

AIR HANDLING UNIT SCHEDULE

TAG	SERVICE	MFR	MODEL	SUPPLY FAN			RETURN FAN			VOLTS	PHASE	MIN. OSA	HEATING COIL DATA						COOLING COIL DATA						WEIGHT (LBS)	REMARKS		
				CFM	E.S.P. (IN. WG)	QTY HP	CFM	E.S.P. (IN. WG)	QTY HP				TYPE	CAP. (MBH)	ROWS	FINS/FT	GPM	EWT	LWT	TYPE	CAP. (MBH)	ROWS	FINS/FT	GPM			EWT	LWT
AHU-10	2ND AND 3RD FLRS WEST	HAAKON (OR APPROVED EQUAL)	CUSTOM AIR HANDLER	17,295	2.0	1 20	14,195	1.0	1 7.5	460	3	3100	5W	200	1	48	13	180	150	UW	766	4	144	15.3	45	55	12,500	(2)(3)(5)(6)(7)(8)(10)(11)(12)
AHU-14	2ND AND 3RD FLRS EAST			22,850	2.0	1 20	19,250	1.0	1 7.5			3600											153			12,500	(2)(3)(5)(6)(7)(8)(10)(11)(12)	
AHU-7	FIRST FLOOR LOBBY			6,850	2.5	2 10	5,850	1.5	2 5			1000		50			3.5				383			77		12,500	(2)(3)(5)(6)(7)(8)(9)(11)(12)	
AHU-1	FIRST FLOOR NORTHWEST			28,000	2.5	2 40	20,700	1.5	2 20			7300		350		12	24				1942	6	108	388		37,000	(2)(3)(5)(6)(7)(8)(11)(9)(12)	

NOTES:

- ① NOT USED
- ② PROVIDE COMBINATION MOTOR STARTER /DISCONNECT; COORDINATE WITH ELECTRICAL
- ③ PROVIDE 2-WAY VALVE PIPING PACKAGE, PROVIDE BOOSTER PUMPS P-1 AND P-2; SEE BOOSTER PUMP SCHEDULE
- ④ NOT USED
- ⑤ PROVIDE SMOKE DETECTOR IN SUPPLY AIR DUCT WIRED TO SHUTDOWN UNIT UPON ACTIVATION, SMOKE DETECTOR SHALL BE AN ADDRESSABLE SYSTEM DETECTOR, COMPATIBLE WITH (E) HOSPITAL FIRE ALARM SYSTEM, SMOKE DETECTOR PROVIDED & INSTALLED BY MECH., & WIRED BY ELEC., SMOKE DETECTOR SHALL BE OF SAME MANUFACTURER AS ALL OTHER FIRE ALARM DEVICES.
- ⑥ START/STOP UNIT WITH NEW JOHNSON "METASYS" SYSTEM, CONNECTED TO EXISTING ENERGY MANAGEMENT SYSTEM (EMS).
- ⑦ PROVIDE INTERNAL TRANSFORMER FOR LIGHTS AND RECEPTACLE.
- ⑧ UNIT MANUFACTURER TO PROVIDE START-UP.
- ⑨ PROVIDE UNIT WITH THE FOLLOWING MODULES: SUPPLY FAN W/ DUAL FANS (NOT REDUNDANT), COOLING COIL, HEATING COIL, FILTER W/ PRE-FILTERS AND BAG FILTERS (LIFT OUT STREAM), RETURN FAN W/ DUAL FANS (NOT REDUNDANT)
- ⑩ PROVIDE UNIT W/ THE FOLLOWING MODULES: SUPPLY FAN, COOLING COIL, HEATING COIL, FILTER W/ THE PRE-FILTERS AND BAG FILTERS (LIFT-OUT UPSTREAM), RETURN FAN.
- ⑪ FILTERS: PRE-FILTERS: 2" MERV 7 AAF PERFECT PLEAT HC, 21" MERV 15 AAF DRI-PAK 95% (OR APPROVED EQUAL) QUANTITY AND SIZES AS REQUIRED.
- ⑫ EACH SUPPLY FAN AND RETURN FAN SHALL BE EQUIPPED WITH IT'S OWN VARIABLE SPEED DRIVE.

VAV AIR TERMINAL UNIT SCHEDULE

TAG	MODEL/MFR (OR APPROVED EQUAL)	TERMINAL TYPE	INLET SIZE	DESIGN CFM	MAX CFM	MIN CFM	REHEAT COIL DATA						REMARKS	
							SIZE (WxH)	ROWS	CIRCUITS	GPM	AIR ΔP	OUTPUT (MBH)		
TU-2.1	TITUS DESV-3000	VAV-RH	12"ø	1000	2000	450	16 X 15	2	MULTI	2	.06	33.2	① ② ③	
TU-2.2			8"ø	600	900	200	12 X 10			2	.08	15.0		
TU-2.3			8"ø	400	900	150	12 X 10			2	.08	15.0		
TU-2.4			6"ø	200	500	80	12 X 8			1	.02	8.6		
TU-2.5			10"ø	800	1400	300	14 X 12½			3	2	.04	24.3	
TU-2.6			8"ø	600	900	200	12 X 10			2	.08	15.0		
TU-2.7			10"ø	840	1400	300	14 X 12½			3	2	.04	24.3	
TU-2.8			8"ø	540	900	200	12 X 10	3		2	.08	15.0		
TU-2.9			6"ø	270	500	100	12 X 8			1	.02	8.6		
TU-2.10			8"ø	600	900	200	12 X 10			2	.08	15.0		
TU-2.11			8"ø	525	900	145	12 X 10	3		3	1	.02	3	10.0
TU-2.12			8"ø	600	900	200	12 X 10			2	.08	15.0		
TU-2.13			8"ø	600	900	200	12 X 10			2	.08	15.0		
TU-2.14			8"ø	700	900	300	12 X 10			2	.08	3	24.3	
TU-2.15			8"ø	500	900	200	12 X 10			2	.08	15.0		
TU-2.16			8"ø	700	900	300	12 X 10			2	.08	15.0		
TU-2.17			10"ø	800	1400	300	14 X 12½			3	2	.04	24.3	
TU-2.18			8"ø	700	900	300	12 X 10			2	.08	15.0		
TU-2.19			8"ø	700	900	300	12 X 10			2	.08	15.0		
TU-2.20			6"ø	100	500	80	12 X 8			1	.02	8.6		
TU-2.21			8"ø	700	900	300	12 X 10			2	.08	15.0		
TU-2.22			8"ø	700	900	300	12 X 10			2	.08	15.0		
TU-2.23			6"ø	350	500	180	12 X 8			1	.02	8.6		
TU-2.24			8"ø	700	900	300	12 X 10			2	.08	15.5		
TU-2.25			6"ø	350	500	100	12 X 8			1	.02	8.6		
TU-2.26			8"ø	500	900	180	12 X 10			2	.08	15.0		
TU-2.27			6"ø	300	500	100	12 X 8			1	.02	8.6		
TU-2.28			6"ø	215	500	70	12 X 8			1	.02	8.6		
TU-2.29			6"ø	300	500	100	12 X 8			1	.02	8.6		
TU-2.30			8"ø	600	900	200	12 X 10			2	.08	15.0		
TU-2.31			8"ø	600	900	200	12 X 10			2	.08	15.0		
TU-2.32			6"ø	360	500	100	12 X 8			1	.02	8.6		
TU-2.33			6"ø	400	500	150	12 X 8			1	.02	8.6		
TU-2.34			8"ø	600	900	200	12 X 10			2	.08	15.0		
TU-2.35			8"ø	750	900	250	12 X 10			2	.08	15.0		
TU-2.36			8"ø	500	900	150	12 X 10			2	.08	15.0		

NOTES:

- ① PROVIDE JOHNSON WALL MOUNTED ZONE THERMOSTAT, JOHNSON DDC CONTROLLER, HOT WATER REHEAT COIL.
- ② PROVIDE STERI-LOC HIGH DENSITY, RIGID INSULATION AND Z-STRIP CONSTRUCTION ON INTERIOR OF BOX AND PLENUM; INSULATION SURFACE EXPOSED TO AIR STREAM SHALL BE NON-POROUS AND CLEANABLE.
- ③ BALANCE (N) VAV AIR TERMINAL UNIT TO CFM & GPM SHOWN.

VAV AIR TERMINAL UNIT SCHEDULE

TAG	MODEL/MFR (OR APPROVED EQUAL)	TERMINAL TYPE	INLET SIZE	DESIGN CFM	MAX CFM	MIN CFM	REHEAT COIL DATA						REMARKS		
							SIZE (WxH)	ROWS	CIRCUITS	GPM	AIR ΔP	OUTPUT (MBH)			
TU-1.700	TITUS DESV-300	VAV-RH	6"ø	275	500	100	12 X 8	2	MULTI	1	.02	8.6	①	②	③
TU-1.701			8"ø	500	900	200	12 X 10			2	.08	17.6			
TU-1.702			6"ø	300	500	150	12 X 8			2	.02	8.6			
TU-1.703			12"ø	1150	2000	400	16 X 15			2	.06	33.2			
TU-1.704			12"ø	1120	2000	400	16 X 15			2	.06	33.2			
TU-1.705			10"ø	800	1400	500	14 X 12 ½	3		2	.04	22.4	3		
TU-1.706			14"ø	2400	3000	500	20 X 12 ½			2	.01	51.4			

NOTES:

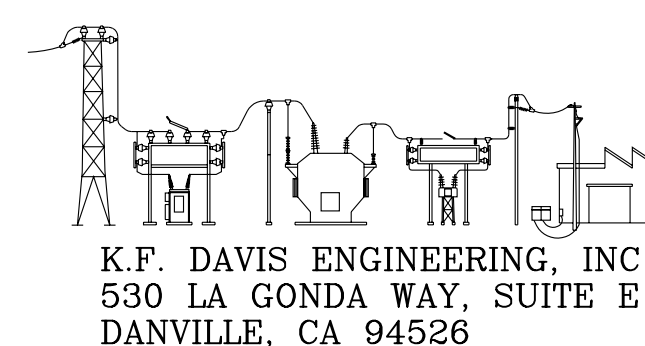
- ① PROVIDE JOHNSON WALL MOUNTED ZONE THERMOSTAT, JOHNSON DDC CONTROLLER, HOT WATER REHEAT COIL.
- ② PROVIDE STERI-LOC HIGH DENSITY, RIGID INSULATION AND Z-STRIP CONSTRUCTION ON INTERIOR OF BOX AND PLENUM; INSULATION SURFACE EXPOSED TO AIR STREAM SHALL BE NON-POROUS AND CLEANABLE.
- ③ BALANCE (N) VAV AIR TERMINAL UNIT TO CFM & GPM SHOWN.

VAV AIR TERMINAL UNIT SCHEDULE

TAG	MODEL/MFR (OR APPROVED EQUAL)	TERMINAL TYPE	INLET SIZE	DESIGN CFM	MAX CFM	MIN CFM	REHEAT COIL DATA						REMARKS		
							SIZE (WxH)	ROWS	CIRCUITS	GPM	AIR ΔP	OUTPUT (MBH)			
TU-3.1	TITUS DESV-3000	VAV-RH	8"ø	600	900	200	12 X 10	2	MULTI	1	.08	17.6	①	②	③
TU-3.2			6"ø	150	500	80	12 X 8			1	.02	8.6			
TU-3.3			6"ø	300	500	100	12 X 8			1	.02	8.6			
TU-3.4			10"ø	800	1400	300	14 X 12½			2	.04	22.4			
TU-3.5			6"ø	400	500	100	12 X 8			2	.02	8.6			
TU-3.6			6"ø	300	500	100	12 X 8			2	.02	8.6			
TU-3.7			6"ø	250	500	100	12 X 8			1	.02	8.6			
TU-3.8			10"ø	800	1400	300	14 X 12½			2	.02	22.4			
TU-3.9			6"ø	250	500	100	12 X 8			1	.02	8.6			
TU-3.10			8"ø	700	900	250	12 X 10			2	.08	17.6			
TU-3.11			6"ø	250	500	100	12 X 8			2	.02	8.6			
TU-3.12			6"ø	390	500	100	12 X 8			2	.02	8.6			
TU-3.13			6"ø	300	500	200	12 X 8			2	.02	8.6			
TU-3.14			8"ø	600	900	400	12 X 10			2	.08	17.6			
TU-3.15			12"ø	1350	2000	800	16 X 15			2	.06	32.2			
TU-3.16			12"ø	1350	2000	400	16 X 15			2	.06	32.2			
TU-3.17			10"ø	900	1400	300	14 X 12½			2	.04	22.4			
TU-3.18			8"ø	700	900	200	12 X 10			2	.08	17.6			
TU-3.19			10"ø	800	1400	300	14 X 12½			2	.04	22.4			
TU-3.20			10"ø	800	1400	300	14 X 12½			2	.04	22.4			
TU-3.21			12"ø	1140	2000	400	16 X 15½			2	.06	32.2			
TU-3.22			8"ø	700	900	200	12 X 10	⚠		2	.06	17.6	⚠		
TU-3.23			8"ø	660	900	250	12 X 10			2	.08	17.6			
TU-3.24			8"ø	560	900	200	12 X 10			2	.08	17.6			
TU-3.25			8"ø	700	900	300	12 X 10			2	.08	17.6			
TU-3.26			8"ø	700	900	200	12 X 10			2	.08	17.6			
TU-3.27			8"ø	700	900	200	12 X 10			2	.08	17.6			
TU-3.28			10"ø	900	1400	300	14 X 12½			2	.04	22.4			
TU-3.29			10"ø	800	1400	300	14 X 12½			2	.04	22.4			
TU-3.30			10"ø	800	1400	300	14 X 12½			2	.04	22.4			
TU-3.31			10"ø	800	1400	300	14 X 12½			2	.04	22.4			
TU-3.32			8"ø	500	900	180	12 X 10			2	.08	17.6			

NOTES:

- ① PROVIDE JOHNSON WALL MOUNTED ZONE THERMOSTAT, JOHNSON DDC CONTROLLER, HOT WATER REHEAT COIL.
- ② PROVIDE STERI-LOC HIGH DENSITY, RIGID INSULATION AND Z-STRIP CONSTRUCTION ON INTERIOR OF BOX AND PLENUM; INSULATION SURFACE EXPOSED TO AIR STREAM SHALL BE NON-POROUS AND CLEANABLE.
- ③ BALANCE (N) VAV AIR TERMINAL UNIT TO CFM & GPM SHOWN.



Revisions:

1	DATED	11/10/08
2	DATED	11/19/08
3	DATED	07/14/09

Approved:

Approved:

	Drawing Title:
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MECHANICAL
SCHEDULES

Approved: Medical Center Director

Approved: Chief, Engineering Service

Project Title: BLDG 650
REPLACE AIR HANDLERS
1 THRU 4,
7 AND 9 - 15

Building Numbers:

Location:	MATHER VAMC MATHER CALIFORNIA
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Date: 08/25/08

Project No.:
612A4-07-342

DRAWING No.

H1.3



Department of
Internal Affairs

SCALE:

SCALE:

 $1/4$

E: 1/

TAG	MODEL/MFR (OR APPROVED EQUAL)	TERMINAL TYPE	INLET SIZE	DESIGN CFM	MAX CFM	MIN CFM	REHEAT COIL DATA						REMARKS			
							SIZE (WxH)	ROWS	CIRCUITS	GPM	AIR ΔP	OUTPUT (MBH)				
TU-1.100	TITUS DESV-3000	VAV-RH	6"ø	150	500	80	12 X 8	2		MULTI	1	.02	8.6			
TU-1.101			6"ø	180	500	90	12 X 8				1	.02	8.6			
TU-1.102			10"ø	825	1400	350	14 X 12½				2	.04	24.3			
TU-1.103			8"ø	400	900	180	12 X 10				2	.08	15.0			
TU-1.104			6"ø	150	500	80	12 X 8				1	.02	8.6			
TU-1.105			10"ø	800	1400	300	14 X 12½				2	.04	24.3			
TU-1.106			12"ø	1200	2000	500	16 X 15				2	.06	32.2			
TU-1.107			8"ø	400	900	180	12 X 10				2	.08	15.0			
TU-1.108			8"ø	450	900	200	12 X 10				2	.08	15.0			
TU-1.109			8"ø	625	900	250	12 X 10				2	.08	15.0			
TU-1.110			8"ø	400	900	180	12 X 10				2	.08	15.0			
TU-1.111			6"ø	200	500	80	12 X 8				1	.02	8.6			
TU-1.112			10"ø	800	1400	320	14 X 12½				2	.04	24.3			
TU-1.113			10"ø	850	1400	300	14 X 12½				2	.04	24.3			
TU-1.114			8"ø	600	900	250	12 X 10				2	.08	15.0			
TU-1.115			10"ø	960	1400	450	14 X 12½				2	.04	24.3			
TU-1.116			8"ø	600	900	200	12 X 10				2	.08	15.0			
TU-1.117			8"ø	700	900	300	12 X 10				2	.08	15.0			
TU-1.118			8"ø	500	900	200	12 X 10				2	.08	15.0			
TU-1.119			10"ø	900	1400	400	14 X 12½				2	.04	24.3			

[illegible]

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TAG	MODEL/MFR (OR APPROVED EQUAL)	TERMINAL TYPE	INLET SIZE	DESIGN CFM	MAX CFM	MIN CFM	REHEAT COIL DATA						REMARKS
							SIZE (WxH)	ROWS	CIRCUITS	GPM	AIR ΔP	OUTPUT (MBH)	
TU-1.200													NOT USED
TU-1.201	TITUS DESV-3000	VAV-RH	10"ø	880	1400	540	14 X 12½	2	MULTI	2	.04	27.4	⚠ ⚠ ⚠
TU-1.202			10"ø	800	1400	300	14 X 12½			2	.04	22.4	
TU-1.203			8"ø	550	900	200	12 X 10			1	.08	17.6	
TU-1.204			14"ø	1500	3000	785	20 X 17½			3	.05	43.9	
TU-1.205													NOT USED
TU-1.206	⚠												NOT USED
TU-1.207													NOT USED
TU-1.208				⚠									NOT USED
TU-1.209	TITUS DESV-3000	VAV-RH	8"ø	500	900	200	12 X 10	2	MULTI	1	.08	17.6	⚠ ⚠ ⚠
TU-1.210			8"ø	500	900	200	12 X 10			1	.08	17.6	
TU-1.211			8"ø	500	900	200	12 X 10			1	.08	17.6	
TU-1.212			6"ø	200	500	100	12 X 8			1	.02	8.6	
TU-1.213			8"ø	500	900	200	12 X 10			1	.08	⚠ 17.6	
TU-1.214			6"ø	300	500	150	12 X 8			1	.02	8.6	
TU-1.215			8"ø	700	900	300	12 X 10			1	.08	17.6	
TU-1.216													NOT USED
TU-1.217	TITUS DESV-3000	VAV-RH	8"ø	710	900	200	12 X 10	2	MULTI	1	.08	⚠ 17.6	⚠ ⚠ ⚠
TU-1.218	TITUS DESV-3000	VAV-RH	10"ø	1080	1400	350	14 X 12½	2	MULTI	2	.04	22.4	⚠ ⚠ ⚠

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TAG	MODEL/MFR (OR APPROVED EQUAL)	TERMINAL TYPE	INLET SIZE	DESIGN CFM	MAX CFM	MIN CFM	REPEAT COIL DATA						REMARKS		
							SIZE (WxH)	ROWS	CIRCUITS	GPM	AIR ΔP	OUTPUT (MBH)			
TU-1.400	TITUS DESV-3000	VAV-RH	12"ø	1280	2000	400	16 X 15	2	MULTI	2	.06	33.2	⚠	⚠	⚠
TU-1.401			6"ø	400	500	150	12 X 8			1	.02	8.6			
TU-1.402			6"ø	150	500	80	12 X 8			1	.02	8.6			
TU-1.403			8"ø	500	900	200	12 X 10			2	.08	15.0			
TU-1.404			10"ø	825	1400	350	14 X 12½			4	.04	24.3			
TU-1.405			8"ø	500	900	200	12 X 10			2	.08	15.0			
TU-1.406	↓	↓	8"ø	600	900	250	12 X 16	↓	↓	2	.08	15.0	↓	↓	↓
TU-1.407													NOT USED		
TU-1.408													NOT USED		
TU-1.409	TITUS DESV-3000	VAV-RH	10"ø	900	1400	400	14 X 12½	2	MULTI	4	.04	24.3	⚠	⚠	⚠
TU-1.410			8"ø	600	900	250	12 X 10			2	.08	15.0			
TU-1.411			8"ø	500	900	250	12 X 10			2	.08	15.0			
TU-1.412			10"ø	825	1400	350	14 X 12½			4	.04	24.3			
TU-1.413			8"ø	500	900	200	12 X 10			2	.04	15.0	↓	↓	↓
TU-1.414	↓	↓	8"ø	500	900	200	12 X 10	↓	↓	3	2	.04	3	15.0	↓
TU-1.415													NOT USED		
TU-1.416	TITUS DESV-3000	VAV-RH	10"ø	1000	1400	400	14 X 12½	2	MULTI	4	.04	24.3	⚠	⚠	⚠
TU-1.417	TITUS DESV-3000	VAV-RH	12"ø	1200	2000	500	16 X 15	2	MULTI	2	.06	33.2	⚠	⚠	⚠

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Approved:

Approved:

Drawing Title:

Approved: Medical Center Director

Approved: Chief, Engineering Service

MECHANICAL SCHEDULES

Drawn:

Checked:

Project Title: BLDG 650
REPLACE AIR HANDLERS
1 THRU 4,
7 AND 9 - 15

Building Number:

Location: MATHER VAMC
MATHER CALIFORNIA

Date: 08/25/08

Project No.:
612A4-07-342

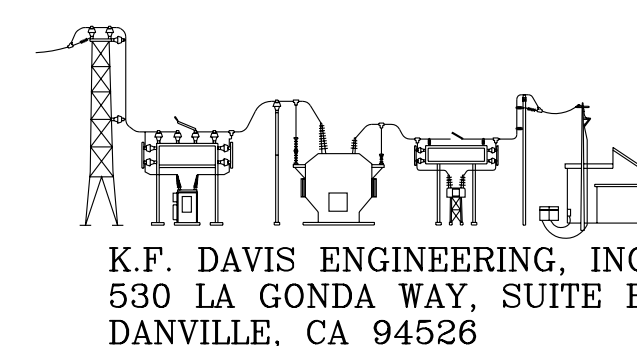
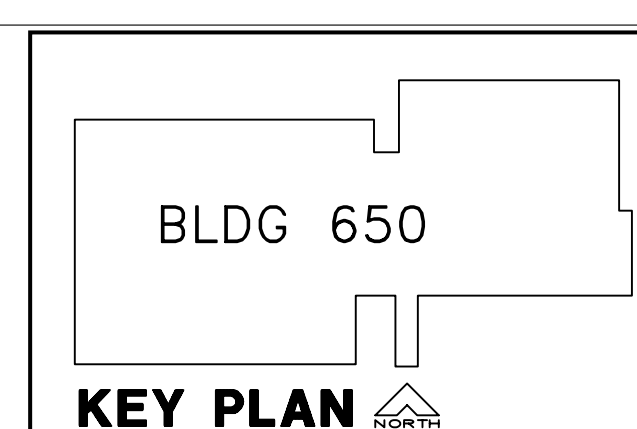
DRAWING No.


HI.4
Dwg. Of



1. CUT AND PATCH AS REQ'D FOR INSTALLATION OF WORK, PATCH TO MATCH (E) ADJACENT MATERIALS AND FINISHES.
2. SEE H1.1 FOR PHASING NOTES.
3. EXISTING RETURN AND EXHAUST DUCTWORK NOT SHOWN FOR CLARITY.

- 1 THIS DRAWING SHOWS THE APPROXIMATE LOCATIONS OF EXISTING DUCT STATIC PRESSURE SENSORS. FIELD VERIFY LOCATIONS. CONTRACTOR SHALL DEMOLISH SENSORS AND INSTALL NEW SENSORS AND TRANSMITTERS. SEE SEQUENCE OF OPERATION.
- 2 CONNECT NEW 4" CHWS & R PIPING TO EXISTING 6" PIPING ABOVE CORRIDOR CEILING. PROTECT AND STORE ANY AFFECTED CEILING TILES. REPLACE TILES UPON COMPLETION OF THIS WORK. ROUTE NEW 4" CHILLED WATER PIPING DOWN WALL AND INTO THE CRAWL SPACE TO THE MECHANICAL ROOM BELOW. AHU-1
- 3 INSTALL (N) VAV BOX IN SAME LOCATION AS (E) VAV BOX. CONN. TO (E) HHWS & R PIPING & (E) DUCTWORK; REPLACE (E) THERMOSTAT WITH (N) WIRELESS JCI THERMOSTAT.
- 4 (E) VAV BOX TO REMAIN (INSTALLED AS A PART OF PHASE II PROJECT). PRIOR TO DEMOLITION, MEASURE (E) VAV BOX MAX. & MIN. CFM, GPM, & AIR FLOW AT EACH OUTLET. AT COMPLETION OF PROJECT RETURN (E) VAV BOX TO (E) AIR AND WATER FLOWS RECORDED PRIOR TO CONSTRUCTION.
- 5 BALANCE (E) DIFFUSER OR GRILLE TO (N) CFM SHOWN.
- 6 BALANCE RETURN AIR TO EQUAL SUPPLY AIR IN EACH ROOM, U.O.N.; (E) RETURN AIR DUCTWORK NOT SHOWN FOR CLARITY.



Revisions:  DATED 07/14/09	Drawing Title: <div style="text-align: center;">FIRST FLOOR PLAN</div>		Project Title: BLDG 650 REPLACE AIR HANDLERS 1 THRU 4, 7 AND 9 - 15	Date: 08/25/08
Approved:	Approved: Medical Center Director	Drawn: RMK	Building Number:	Project No.: 61244-07-342
Approved:	Approved: Chief, Engineering Service	Checked: KL	Location: MATHER VAMC Kalamazoo, Michigan	DRAWING No. <div style="font-size: 2em; font-weight: bold;">H.3.1</div> Date: 08/25/08



12
8
4
0
3/4"=1'-0"
SCALE:
12
8
4
0
1/2"=1'-0"
SCALE:
12
8
4
0
1/4"=1'-0"
SCALE:
12
8
4
0
1/8"=1'-0"
SCALE:
082107

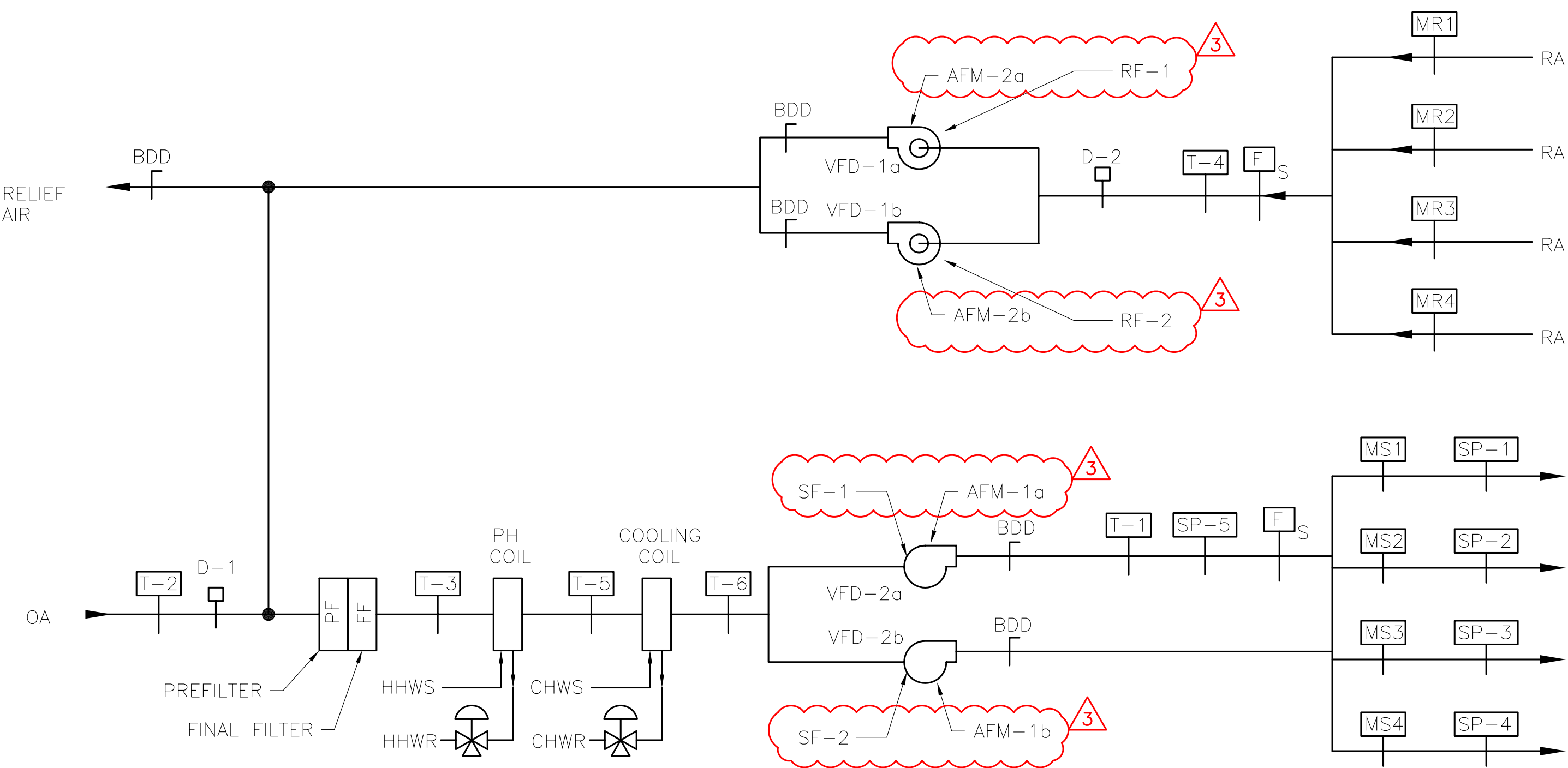
SEQUENCE OF OPERATION: 3

- A. GENERAL UNIT OPERATION
- VFD POWERED FANS
 - VARIABLE FREQUENCY DRIVES (VFD) SHALL START AT THE MINIMUM SPEED SETTING AND SHALL RAMP TO THE CONTROL POINT. UNLESS OTHERWISE NOTED, THE VFD SHALL RAMP UP AND DOWN FULL SCALE OVER 180 (FA) SECONDS. THE VFD SHALL NOT BE ALLOWED TO OPERATE AT LESS THAN 15 HZ. IF AN ELECTRICAL DISCONNECT IS CONNECTED BETWEEN THE VFD AND THE EQUIPMENT, THE VFD SHALL NOT BE ALLOWED TO OPERATE IF THE DISCONNECT IS OPEN.
 - SEE SPECIFICATION SECTIONS 15763 AND 15902 FOR ADDITIONAL VFD REQUIREMENTS.
 - SUPPLY AIR SYSTEM – CONTROL SEQUENCE
 - AHU-1 IS ROOF TOP AIR HANDLING UNIT. THE UNIT CONSISTS OF AN OUTDOOR AIR INTAKE WITH ECONOMIZER CONTROLS AND (2) NON-REDUNDANT RETURN FANS, MIXED AIR/FILTER SECTION, COOLING COIL SECTION, HOT WATER PRE-HEAT COIL SECTION AND (2) NON-REDUNDANT SUPPLY FANS.
 - THE UNIT SHALL BE PLACED IN THE START-UP MODE BY THE EXISTING ECC.
 - THE OUTDOOR AIR DAMPER SHALL BE CLOSED.
 - SYSTEM IS DESIGNED AS HEATING-COOLING, SINGLE DUCT, VARIABLE AIR VOLUME REHEAT SYSTEM WHERE REHEAT IS PROVIDED BY VAV TERMINAL UNIT HOT WATER REHEAT COILS.
 - SUPPLY AND RETURN FANS ARE INTERLOCKED TOGETHER.
 - SUPPLY AND RETURN FAN START/STOP (AHU-1)
 - AHU-1 SUPPLY AND RETURN FANS SHALL BE STARTED AND STOPPED THROUGH E.C.C. BY A SINGLE START OR STOP COMMAND INITIATED MANUALLY BY BUILDING OPERATING PERSONNEL. UPON INITIATION OF A START COMMAND, BOTH FANS SHALL BE STARTED AUTOMATICALLY IN A SEQUENCE AS SPECIFIED.
 - AHU-1 IS POWERED BY ENGINE GENERATOR SET WHEN THE AHU IS OPERATING IN EMERGENCY MODE.
 - GENERAL:
 - NEW CONTROLS SHALL INCLUDE ALL COMPONENTS AS NECESSARY TO ACCOMMODATE SEQUENCE OF OPERATION. PROVIDE A TEMPERATURE CONTROL PANEL (TCP). LOCATE THE PANEL IN THE (E) FAN ROOM BELOW THE UNIT. TCP SHALL CONTAIN ALL CONTROLLERS, TRANSFORMERS AND RELAYS. CONTRACTOR SHALL PROVIDE DEVICES AND CONNECTIONS REQUIRED TO PRODUCE INDICATED SEQUENCE OF OPERATION. FURNISH ALL RELAYS, SENSORS, WIRING, TRANSFORMERS, CONTROL LOOPS AND OTHER CONTROL DEVICES NECESSARY TO MEET THE INTENT OF THE SEQUENCE OF OPERATION.
 - H-O-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE. WHEN THE UNIT IS "OFF" D-1 AND D-2 SHALL BE FULLY CLOSED. WHEN THE UNIT IS "ON" D-2 AND D-1 SHALL MODULATE IN ACCORDANCE WITH THE FOLLOWING SEQUENCE:
 - SUPPLY FAN VOLUME CONTROL
 - SYSTEM VOLUME CONTROL WILL BE ACCOMPLISHED UTILIZING VARIABLE SPEED DRIVES. PROVIDE 4-20 MA DC OR 0-10 VDC STATIC PRESSURE CONTROL SIGNAL TO MODULATE FAN SPEED AS SPECIFIED HEREIN. RATE OF CHANGE OF FAN SPEED SHALL BE ADJUSTABLE. FOUR (AVERAGING TYPE) SUPPLY DUCT PRESSURE SIGNALS SHALL BE USED FOR CONTROL. SEE SHEET H4.2 FOR LOCATION OF DUCT SP SENSORS AND TRANSMITTERS. PRESSURE SETPOINTS SHALL BE 1.0" W.C. (FA). THIS MINIMUM PRESSURE REQUIRED SHALL BE DETERMINED BY THE TEST-ADJUST-BALANCE CONTRACTOR DURING THE AIR BALANCE. SEE SPECIFICATION SECTION 15980, TESTING, ADJUSTING AND BALANCING. IF ANY OF THE DUCT PRESSURES ARE BELOW SETPOINT, SUPPLY DUCT PRESSURE SHALL BE ALLOWED TO RISE ABOVE SETPOINT IF NEEDED TO RAISE THE OTHER PRESSURE TO MEET SETPOINT.
 - ARRANGE CONTROLS SO THAT AHU-1 WILL START ON LOW SPEED. ON FAILURE OF FAN VOLUME CONTROL SIGNAL, FAN SHALL GO TO LOW SPEED AND STOP.
 - PROVIDE ALARM INDICATION AT E.C.C. FOR VFD FAULT CONDITION. BOTH N.O. AND N.C. CONTACTS SHALL BE PROVIDED WITH VFD. ON FAILURE OF A VFD, THE ASSOCIATED SUPPLY FAN SHALL GO TO LOW SPEED AND STOP.
 - VFD'S SHALL RAMP UP AND DOWN FULL SCALE OVER 180 SECONDS (FA).
 - MAIN SUPPLY DUCT PRESSURE CONTROL:
 - STATIC PRESSURE IN THE SUPPLY DUCT SHALL BE CONTROLLED BY NEW STATIC PRESSURE SENSOR/TRANSMITTERS; STATIC PRESSURE SENSOR/TRANSMITTERS SHALL BE LOCATED WHERE INDICATED ABOVE.
 - STATIC PRESSURE SENSOR/TRANSMITTER SHALL MODULATE SUPPLY FAN TO MAINTAIN MAIN STATIC PRESSURE SETPOINT.
 - THE STATIC PRESSURE CONTROL SETPOINTS SHALL BE 1.0" W.G. (FA) AS DETERMINED BY THE TEST-ADJUST-BALANCE CONTRACTOR DURING THE AIR BALANCE.
 - MISCELLANEOUS SUPPLY FAN CONTROL:
 - VFD CURRENT INPUT TO PROVIDE FAN STATUS INDICATION TO E.C.C. CURRENT FUNCTION SHALL BE PROVIDED WITH VFD. PROVIDE ALARM INDICATION TO E.C.C. WHENEVER CURRENT LEVEL IS BELOW 10% OF MAXIMUM (FA) FOR 20 SECONDS (FA) OF START COMMAND. FAN SHALL THEN BE LOCKED OUT UNTIL RESET THROUGH E.C.C. BY BUILDING OPERATING PERSONNEL. ON FAILURE OF AN OPERATING FAN AS SENSED BY THE ASSOCIATED SWITCH INDICATION, THE SAME SEQUENCE SHALL OCCUR.
 - RETURN FAN VOLUME CONTROL:
 - AHU-1 RETURN FAN VOLUME CONTROL WILL BE ACCOMPLISHED UTILIZING VARIABLE SPEED DRIVES. SEE PARAGRAPH C.6 BELOW
 - ARRANGE CONTROLS SO THAT FAN WILL START ON LOW SPEED. ON FAILURE OF FAN VOLUME CONTROL SIGNAL, FAN SHALL GO TO LOW SPEED AND STOP.
 - PROVIDE ALARM INDICATION AT E.C.C. FOR VFD FAULT CONDITION. BOTH N.O. AND N.C. CONTACTS SHALL BE PROVIDED WITH VFD. VFD SHALL RAMP UP AND DOWN FULL SCALE OVER 180 SECONDS.
 - RETURN FAN CONTROL:
 - PROVIDE CURRENT INPUT TO PROVIDE FAN STATUS INDICATION TO E.C.C. CURRENT FUNCTION WILL BE PROVIDED WITH VFD. PROVIDE ALARM INDICATION TO E.C.C. WHENEVER CURRENT LEVEL IS BELOW 10% OF MAXIMUM (FA) FOR 20 SECONDS (FA) OF START COMMAND. FAN SHALL THEN BE LOCKED OUT UNTIL RESET THROUGH E.C.C. BY BUILDING OPERATING PERSONNEL. ON FAILURE OF RETURN FAN AS SENSED BY THE ASSOCIATED CURRENT INDICATION, THE SAME SEQUENCE SHALL OCCUR.
- AHU SEQUENCE OF OPERATION
 - SUPPLY AND RETURN FANS SHALL OPERATE CONTINUOUSLY.
 - WHENEVER OUTSIDE AIR DRY-BULB TEMPERATURE IS ABOVE 70° (FA), THE CONTROL SHALL OVERRIDE MIXED AIR CONTROLLER AND FULLY OPEN THE RETURN AIR DAMPER D-2 AND SET THE OUTSIDE AIR DAMPER D-1 TO MAINTAIN MINIMUM OUTDOOR AIR.
 - THE COOLING COIL CONTROL VALVE SHALL MODULATE TO CONTROL SET POINT. THE SECONDARY CHILLED WATER PUMP SHALL START WITH THE SIGNAL TO MODULATE THE CONTROL VALVE. WHEN CHILLED WATER IS NOT NEEDED, THE PUMP SHALL STOP.
 - WHENEVER OUTSIDE AIR DRY-BULB TEMPERATURE IS BETWEEN 52°F (FA) AND 70° (FA), THE ECONOMIZER CONTROL SHALL MAINTAIN SETPOINT BY MODULATING DAMPERS D-1 AND D-2.
 - THE TCP SHALL MAINTAIN THE SUPPLY AIR TEMPERATURE SENSED BY T-1.
 - WHEN THE TEMPERATURE OF THE OUTSIDE AIR, SENSED BY T-2 IS BELOW THE SUPPLY AIR TEMPERATURE, SENSED BY T-1, DAMPERS D-1 AND D-2 SHALL MODULATE TO MAINTAIN THE SCHEDULED SUPPLY AIR TEMPERATURE.
 - PRE-HEAT COIL
 - WHEN THE OUTDOOR AIR TEMPERATURE IS BELOW 55°F (FA), THE PRE-HEAT COIL VALVE SHALL MODULATE TO MAINTAIN A PREHEAT COIL DISCHARGE AIR TEMPERATURE OF 55°F (FA). THE SECONDARY HOT WATER PUMP SHALL START WITH THE SIGNAL TO MODULATE THE HOT WATER CONTROL VALVE. WHEN HOT WATER IS NOT NEEDED, THE SECONDARY HOT WATER PUMP SHALL STOP. THE COOLING COIL CHILLED WATER CONTROL VALVE SHALL CLOSE.
 - AIR FLOW CONTROL
 - THE SUPPLY AIR FLOW SHALL BE CONTROLLED BY THE TCP MODULATING THE SUPPLY FAN VARIABLE SPEED MOTOR CONTROLLER (VFD-2a & VFD-2b) TO MAINTAIN 1.0"W.C. (37 MM) OF DUCT STATIC PRESSURE (FIELD ADJUSTABLE). SENSED BY SP-1, SP-2, SP-3 AND SP-4. SEE ABOVE FOR LOCATION OF THE DUCT STATIC PRESSURE SENSORS/TRANSMITTERS.
 - THE TCP, USING TOTAL SUPPLY AIR AND RETURN AIR FLOW SIGNALS, SHALL RESET THE RETURN AIR FAN (VFD-1) TO MAINTAIN A CONSTANT AIR FLOW DIFFERENCE BETWEEN THE SUPPLY AIR AND THE RETURN AIR EQUAL TO MINIMUM OUTSIDE AIR.
 - THE TCP, USING HIGH PRESSURE SENSOR SP-5 LOCATED AT THE SUPPLY FAN DISCHARGE, SHALL PREVENT THE SUPPLY FAN FROM DEVELOPING OVER 5" (125 MM) OF STATIC PRESSURE (FIELD ADJUSTABLE). IF STATIC PRESSURE AT SP-5 DOES EXCEED 5" (125 MM) THE SUPPLY AIR FAN SHALL STOP.
 - FREEZE PROTECTION
IF THE AIR TEMPERATURE AS SENSED BY T-5 FALLS BELOW 45°F (FA) (7°C), AN ALARM SIGNAL SHALL INDICATE AT THE TCP AND ECC. IF THIS TEMPERATURE FALLS BELOW 40°F (FA) (4.4°C), THE SUPPLY AND RETURN FANS SHALL SHUT DOWN AND A CRITICAL ALARM SHALL INDICATE AT THE TCP AND ECC.
 - AUTOMATIC SHUTDOWN/RESTART
WHEN SMOKE IS DETECTED BY EITHER SUPPLY OR RETURN AIR SMOKE DETECTORS, THE SUPPLY AND RETURN FANS SHALL SHUT "OFF" AND AN ALARM SIGNAL SHALL BE TRANSMITTED TO THE FIRE ALARM SYSTEM. DAMPER D-2 IN THE RETURN DUCT SHALL CLOSE. SUPPLY AND RETURN FANS SHALL RESTART AND DAMPERS D-2 SHALL OPEN WHEN THE FIRE ALARM CIRCUIT IS RESET.
 - EMERGENCY CONSTANT SPEED OPERATION
UPON FAILURE OF THE VFD, THE SUPPLY AND RETURN FANS SHALL BE STARTED/STOPPED MANUALLY AT THE TCP OR ECC THROUGH THE BY-PASS STARTER. FANS SHALL THEN BE OPERATED AT CONSTANT SPEED.
- MISCELLANEOUS CONTROLS:
PROVIDE INDICATIONS AND ALARM CONDITIONS TO ECC FOR LOW VFD MOTOR CURRENT AND HIGH FILTER PRESSURE DROP (FA).

NOTE: TCP (TEMPERATURE CONTROL PANEL) REFERS TO THE CONTROL CONTRACTOR NEW CONTROL PANEL LOCATED IN THE FAN ROOM BELOW THE ROOF TOP UNIT.

SEQUENCE OF OPERATION: (EMERGENCY POWER MODE) 3

- UPON LOSS OF REGULAR POWER, MOTORIZED DAMPERS MS1, MS2, MS3, MS4, MR1, MR2, MR3 AND MR4 SHALL REMAIN FULLY OPENED. THE ENGINE GENERATOR SHALL START. AFTER A TIME DELAY OF 5 MIN. (FA), SUPPLY FAN SF-1 AND RETURN FAN RF-1 SHALL BE COMMANDED TO START & SHALL RAMP UP TO MAXIMUM SPEED.
- MOTORIZED DAMPERS MS3 AND MR3 SERVING THE PATHOLOGY/RADIOLOGY AREAS SHALL REMAIN FULLY OPENED. MOTORIZED DAMPERS MS1, MS2, MS4, MR1, MR2 AND MR4 SHALL SLOWLY MODULATE TOWARDS THE CLOSED POSITION UNTIL DUCT STATIC PRESSURE SENSOR/TRANSMITTER SP-3 FAILS TO MAINTAIN ITS SET POINT. MOTORIZED DAMPERS MS1 AND MR1 SHALL MODULATE OPEN AS REQUIRED TO MAINTAIN SP-3 SET POINT.



CONTROL DIAGRAM (AHU-1, AHU-7) 3

SCALE: NONE

GENERAL NOTES:

- SEE CONTROL DAMPER AND DUCT CONNECTION POINT PLAN.
- CLOSE-OFF PRESSURE OF ALL CONTROL VALVE SHALL BE EQUAL TO OR EXCEED THE TOTAL DYNAMIC HEAD OF THE ASSOCIATED CENTRAL PLANT HEATING HOT WATER PUMPS AND THE CHILLED WATER PUMPS.
- SP-1 AND SP-2 SHALL BE AVERAGING TYPE DUCT STATIC PRESSURE SENSORS/TRANSMITTERS USED TO CONTROL THE FAN SPEED OF SF-1 VIA VFD-2a.
- SP-3 & SP-4 SHALL BE AVERAGING TYPE DUCT STATIC PRESSURE SENSORS/TRANSMITTERS USED TO CONTROL THE FAN SPEED OF SF-2 VIA VFD-2b.

LEGEND

- T-1 SF DISCHARGE
T-2 OA
T-3 MIXED AIR
T-4 RA
T-5 PH COIL DISCHARGE
T-6 COOLING COIL DISCHARGE

- D-1 OA MOTORIZED DAMPER
D-2 RA MOTORIZED DAMPER

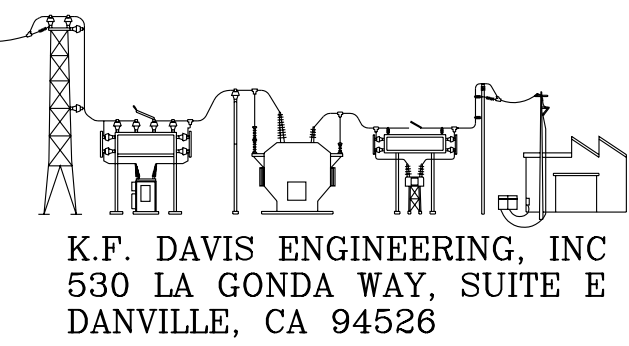
- AFM-1a AND 1b RETURN FAN AIR FLOW MEASURING STATION
AFM-2a AND 2b SUPPLY FAN AIR FLOW MEASURING STATION

- VFD-1a AND 1b RETURN FAN VARIABLE FREQUENCY DRIVE
VFD-2a AND 2b SUPPLY FAN VARIABLE FREQUENCY DRIVE

- F S SMOKE DETECTOR

- SP-1 THROUGH SP-4 DUCT STATIC PRESSURE SENSOR AND TRANSMITTER

- SP-5 DUCT HIGH STATIC PRESSURE SENSOR AND TRANSMITTER



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Approved:

Approved:

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TEMPERATURE CONTROLS AND
SEQUENCE OF OPERATIONS

Approved: Medical Center Director

Approved: Chief, Engineering Service

Drawn:

RMK

Checked:

KL

Project Title:

BLDG 650
REPLACE AIR HANDLERS
1 THRU 4,
7 AND 9 - 15

Building Number:

Location: MATHER VAMC
MATHER CALIFORNIA

Date:
08/25/08

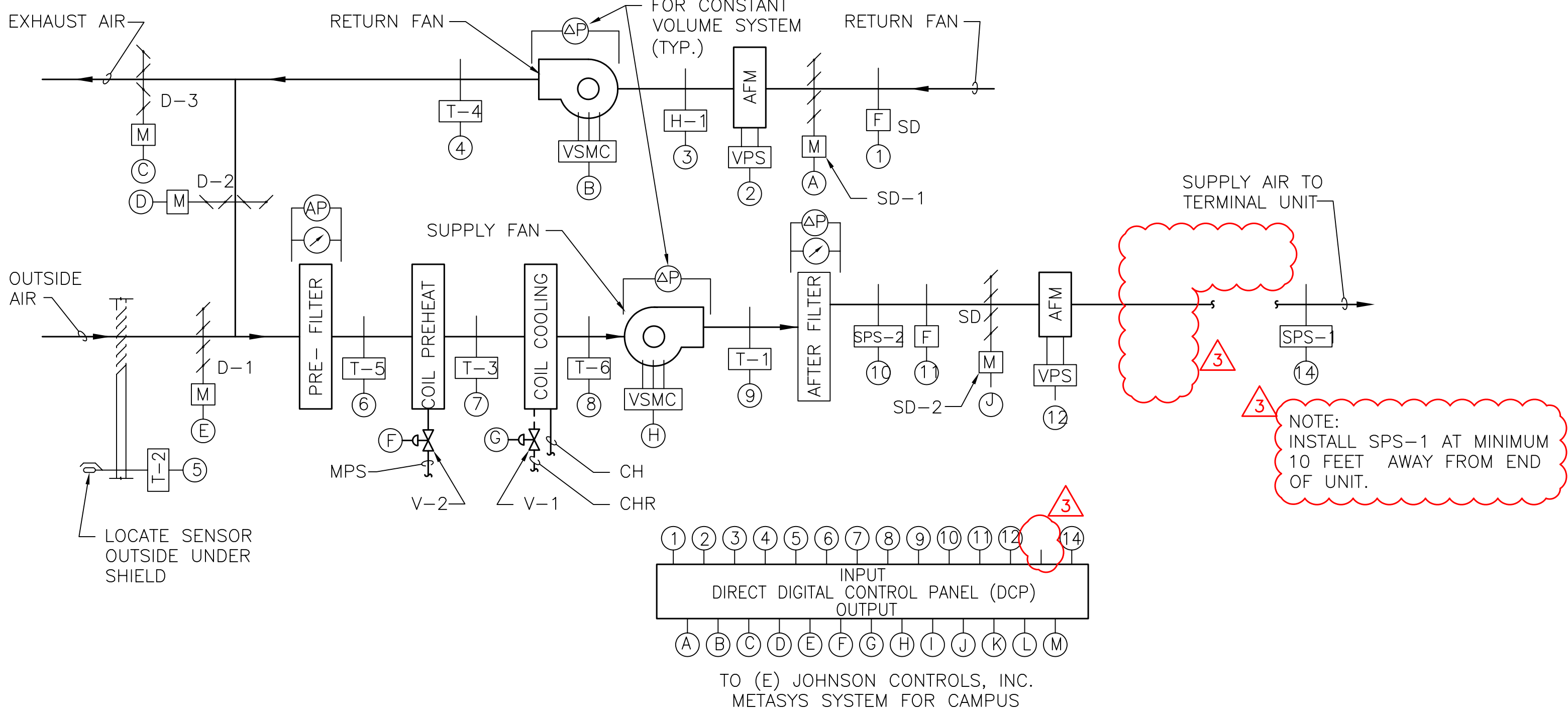
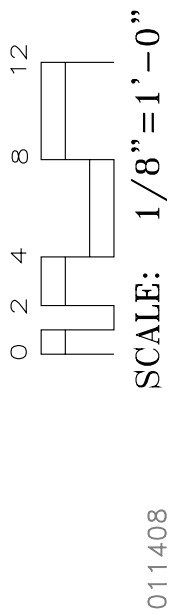
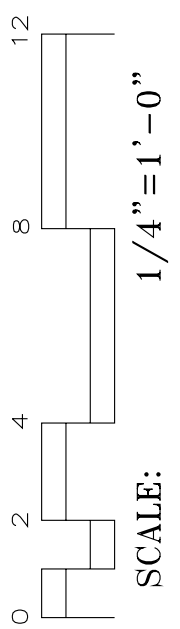
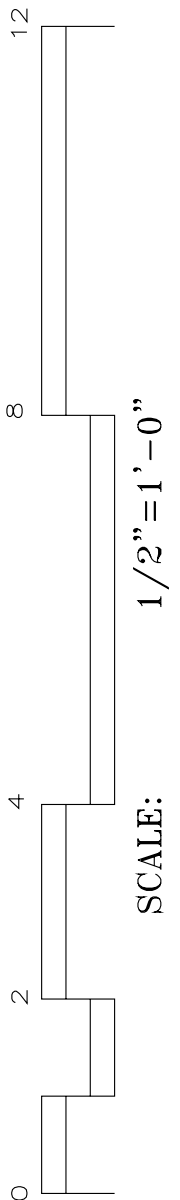
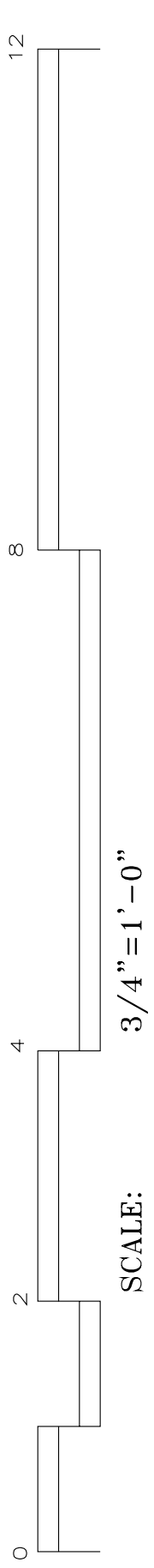
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Dwg. Of



Department of
Veterans Affairs



**VARIABLE AIR VOLUME AIR HANDLING
UNIT WITH ECONOMIZER CONTROL DIAGRAM**

3 (AHU-10 & 14)

**SEQUENCE OF OPERATION FOR VARIABLE AIR VOLUME AIR HANDLING
UNIT WITH ECONOMIZER**

1. GENERAL

1.1 UNIT IS NORMALLY STARTED AND STOPPED BY THE DCP OR REMOTELY AT THE ECC. H-0-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE. WHEN THE UNIT IS "OFF" D-1, D-3, SD-1 AND SD-2 SHALL BE FULLY CLOSED. WHEN THE UNIT IS "ON" D-1, SD-1 AND SD-2 SHALL BE FULLY OPEN. D-2 AND D-3 SHALL MODULATE IN ACCORDANCE WITH THE FOLLOWING SEQUENCE:

2. TEMPERATURE CONTROL

- 2.1 SUPPLY AIR TEMPERATURE, SENSED BY T-1, SHALL BE MAINTAINED AT SETPOINT VIA DCP BY MODULATING V-1 OR D-2 AND D-3 OR V-2 IN SEQUENCE.
- 2.2 WHEN THE TEMPERATURE OF THE OUTSIDE AIR, SENSED BY T-2, IS ABOVE 85°F [29.4°C], THE DCP SHALL PREVENT THE MODULATION OF D-2 AND D-3 AND SHALL ASSUME THE MINIMUM OUTSIDE AIR POSITION (D-2 FULLY OPENED AND D-3 FULLY CLOSED). THE DCP SHALL MODULATE V-1 TO MAINTAIN THE SUPPLY AIR TEMPERATURE, SENSED BY T-1.
- 2.3 WHEN THE TEMPERATURE OF THE OUTSIDE AIR, SENSED BY T-2, IS BETWEEN 65°F [18.3°C] AND THE SUPPLY AIR TEMPERATURE SENSED BY T-1, DAMPER D-2 SHALL FULLY CLOSE AND D3 SHALL BE FULLY OPEN (MAXIMUM OUTSIDE AIR POSITION). THE DCP SHALL MODULATE V-1 TO MAINTAIN THE SUPPLY AIR TEMPERATURE, SENSED BY T-1.
- 2.4 WHEN THE TEMPERATURE OF THE OUTSIDE AIR, SENSED BY T-2, IS BELOW THE SUPPLY AIR TEMPERATURE, SENSED BY T-1, DAMPERS D-2 AND D-3 SHALL MODULATE TO MAINTAIN THE SCHEDULED SUPPLY AIR TEMPERATURE. IF D-2 IS OPEN AND D-3 IS CLOSED TO MINIMUM OUTSIDE AIR, V-2 SHALL MODULATE OPEN TO MAINTAIN THE SUPPLY AIR TEMPERATURE, SENSED BY T-1.

3. AIR FLOW CONTROL

- 3.1 THE SUPPLY AIR FLOW SHALL BE CONTROLLED BY THE DCP MODULATING THE SUPPLY FAN VARIABLE SPEED MOTOR CONTROLLER (VSMC) TO MAINTAIN 1.0" [25mm] OF DUCT STATIC PRESSURE (FIELD ADJUSTABLE), SENSED BY SPS-1. SEE FLOOR PLANS FOR LOCATION OF SPS-1.
- 3.2 THE DCP, USING TOTAL SUPPLY AIR AND RETURN AIR FLOW SIGNALS, SHALL RESET THE RETURN AIR FAN VSMC TO MAINTAIN A CONSTANT AIR FLOW DIFFERENCE BETWEEN THE SUPPLY AIR AND THE RETURN AIR EQUAL TO MINIMUM OUTSIDE AIR.
- 3.3 THE DCP, USING HIGH PRESSURE SENSOR SPS-2 LOCATED AT THE SUPPLY FAN DISCHARGE, SHALL PREVENT THE SUPPLY FAN FROM DEVELOPING OVER 3" [76mm] OF STATIC PRESSURE (FIELD ADJUSTABLE). IF STATIC PRESSURE AT SPS-2 DOES EXCEED 3" [76mm] THE SUPPLY AIR FAN SHALL STOP.

4. FREEZE PROTECTION

- 4.1 IF THE AIR TEMPERATURE AS SENSED BY T-3 FALLS BELOW 45°F [7°C], AN ALARM SIGNAL SHALL INDICATE AT THE DCP AND ECC. IF THIS TEMPERATURE FALLS BELOW 40°F [4.4°C], THE SUPPLY AND RETURN FANS SHALL SHUT DOWN AND A CRITICAL ALARM SHALL INDICATE AT THE DCP AND ECC.

5. AUTOMATIC SHUTDOWN/RESTART

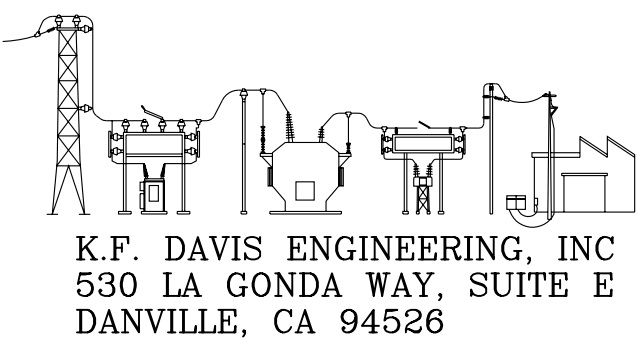
- 5.1 WHEN SMOKE IS DETECTED BY DUCT SMOKE DETECTOR, F SD, THE SUPPLY AND RETURN FANS SHALL SHUT "OFF" AND AN ALARM SIGNAL SHALL BE TRANSMITTED TO THE FIRE ALARM SYSTEM. ALL SMOKE DAMPERS IN THE SUPPLY AND RETURN DUCTS SHALL CLOSE.
- 5.2 EXHAUST FANS SERVING AREA OF THE SUPPLY FAN SHALL CONTINUE TO RUN. SUPPLY AND RETURN FANS SHALL RESTART AND SMOKE DAMPERS SHALL OPEN WHEN FIRE ALARM CIRCUIT IS RESET.

6. EMERGENCY CONSTANT SPEED OPERATION

- 6.1 UPON FAILURE OF THE VSMC, THE SUPPLY AND RETURN FANS SHALL BE STARTED/STOPPED MANUALLY AT THE DCP OR THE ECC THROUGH THE BY-PASS STARTER. FANS SHALL THEN BE OPERATED AT CONSTANT SPEED.

7. CONTRACTOR

- 7.1 CONTROLS SHALL BE JOHNSON CONTROLS, INC. TO MATCH EXISTING. ONLY AUTHORIZED JCI CONTRACTORS SHALL INSTALL THIS WORK.
- 7.2 CONTRACTOR SHALL PROVIDE POWER, WIRING, CONDUIT, ETC. AS REQUIRED FOR CONTROLS WORK.
- 7.3 SEE SPECIFICATIONS SECTION 23 09 23 FOR ADDITIONAL REQUIREMENTS.



Revisions: 3 DATED 07/14/09	Drawing Title: MECHANICAL DIAGRAMS	Project Title: BLDG 650 REPLACE AIR HANDLERS 1 THRU 4, 7 AND 9 - 15	Date: 08/25/08
Approved:	Approved: Medical Center Director	Drawn: RMK	Project No.: 61244-07-342
Approved:	Approved: Chief, Engineering Service	Building Number:	DRAWING No. H5.2
		Location: MATHER VAMC MATHER CALIFORNIA	Dwg. Of

