE

BUILDING	HARDWARE				SOFTWARE (INFO ONLY)											
	OUTPUT		INPUT		ALARMS		APPLICATION PROGRAMS									
	DIGITAL	ANALOG	DIGITAL	ANALOG	DIGITAL	ANALOG										
SYSTEM(S) HOT WATER UNIT HEATER																
OCCUPANCY TIME																
GRAPHIC DISPLAY																
POINT DESCRIPTION																
HOT WATER UNIT HEATER																
HOT WATER SUPPLY VALVE																
SPACE																
OUTSIDE AIR *																

- ONE MEASUREMENT FOR ENTIRE SYSTEM
- C- LAST COMMAND O- ON (OPEN)
- H- HIGH VALUE F- OFF (CLOSED)
- L- LOW VALUE N- LOCAL LOOP

I/O SUMMARY TABLE FOR HOT WATER UNIT HEATER



HOT WATER UNIT HEATER SCHEMATIC (UH-1,2,3,4,5,6,7)

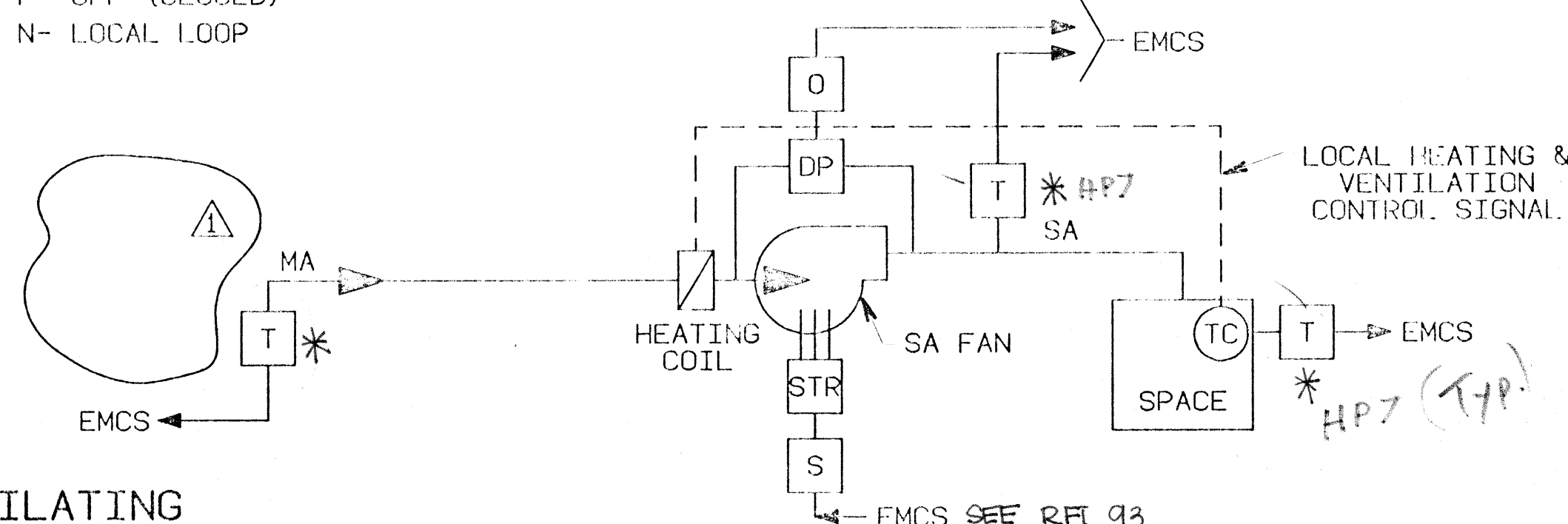
EMCS SCHEMATIC - 4

SCALE: NONE

BUILDING	HARDWARE				SOFTWARE (INFO ONLY)											
	OUTPUT		INPUT		ALARMS		APPLICATION PROGRAMS									
	DIGITAL	ANALOG	DIGITAL	ANALOG	DIGITAL	ANALOG										
SYSTEM(S) HVAC																
OCCUPANCY TIME																
GRAPHIC DISPLAY																
POINT DESCRIPTION																
H & V UNIT																
SUPPLY FAN																
SUPPLY AIR																
SPACE																
MIXED AIR																
OUTSIDE AIR *																

- ONE MEASUREMENT FOR ENTIRE SYSTEM
- C- LAST COMMAND O- ON (OPEN)
- H- HIGH VALUE F- OFF (CLOSED)
- L- LOW VALUE N- LOCAL LOOP

I/O SUMMARY TABLE FOR HEATING AND VENTILATING UNIT



HEATING AND VENTILATING UNIT SCHEMATIC (MU-1)

EMCS SCHEMATIC - 5

SCALE: NONE

NOTES													
<p>a. References to made to previous drawings shall be made to the latest revision of the drawing. The control of Unit-1 through Unit-6 is to be per drawing M-9, note 1, and Section 1550, paragraph 3.3.2. The EMCS is to monitor the heating system controls only, and is required for both buildings, per drawing M-14, Schematic 4. All control for Unit-1 through Unit-7 is to be accomplished with local controls. Operation is called out on drawing M-10 (Sequence of Operation). For Units Unit-1 through Unit-6, one thermostat only is required for control. All units 1-6 shall turn on and off at the same time.</p> <p>b. <del>REF 101 states problems in coordination with EMCS and M-10 (Sequence of Operation) call for the FCU-1, 2 to be energized thru the EMCS system, and the room thermostat furnished with the unit to automatically control heating and cooling operation. The EMCS shall be as called out on contract drawing M-14, Schematic 3.</del></p>													
<p>REVISIONS</p> <table border="1"> <thead> <tr> <th>NO.</th> <th>DATE</th> <th>DESCRIPTION</th> <th>BY</th> <th>CHKD</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>11/25/92</td> <td>MISCELLANEOUS REVISIONS</td> <td>DA</td> <td></td> </tr> </tbody> </table>				NO.	DATE	DESCRIPTION	BY	CHKD	1	11/25/92	MISCELLANEOUS REVISIONS	DA	
NO.	DATE	DESCRIPTION	BY	CHKD									
1	11/25/92	MISCELLANEOUS REVISIONS	DA										
<p>DESIGNED BY E. ABRAHAMIAN</p>		<p>CHECKED BY D. MARTINOLI</p>											
<p>PROJECT NO. M-14</p>		<p>DATE 9/30/92</p>											
<p>SCALE NONE</p>		<p>FILE NO. 100-25-2051</p>											
<p>REVISIONS</p>		<p>SCALE NONE</p>											
<p>DATE 9/30/92</p>		<p>FILE NO. 100-25-2051</p>											