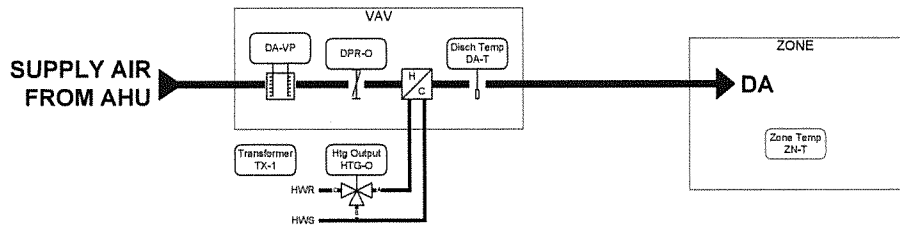


**EQUIPMENT  
SEQUENCE  
OF  
OPERATION**



**BILL OF MATERIALS**

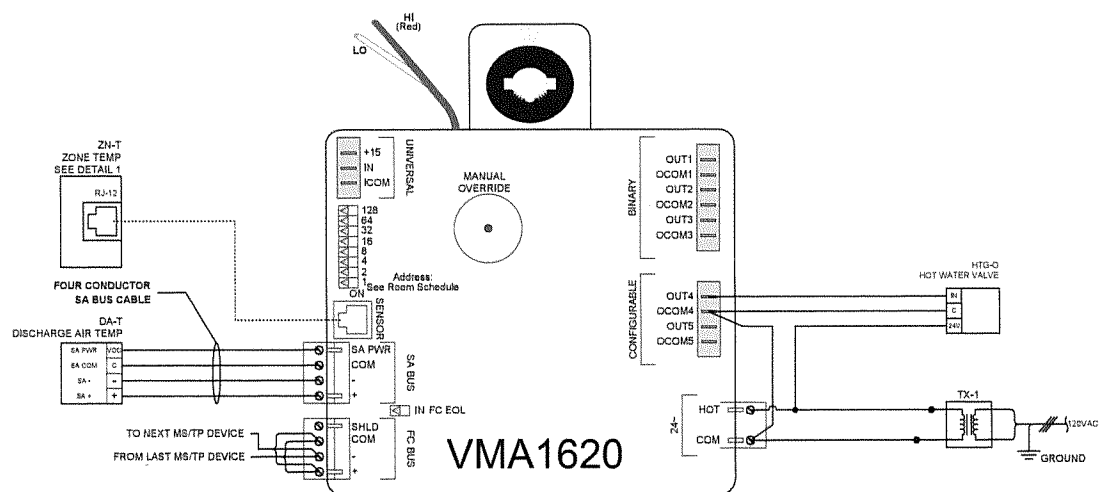
Designation	Qty	Part Number	Description
<b>Field Devices:</b>			
DA-T	72	NS-DTN7043-0	NETWORK DAS 4 INCH PROBE
HTG-O	63	VG1845AD-#36GGA	SS TRIM SPRING CCW M9206-GGA-2
	9	VG1845AF-#36GGA	SS TRIM SPRING CCW M9206-GGA-2
TX-1	72	Y6ST42-0	TRANSFORMER UR CLASS 2
VMA	72	MS-VMA1620-0	VAV CTRL/ACT/DR HTG.FAH
ZN-T	72	NS-ATB7001-0	T.F.C.OCC D.ADJ.P1.3x3
	72	GRD10A-609	PLASTIC THERMOSTAT GUARD

**SEQUENCE OF OPERATION**

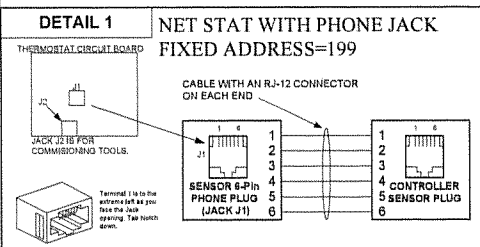
**OCCUPIED MODE:** THE ZONE TEMPERATURE SENSOR (ZN-T) TRANSMITS READINGS TO THE VMA CONTROLLER WHICH IN TURN MODULATES THE PRIMARY AIRFLOW VAV DAMPER AND HEATING VALVE TO MAINTAIN SPACE TEMPERATURE SETPOINTS (ADJ). UPON A RISE IN ZONE TEMPERATURE ABOVE SETPOINT THE VAV BOX CONTROLLER MODULATES THE PRIMARY AIRFLOW DAMPER TO MAXIMUM CFM SETPOINT. A DROP IN SPACE TEMPERATURE BELOW SETPOINT SIGNALS THE VMA TO MODULATE THE PRIMARY AIR DAMPER TO THE MINIMUM CFM SETPOINT. A FURTHER DROP IN ZONE TEMPERATURE SIGNALS THE VMA TO MODULATE THE VAV BOX REHEAT CONTROL VALVE OPEN TO HEAT THE ZONE TO WITHIN +/- 0.5 DEG F OF SETPOINT.

**UNOCCUPIED MODE:** WHEN THE SYSTEM IS INDEXED TO UNOCCUPIED MODE, THE AIR HANDLER STOPS, THE VAV BOX AIR DAMPER AND THE REHEAT VALVE CLOSES. IF THE ZONE TEMPERATURE FALLS BELOW THE NIGHT SETBACK SETPOINT (ADJ) THE AIR HANDLING UNIT WILL START, THE VAV BOX DAMPER WILL OPEN AND THE REHEAT VALVE WILL MODULATE OPEN TO MAINTAIN THE UNOCCUPIED ZONE TEMPERATURE AT SETPOINT. IF THE ZONE TEMPERATURE RISES ABOVE THE NIGHT CYCLE SETPOINT THE AIR HANDLING UNIT WILL START AND THE VAV BOX DAMPER WILL MODULATE OPEN TO COOL THE ZONE TO THE UNOCCUPIED COOLING SETPOINT TEMPERATURE. THE ZN-T SENSOR CONTAINS A PUSH BUTTON OVERRIDE TO ALLOW OCCUPANTS TO INDEX THE SYSTEM TO OCCUPIED MODE FOR AFTER HOURS USE. THE VMA CONTROLLER WILL FUNCTION PER THE OCCUPIED MODE OF OPERATION UNTIL THE TEMPORARY OCCUPANCY TIMER EXPIRES. AT WHICH TIME THE VMA CONTROLLER SHALL REVERT TO UNOCCUPIED MODE OF OPERATION DEPENDING ON TIME OF DAY SCHEDULING.

**MORNING WARM-UP MODE:** WHEN INDEXED TO THE MORNING WARM-UP MODE OF OPERATION THE DDC SYSTEM SHALL SET THE SPACE SENSOR TO ITS OCCUPIED HEATING TEMPERATURE SETPOINT (ADJ). THE VMA CONTROLLER SHALL INDEX THE VAV AIRFLOW DAMPER TO 100% OPEN. THE REHEAT VALVE SHALL OPEN AND ALLOW THE PRIMARY AIRFLOW TO HEAT THE ZONE WHEN THE RESPECTIVE AIR HANDLER IS CYCLED TO MORNING WARM-UP MODE. WHEN THE ZONE TEMPERATURE REACHES ITS OCCUPIED SETPOINT THE VAV DAMPER AND REHEAT VALVE SHALL CLOSE AND THE AIR HANDLER IS STILL IN WARM-UP MODE. AS THE AIR HANDLER IS INDEXED TO OCCUPIED MODE OF OPERATION THE VAV BOX SHALL INDEX TO OCCUPIED MODE AS WELL.



Submittal					Controller Information					Field Device					
Tag	Point Type	System Name	Object Name	Expanded ID	Controller Type	Trunk Type	Trunk Nbr	Trunk Addr.	Cable Destination Bay/Terminal	DO Type	Module Type	Wiring /Tubing	Device	Location	Comment
		VE-xxx			FEC VMA	MS/TP	x	See Riser							Power to Controller
		VG-xxx			FEC VMA	MS/TP	x	See Riser							BacNet FC Bus
UI	IN-1	VG-xxx			FEC VMA	MS/TP	x	See Riser	UI IN-1						
BO	OUT-1	VG-xxx			FEC VMA	MS/TP	x	See Riser	BO OUT-1						
BO	OUT-2	VG-xxx			FEC VMA	MS/TP	x	See Riser	BO OUT-2						
BO	OUT-3	VG-xxx			FEC VMA	MS/TP	x	See Riser	BO OUT-3						
CO	OUT-4	VG-xxx	HTG-O	Heating Output	FEC VMA	MS/TP	x	See Riser	CO OUT-4						M9206-GGA-2 (24VAC) EXT SOURCE
CO	OUT-5	VG-xxx			FEC VMA	MS/TP	x	See Riser	CO OUT-5						
		VG-xxx			NET STAT										
STAT		VG-xxx	ZN-T/H	Zone Temp/Humidity	NET STAT	SA Bus		1	199						BacNet SA Bus
		VG-xxx			NET STAT	SA Bus		1	199	STAT					
		VG-xxx			NET STAT	SA Bus			204						
STAT		VG-xxx	DA-T	Discharge Air Temp	NET STAT	SA Bus			204	STAT					



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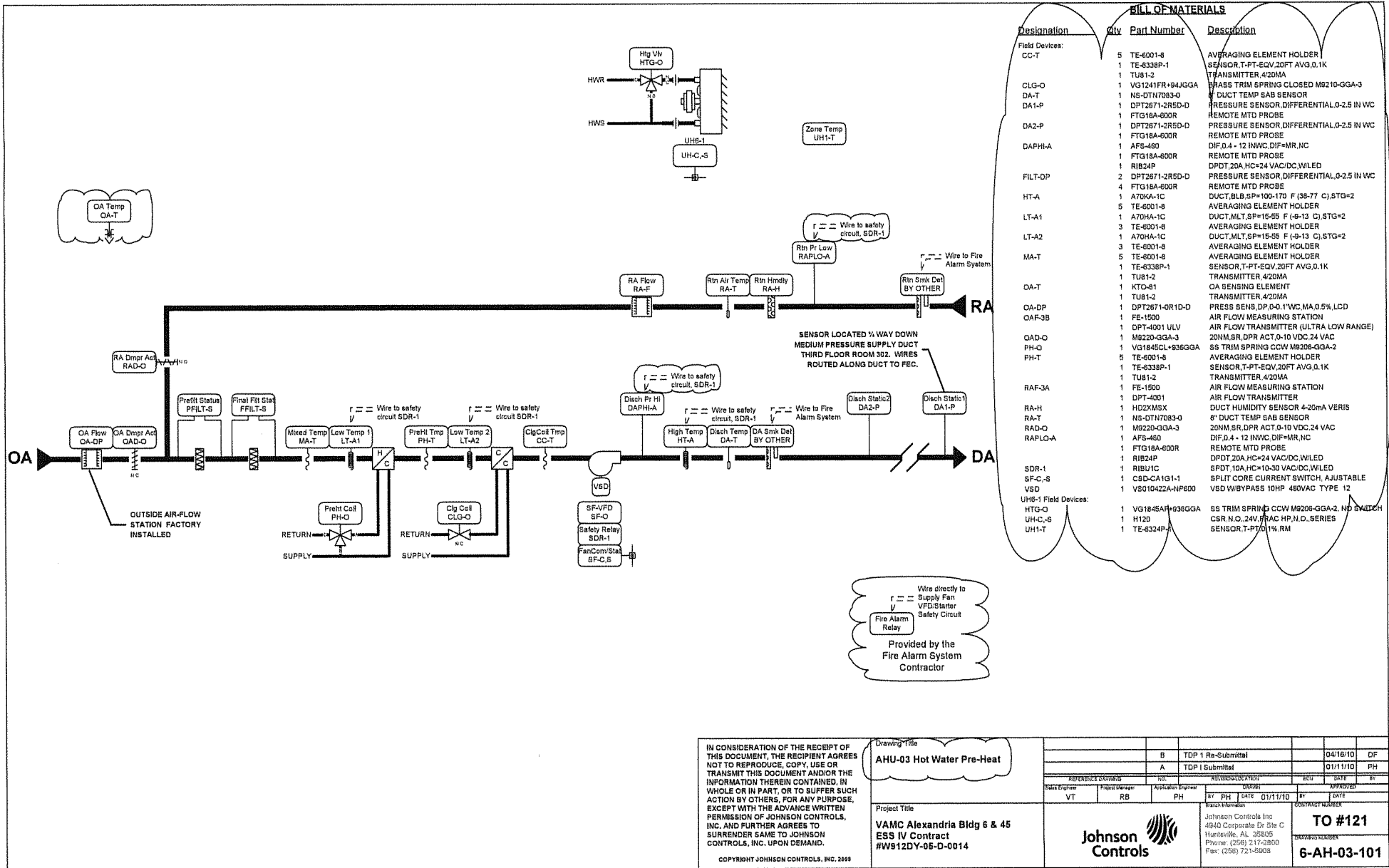
Drawing Title: **VAV Box Flow Diagram**  
Typical of 72

Project Title: **VAMC Alexandria Bldg 6 & 45**  
ESS IV Contract #W912DY-05-D-0014

Design	Rev	Date	By	Appr
B	TDP 1 ReSubmittal			04/18/10
A	TDP 1 Submittal			01/11/10

Johnson Controls  
4940 Corporate Dr Ste C  
Huntsville, AL 35895  
Phone: (256) 217-2800  
Fax: (256) 721-5908

**TO #121**  
DRAWING NUMBER  
**6-VAV-101**



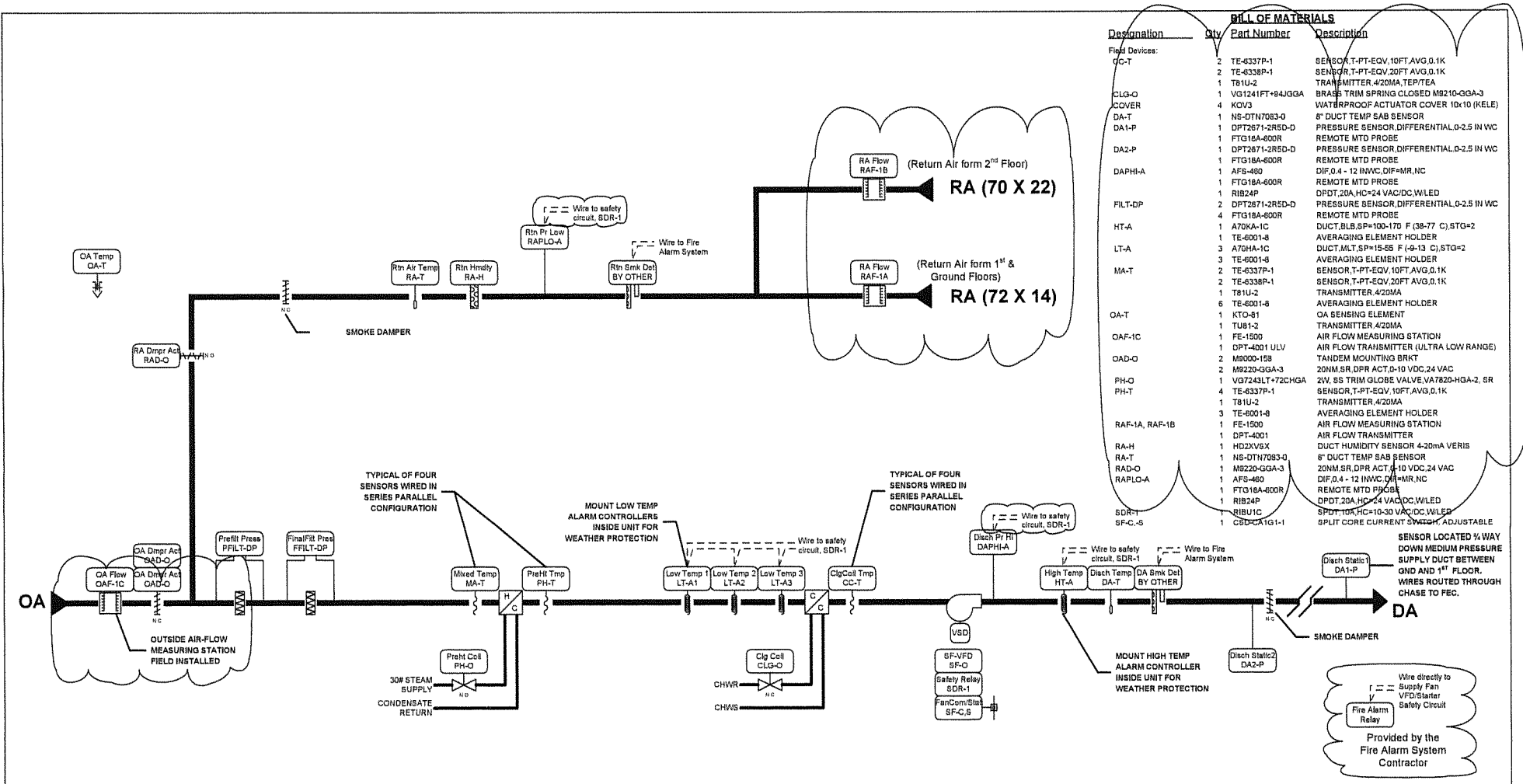
Designation	Qty	Part Number	Description
<b>Field Devices:</b>			
CC-T	5	TE-6001-8	AVERAGING ELEMENT HOLDER
	1	TE-6338P-1	SENSOR, T-PT-EQV, 20FT AVG, 0.1K
	1	TU81-2	TRANSMITTER, 4/20MA
CLG-O	1	VG1241FR+94JGGA	PASS TRIM SPRING CLOSED M9210-GGA-3
DA-T	1	NS-DT17083-0	DUCT TEMP SAB SENSOR
DA1-P	1	DPT2671-2R5D-D	PRESSURE SENSOR DIFFERENTIAL, 0-2.5 IN WC
	1	FTG18A-600R	REMOTE MTD PROBE
DA2-P	1	DPT2671-2R5D-D	PRESSURE SENSOR DIFFERENTIAL, 0-2.5 IN WC
	1	FTG18A-600R	REMOTE MTD PROBE
DAPH-A	1	AFS-480	DIF, 0.4 - 12 INWC, DIF=MR, NC
	1	FTG18A-600R	REMOTE MTD PROBE
	1	RIB24P	DPDT, 20A, HC=24 VAC/DC, W/LED
FILT-DP	2	DPT2671-2R5D-D	PRESSURE SENSOR DIFFERENTIAL, 0-2.5 IN WC
	4	FTG18A-600R	REMOTE MTD PROBE
HT-A	1	A70KA-1C	DUCT, BLB, SP=100-170 F (36-77 C), STG=2
	5	TE-6001-8	AVERAGING ELEMENT HOLDER
LT-A1	1	A70HA-1C	DUCT, MLT, SP=15-55 F (-9-13 C), STG=2
	3	TE-6001-8	AVERAGING ELEMENT HOLDER
LT-A2	1	A70HA-1C	DUCT, MLT, SP=15-55 F (-9-13 C), STG=2
	3	TE-6001-8	AVERAGING ELEMENT HOLDER
MA-T	5	TE-6001-8	AVERAGING ELEMENT HOLDER
	1	TE-6338P-1	SENSOR, T-PT-EQV, 20FT AVG, 0.1K
	1	TU81-2	TRANSMITTER, 4/20MA
OA-T	1	KTC-01	OA SENSING ELEMENT
	1	TU81-2	TRANSMITTER, 4/20MA
OA-3P	1	DPT2671-R1D-D	PRESS SENS DP, 0-3.1 WC, MA, 0.5%, LCD
OAF-3B	1	FE-1500	AIR FLOW MEASURING STATION
	1	DPT-4001 ULV	AIR FLOW TRANSMITTER (ULTRA LOW RANGE)
OAD-O	1	M9220-GGA-3	20MM, SR, DPR ACT, 0-10 VDC, 24 VAC
PH-O	1	VG1845CL+936GGA	SS TRIM SPRING CCW M9206-GGA-2
PH-T	5	TE-6001-8	AVERAGING ELEMENT HOLDER
	1	TE-6338P-1	SENSOR, T-PT-EQV, 20FT AVG, 0.1K
	1	TU81-2	TRANSMITTER, 4/20MA
RAF-3A	1	FE-1500	AIR FLOW MEASURING STATION
	1	DPT-4001	AIR FLOW TRANSMITTER
RA-H	1	HD2XMSX	DUCT HUMIDITY SENSOR 4-20mA, VERIS
RA-T	1	NS-DT17083-0	8" DUCT TEMP SAB SENSOR
RAD-O	1	M9220-GGA-3	20MM, SR, DPR ACT, 0-10 VDC, 24 VAC
RALFO-A	1	AFS-480	DIF, 0.4 - 12 INWC, DIF=MR, NC
	1	FTG18A-600R	REMOTE MTD PROBE
	1	RIB24P	DPDT, 20A, HC=24 VAC/DC, W/LED
	1	RIBU1C	SPDT, 10A, HC=10-30 VAC/DC, W/LED
SDR-1	1	CSB-CA1G11-1	SPLIT CORE CURRENT SWITCH, ADJUSTABLE
SFC-S	1	V3010A22A-1P600	VSD W/BYPASS 10HP 480VAC TYPE 12
VSD	1	V3010A22A-1P600	VSD W/BYPASS 10HP 480VAC TYPE 12
<b>UH6-1 Field Devices:</b>			
HTG-O	1	VG1845AH+936GGA	SS TRIM SPRING CCW M9206-GGA-3, NO SWITCH
H120	1	H120	CSR N.O., 24V, FRAC HP, N.O., SERIES
UH-C-S	1	TE-6324P-A	SENSOR, T-PT, 0.1% RM
UH1-T	1	TE-6324P-A	SENSOR, T-PT, 0.1% RM

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Drawing Title  
**AHU-03 Hot Water Pre-Heat**

Project Title  
**VAMC Alexandria Bldg 6 & 45  
 ESS IV Contract  
 #W912DY-06-D-0014**

DATE	BY	DATE	BY
04/16/10	DF	01/11/10	PH
TDP 1 Re-Submittal		TDP 1 Submittal	
DATE	BY	DATE	BY
01/11/10	PH	01/11/10	PH
DATE	BY	DATE	BY
01/11/10	PH	01/11/10	PH
Johnson Controls Inc 4940 Corporate Dr Ste C Huntsville, AL 35895 Phone: (256) 217-2800 Fax: (256) 721-5908			
<b>TO #121</b>			
<b>6-AH-03-101</b>			



Designation	Qty	Part Number	Description
<b>Field Devices:</b>			
GC-T	2	TE-4337P-1	SENSOR, T-PT-EQV, 10FT AVG, 0.1K
	2	TE-4338P-1	SENSOR, T-PT-EQV, 20FT AVG, 0.1K
	1	T81U-2	TRANSMITTER, 4Z20MA, TEP/TEA
CLG-O	1	VG1241FT+84JGGA	BRASS TRIM SPRING CLOSED M9210-GGA-3
COVER	4	KOV3	WATERPROOF ACTUATOR COVER 10X10 (KELE)
DA-T	1	NS-DTN7083-0	8" DUCT TEMP SAB SENSOR
DA1-P	1	DPT2671-2R5D-D	PRESSURE SENSOR, DIFFERENTIAL, 0-2.5 IN WC
DA2-P	1	FTG18A-600R	REMOTE MTD PROBE
	1	DPT2671-2R5D-D	PRESSURE SENSOR, DIFFERENTIAL, 0-2.5 IN WC
FTG18A-600R	1	FTG18A-600R	REMOTE MTD PROBE
DA-PHI-A	1	AFS-460	DIF, 0.4 - 12 INWC, DIF-MR, NC
	1	FTG18A-600R	REMOTE MTD PROBE
	1	RIB24P	DPDT, 20A, HC=24 VAC/DC, W/LED
FILT-DP	2	DPT2671-2R5D-D	PRESSURE SENSOR, DIFFERENTIAL, 0-2.5 IN WC
	4	FTG18A-600R	REMOTE MTD PROBE
HT-A	1	A70KA-1C	DUCT, BLB, SP=100-170 F (38-77 C), STG=2
	1	TE-6001-B	AVERAGING ELEMENT HOLDER
LT-A	3	A70HA-1C	DUCT, M.LT, SP=15-55 F (-9-13 C), STG=2
	3	TE-6001-B	AVERAGING ELEMENT HOLDER
MA-T	2	TE-4337P-1	SENSOR, T-PT-EQV, 10FT AVG, 0.1K
	2	TE-4338P-1	SENSOR, T-PT-EQV, 20FT AVG, 0.1K
	1	T81U-2	TRANSMITTER, 4Z20MA
	6	TE-6001-B	AVERAGING ELEMENT HOLDER
OA-T	1	KTO-61	OA SENSING ELEMENT
	1	TU81-2	TRANSMITTER, 4Z20MA
OAF-1C	1	FE-1500	AIR FLOW MEASURING STATION
	1	DPT-4001 ULV	AIR FLOW TRANSMITTER (ULTRA LOW RANGE)
OAD-O	2	M8000-159	TANDEM MOUNTING BRKT
	2	M9220-GGA-3	20MM SR DPR ACT, 0-10 VDC, 24 VAC
PH-O	1	V37243LT+7ZCHGA	2IV, SS TRIM GLOBE VALVE, V47820-HGA-2, GR
PH-T	4	TE-4337P-1	SENSOR, T-PT-EQV, 10FT AVG, 0.1K
	1	T81U-2	TRANSMITTER, 4Z20MA
	3	TE-6001-B	AVERAGING ELEMENT HOLDER
RAF-1A, RAF-1B	1	FE-1500	AIR FLOW MEASURING STATION
	1	DPT-4001	AIR FLOW TRANSMITTER
RA-H	1	HD2XV6X	DUCT HUMIDITY SENSOR 4-20mA VERIS
RA-T	1	NS-DTN7083-0	8" DUCT TEMP SAB SENSOR
RAD-O	1	M9220-GGA-3	20MM SR DPR ACT, 0-10 VDC, 24 VAC
RAPLO-A	1	AFS-460	DIF, 0.4 - 12 INWC, DIF-MR, NC
	1	FTG18A-600R	REMOTE MTD PROBE
	1	RIB24P	DPDT, 20A, HC=24 VAC/DC, W/LED
	1	RIBU1C	SPDT, 10A, HC=10-30 VAC/DC, W/LED
SDR-1	1	SDR-1	SPLIT CORE CURRENT TRANSFORMER, ADJUSTABLE
SF-C-5	1	SDR-1	SPLIT CORE CURRENT TRANSFORMER, ADJUSTABLE

SENSOR LOCATED 1/4 WAY DOWN MEDIUM PRESSURE SUPPLY DUCT BETWEEN 0ND AND 1<sup>ST</sup> FLOOR. WIRES ROUTED THROUGH CHASE TO FEC.

Wire directly to Supply Fan VFD/Start Safety Circuit

Fire Alarm Relay

Provided by the Fire Alarm System Contractor

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**Drawing Title**  
AHU-01 Steam Pre-Heat Flow Diagram

REVISIONS	DATE	BY
B	TDP 1 Re-Submittal	04/14/10 DF
A	TDP 1 Submittal	01/11/10 PH

Project Title  
VAMC Alexandria Bldg 6 & 45  
ESS IV Contract  
#W912DY-05-D-0014

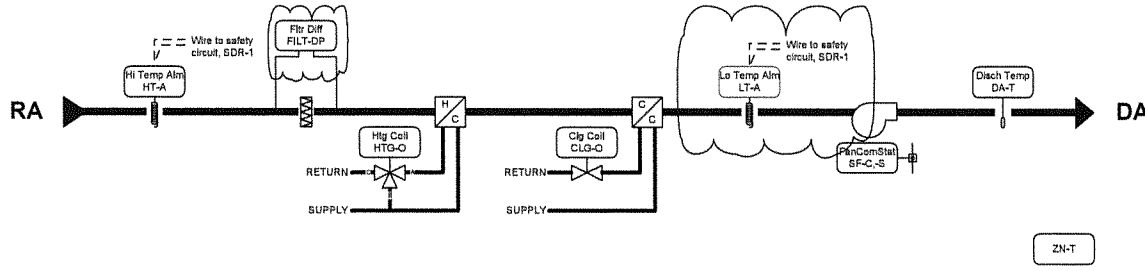
**Johnson Controls**

Johnson Controls Inc.  
4840 Corporate Dr. Ste C  
Huntsville, AL 35895  
Phone: (256) 217-2600  
Fax: (256) 721-6908

**TO #121**  
CONTRACT NUMBER  
**6-AH-01-101**

**BILL OF MATERIALS**

Designation	Qty	Part Number	Description
<b>Field Devices:</b>			
CLG-O	1	VG1241AD+956GGA	BRASS TRIM SPRING CLOSERS M9209-GGA-3
DA-T	1	NS-DTN7083-O	8" DUCT TEMP S&B SENSOR
FILT-DP	1	DPT2671-2R5D-D	PRESSURE SENSOR, DIFFERENTIAL, 0-2.5 IN WC
HT-A	2	FTG18A-800R	REMOTE MTD PROBE
	1	A70KA-1C	DUCT, BLB, SP=100-170 F (38-77 C), STG=2
	5	TE-6001-B	AVERAGING ELEMENT HOLDER
HTG-O	1	VG1845AD+936GGA	SS TRIM SPRING CCW M9205-33A-2
LT-A	1	A70HA-1C	DUCT, MLT, SP=15-68 F (-3-13 C), STG=2
	5	TE-6001-B	AVERAGING ELEMENT HOLDER
SDR-1	1	R192402D	DPDT, 10A @ 277VAC, COIL=24 VAC/DC, WITH LED
SF-C-S	1	H120	CSR, N.O., 24V, FRAC HP, N.O., SERIES
ZN-T	1	NS-9TB7003-O	TE, FIC, DIS, ADJ, OCC, TS



ZN-T

**SEQUENCE OF OPERATION**

**START/STOP CONTROL:** THE FAN COIL UNIT SHALL OPERATE ON A SCHEDULE AS SET BY THE ECC. THE UNIT FAN SHALL BE STARTED AND STOPPED BY THE DDC SYSTEM THROUGH THE ECC. THE CONTROL LOOPS ARE ENERGIZED WHEN FAN RUN STATUS IS PROVEN BY THE CURRENT SENSING RELAY. STOPPING THE UNIT WILL DE-ENERGIZE THE CONTROL LOOPS AND SEND THE HOT WATER AND CHILLED WATER CONTROL VALVES TO THE CLOSED POSITION.

**TEMPERATURE CONTROL:** A ZONE TEMPERATURE SENSOR SENDS TEMPERATURE INFORMATION TO THE DDC SYSTEM. THE DDC SYSTEM THEN MODULATES THE CHILLED WATER AND HOT WATER CONTROL VALVES IN SEQUENCE TO MAINTAIN ZONE TEMPERATURE SETPOINT. UPON A RISE IN ZONE TEMPERATURE THE CHILLED WATER VALVE SHALL MODULATE OPEN TO MAINTAIN ZONE TEMPERATURE SETPOINT OF 75 DEG F (ADJ). IF THE ZONE TEMPERATURE FALLS BELOW 70 DEG F SETPOINT (ADJ) THE HOT WATER VALVE SHALL MODULATE OPEN TO MAINTAIN ZONE SETPOINT. IF THE UNIT FAILS TO OPERATE BETWEEN THE RANGE OF 70-75 DEG F (ADJ) AN ALARM MESSAGE WILL BE SENT TO THE ECC AND BOTH CHILLED AND HOT WATER CONTROL VALVES SHALL CLOSE.

**SYSTEM SAFETIES:** A HIGH LIMIT THERMOSTAT IN THE RETURN AIR PATH WILL STOP THE UNIT UPON DETECTION OF TEMPERATURE ABOVE ITS SETPOINT OF 125 DEG F. A LOW LIMIT THERMOSTAT LOCATED BEFORE THE COILS WILL STOP THE UNIT UPON DETECTION OF AIR TEMPERATURE BELOW ITS SETPOINT OF 35 DEG F. FILTER STATUS SHALL BE MONITORED BY A DIFFERENTIAL PRESSURE SENSOR AT THE FILTER BANK.

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	Project Title	VAMC Alexandria Bldg 6 & 45 ESS IV Contract #W912DY-05-D-0014		A TDP I Submittal		01/11/10	PH
	Revision	VT	RB	PH	PH	DATE	BY
	Project Information	Johnson Controls Inc 4840 Corporate Dr Site C Huntsville, AL 35895 Phone: (256) 217-2600 Fax: (256) 721-9308		TO #121		6-FCU-101	

**SEQUENCE OF OPERATION**

**START-STOP CONTROL:** THE AIR HANDLING UNIT SHALL BE STARTED AND STOPPED AUTOMATICALLY AT THE ECC. THE HOA SWITCH SHALL BE KEPT IN THE AUTO POSITION – HAND AND OFF POSITIONS WILL BE USED FOR MAINTENANCE ONLY. UPON RECEIVING A START COMMAND THE SUPPLY FAN SHALL START ONLY AFTER ALL INTERNAL SAFETIES ARE PROVEN. ONCE FAN RUN STATUS IS PROVEN BY A CURRENT SENSING RELAY, THE CONTROLS SHALL OPERATE ACCORDING TO THE SEQUENCES AS DESCRIBED BELOW.

**MINIMUM OUTSIDE AIR FLOW CONTROL:** OUTSIDE AIR IS METERED TO MONITOR AND MAINTAIN A CONSTANT MINIMUM OUTSIDE AIR FLOW BY MODULATING THE RETURN AND OUTSIDE AIR DAMPERS UP TO THE MAXIMUM FLOW SETPOINT OF 5000 CFM (ADJUSTABLE).

**PREHEAT TEMPERATURE CONTROL:** A TEMPERATURE SENSOR IN THE PREHEAT COIL DISCHARGE WILL TRANSMIT TEMPERATURE CHANGES TO THE DDC. THE DDC SYSTEM WILL MODULATE THE 2 WAY STEAM PRE-HEAT CONTROL VALVE TO MAINTAIN PREHEAT TEMPERATURE SETPOINT (ADJ).

**DISCHARGE AIR TEMPERATURE CONTROL:** A TEMPERATURE SENSOR IN THE DISCHARGE AIR DUCT TRANSMITS TEMPERATURE CHANGES TO THE DDC. THE DDC MODULATES THE 2 WAY COOLING COIL CONTROL VALVE TO MAINTAIN DISCHARGE AIR TEMPERATURE SETPOINT OF 55 DEG F (ADJUSTABLE).


**STATIC PRESSURE AND SUPPLY FAN SPEED CONTROL:** THE VFD SHALL MODULATE THE SPEED OF THE SUPPLY FAN TO MAINTAIN DISCHARGE AIR STATIC PRESSURE TO ITS SETPOINT OF 1.0 IN WC (ADJUSTABLE) AS SENSED BY THE DUCT STATIC PRESSURE SENSOR LOCATED ¼ OF THE WAY DOWN THE LONGEST DUCT MAIN. AS THE DISCHARGE AIR STATIC PRESSURE INCREASES, THE SUPPLY FAN SPEED SHALL DECREASE TOWARDS ITS MINIMUM FREQUENCY. AS THE DISCHARGE AIR STATIC PRESSURE DECREASES THE SUPPLY FAN SPEED SHALL INCREASE. THE STATIC PRESSURE IS RESET BASED ON ACTUAL BUILDING LOAD BY POLLING ALL VAV TERMINAL UNITS

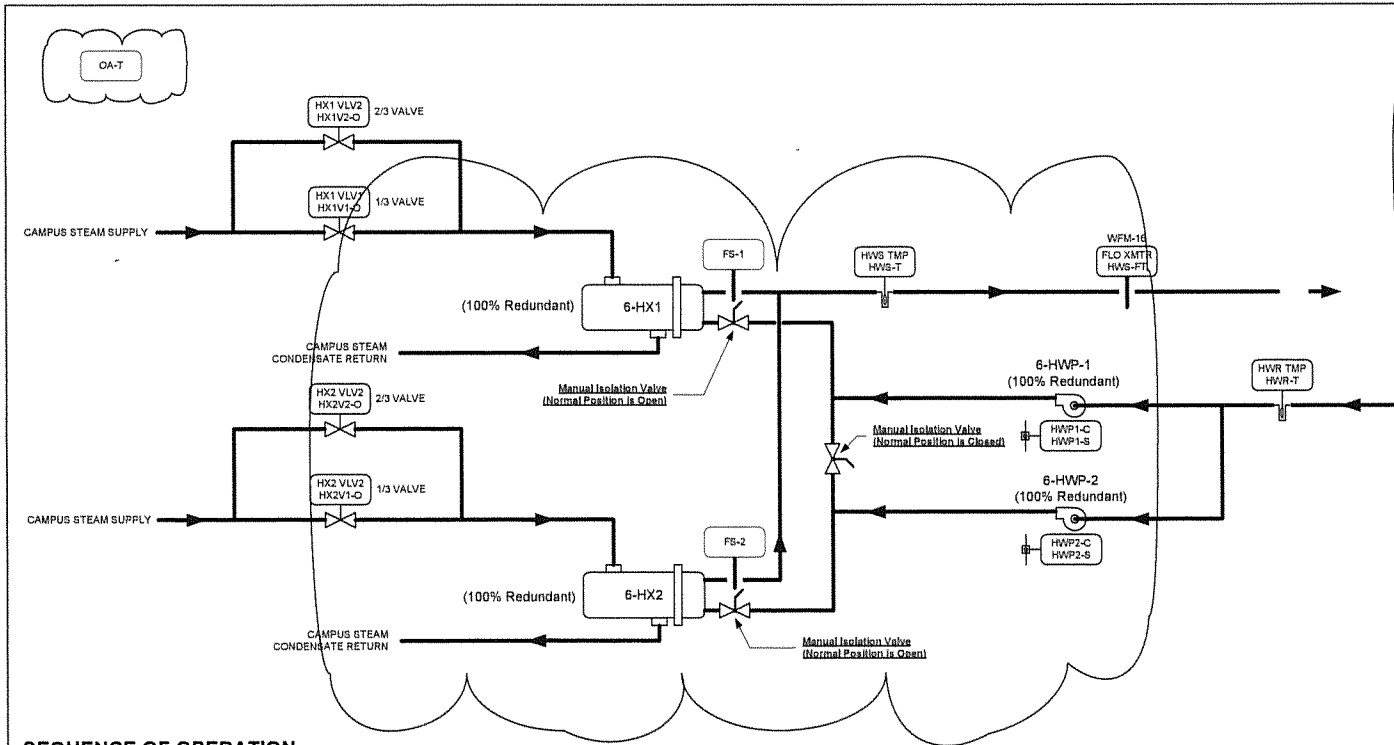
**DEHUMIDIFICATION CONTROL:** A DUCT HUMIDITY SENSOR (RA-H) SHALL MEASURE THE RETURN AIR HUMIDITY AT THE AHU. THE DDC SHALL AVERAGE THE POSITION OF THE VAV BOX AIR VALVES AND SHALL ADJUST THE AIR TEMPERATURE UP OR DOWN TO PROVIDE THE MOST EFFICIENT SUPPLY AIR TEMPERATURE TO SATISFY VAV BOX DURING OCCUPIED OPERATION. IF THE RETURN AIR HUMIDITY RISES ABOVE SETPOINT OF 60% (ADJ) THE SUPPLY AIR TEMPERATURE OF THE AHU WILL BE LOWERED TO KEEP THE RETURN AIR HUMIDITY BELOW SETPOINT. DISCHARGE AIR HUMIDITY IS ALSO MONITORED BY THE DDC WITH DUCT HUMIDITY SENSOR DA-H WHICH IS USED TO MAINTAIN DISCHARGE AIR HUMIDITY BELOW SETPOINT.

**SAFETIES:** THE UNIT SHALL STOP UPON ANY OF THE SAFETIES BEING TRIPPED REGARDLESS OF THE MODE OF OPERATION (AUTOMATIC, HAND OR BYPASS) (1) THE AIR HANDLER RETURN AIR AND DISCHARGE AIR SMOKE DETECTORS SHALL STOP THE UNIT AND CLOSE THE SMOKE DAMPERS UPON SENSING COMBUSTION PRODUCTS IN THE SYSTEM. ~~THE SMOKE DETECTORS MUST BE MANUALLY RESET AFTER~~ AN ALARM CONDITION IN ORDER FOR THE FAN TO RESTART AND THE SMOKE DAMPERS TO OPEN. (2) A MIXED AIR TEMPERATURE SENSOR (MA-T) UPSTREAM OF THE COOLING COIL SIGNALS THE DDC UPON A DROP IN TEMPERATURE BELOW 45 DEG F WHICH WILL GENERATE AN ALARM TO THE ECC. A TEMPERATURE LOW LIMIT SWITCH (LT-A) SHALL STOP THE UNIT, CLOSE THE OUTSIDE AIR DAMPER, OPEN THE PREHEAT VALVE, AND SEND A CRITICAL ALARM TO THE ECC UPON SENSING A FALL IN TEMPERATURE BELOW SETPOINT (40 DEG F ADJ). THE LOW LIMIT SWITCHES MUST BE MANUALLY RESET AFTER AN ALARM CONDITION. (3) A TEMPERATURE HIGH LIMIT (FIRESTAT, HT-A) SHALL SHUTDOWN THE FAN AND SEND AN ALARM TO THE ECC UPON A RISE IN DISCHARGE AIR TEMPERATURE ABOVE 125 DEG F. THE HIGH LIMIT SWITCH MUST BE MANUALLY RESET AFTER AN ALARM CONDITION. (4) A DISCHARGE AIR HIGH STATIC PRESSURE SAFETY SWITCH (DAPH-A) LOCATED AT THE SUPPLY FAN DISCHARGE SHALL STOP THE UNIT UPON SENSING HIGH DISCHARGE DUCT STATIC ABOVE 3 IN STATIC PRESSURE (ADJ) TO PREVENT OVER PRESSURIZING THE DUCTWORK. STATIC PRESSURE SWITCH IS HARDWIRED TO THE VFD AND UNIT IS SHUTDOWN IN HAND, AUTO, OR BYPASS MODE. THE HIGH STATIC PRESSURE SAFETIES MUST BE MANUALLY RESET AFTER AN ALARM CONDITION. (5) UPON FAILURE OF THE VFD THE SUPPLY FAN SHALL BE CONTROLLED MANUALLY AT THE DDC PANEL OR THE ECC THROUGH THE BYPASS STARTER. FAN SHALL BE OPERATED AT CONSTANT SPEED.

**MONITORING:** THE DDC SYSTEM MONITORS THE DIFFERENTIAL PRESSURE ACROSS EACH FILTER AND GENERATES AN ALARM IF THE DIFFERENTIAL PRESSURE INCREASES ABOVE THE SETPOINT OF 0.75 IN WC (ADJ) TO PROVIDE NOTIFICATION OF A DIRTY FILTER.

**SHUTDOWN:** STOPPING THE UNIT WILL DE-ENERGIZE THE CONTROL LOOPS AND SEND THE CONTROL VALVES TO THE CLOSED POSITION. THE OUTSIDE AIR DAMPER WILL CLOSE AND THE RETURN AIR DAMPER WILL OPEN.

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		AHU-01 Sequence of Operation									
				B		TDP 1 Re-Submittal				04/14/10 DF	
				A		TDP I Submittal				01/11/10 PH	
REFERENCE TO DRAWING NO.		NO.		REVISION/DESCRIPTION		ECU		DATE		BY	
ECU Engineer		Project Manager		Application Engineer		UNKNOWN		DATE		APPROVED	
VT		RB		PH		BY PH		DATE		01/11/10	
		Project Title								AUTHORITY NUMBER	
		VAMC Alexandria Bldg 6 & 45 ESS IV Contract #W912DY-05-D-0014								TO #121	
								Johnson Controls Inc. 4940 Corporate Dr Ste C Huntsville, AL 35895 Phone: (256) 217-2800 Fax: (256) 721-5908		DRAWING NUMBER <b>6-AH-01-110</b>	
										COPYRIGHT JOHNSON CONTROLS, INC. 2009	



**BILL OF MATERIALS**

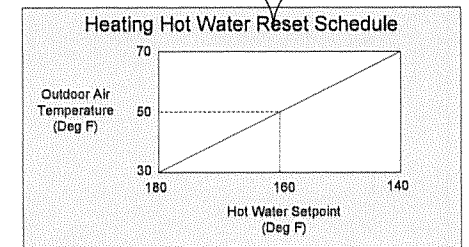
Designation	Qty	Part Number	Description
Field Devices:			
HWPx-C-S	2	CSD-CA1G1-1	SPLIT CORE CURRENT SWITCH ADJUSTABLE
HWR-T	1	TE-6300W-102	T-WELL 6" SS DIRECT MNT
	1	TEP-J000000	SENSOR,T-PT,100 OHM,PROBE
	1	TU81-4	TRANSMITTER,420MA
HWS-T	1	TE-6300W-102	T-WELL 6" SS DIRECT MNT
	1	TEP-J000000	SENSOR,T-PT,100 OHM,PROBE
	1	TU81-4	TRANSMITTER,420MA
OA-T	1	KTO-81	OA SENSING ELEMENT
	1	TU81-2	TRANSMITTER,420MA
HxV1-O	2	VG7443LT+72CHGA	2W, SS TRIM GLOBE VALVE,VA7820-HGA-2, SR
HxV2-O	2	VG7443PT+72CHGA	2W, SS TRIM GLOBE VALVE,VA7820-HGA-2, SR
WFM-1B	1	F-1210	FLOW METER, DUAL TURBINE, ANA OUT
	1	F-1299-STANLS	1200 OPTION, STAINLESS WETTED METAL
	1	F-HTAP-INSTL2	INSTALL KIT, HOT TAP
FS-1, FS-2	2	F81MD-5C	WATERFLOW SWITCH NEMA3R

**SEQUENCE OF OPERATION**

**OCCUPIED MODE:** (1) STEAM CONTROL VALVES SHALL MODULATE TO MAINTAIN THE HOT WATER SUPPLY TEMPERATURE AT SETPOINT. (2) THE HOT WATER SUPPLY TEMPERATURE RESETS INVERSELY WITH THE OUTDOOR TEMPERATURE AS SCHEDULED. AT 30 DEG F OA – HWS AT 180 DEG F, AT 70 DEG F OA – HWS AT 140 DEG F. (3) STEAM HOT WATER CONVERTERS 1 & 2 ARE 100% REDUNDANT AND ONLY ONE UNIT AT A TIME WILL OPERATE. (4) HOT WATER PUMPS ARE CONTROLLED BY THE DDC SYSTEM. THE PUMPS ARE 100% REDUNDANT REQUIRING ONLY 1 PUMP AT A TIME TO OPERATE. THE LEAD/LAG WATER PUMPS AND HEAT EXCHANGERS ARE SEQUENCED BY THE DDC SYSTEM TO CHANGE EVERY SEVEN DAYS. IN THE EVENT A PUMP FAILS TO START IN 30 SECONDS OR NO FLOW CONDITION AT THE HEAT EXCHANGER AN ALARM IS GENERATED AND THE SECOND PUMP/EXCHANGER STARTS AUTOMATICALLY.

**UNOCCUPIED MODE:** IF THE OUTSIDE AIR TEMPERATURE IS BELOW 40 DEG F (ADJ) THE DDC SYSTEM WILL PLACE THE HWS IN OCCUPIED MODE TO START PUMPS AND ACTUATE STEAM VALVES TO MAINTAIN SETPOINT AS NEEDED BY THE RESET SCHEDULE.

**VALVE SEQUENCE FOR LEAD HEAT EXCHANGER:** AFTER THE FLOW THROUGH THE HEAT EXCHANGER HAS BEEN CONFIRMED VIA THE FLOW SWITCH (FS-x) THE DDC CONTROLLER WILL RECEIVE AN INPUT AND THE 24VAC POWER WILL BE APPLIED TO THE STEAM VALVE ACTUATORS. THE STEAM VALVES SHALL OPERATE IN THREE MODES OF CONTROL. FIRST MODE THE 1/3 CAPACITY STEAM VALVE MODULATES TO MAINTAIN THE ACTIVE SETPOINT. AFTER THE 1/3 VALVE HAS REACHED 100% FOR 5 MINUTES THE SECOND MODE SHALL BE ENBALED. THE 1/3 VALVE SHALL BE COMMANDED CLOSED AND THE 2/3 CAPACITY STEAM VALVE MODULATES TO MAINTAIN SETPOINT. AFTER THE 2/3 VALVE HAS REACHED 100% FOR 5 MINUTES THE THIRD MODE SHALL BE ENBALED. THE 1/3 VALVE SHALL BE RE-ENABLED AND BOTH STEAM VALVES MODULATE TOGETHER TO MAINTAIN SETPOINT. AS THE SYSTEM DEMAND REDUCES THE MODES SHALL BE DISABLED AT 40% COMMANDED VALVE (DIFFERENTIAL OF 60%) AND A 5 MINUTE DELAY WILL BE ACTIVED BETWEEN MODES. UPON A LOSS OF FLOW THE STEAM VALVES SHALL BE CLOSED (HARDWIRED AND SOFTWARE INTERLOCKS).



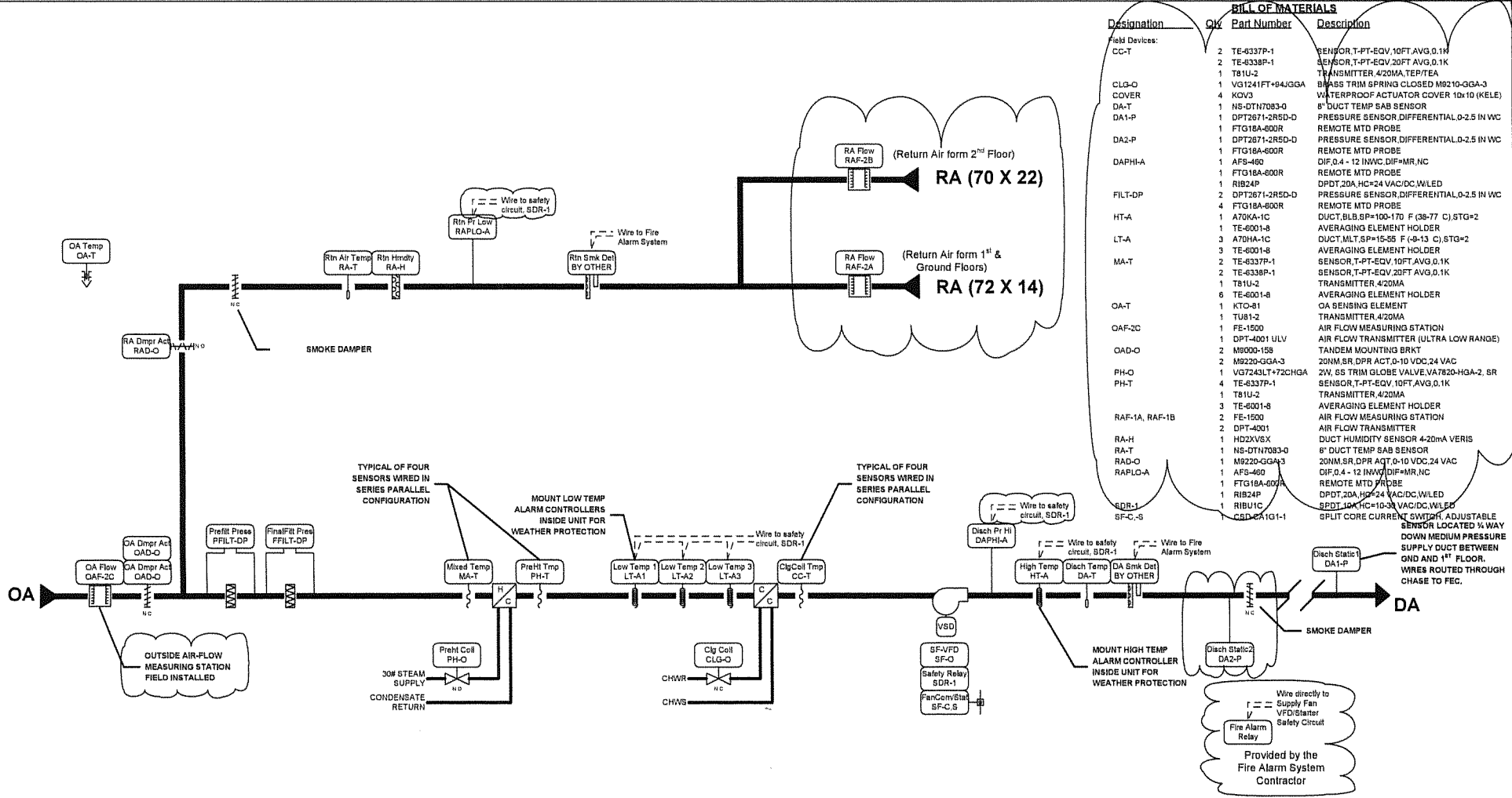
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PROJECT TITLE: VAMC Alexandria Bldg 6 & 45 ESS IV Contract #W912DY-05-D-0014

DATE: 01/11/10

CONTRACT NUMBER: 6-HWS-101

JOHNSON CONTROLS



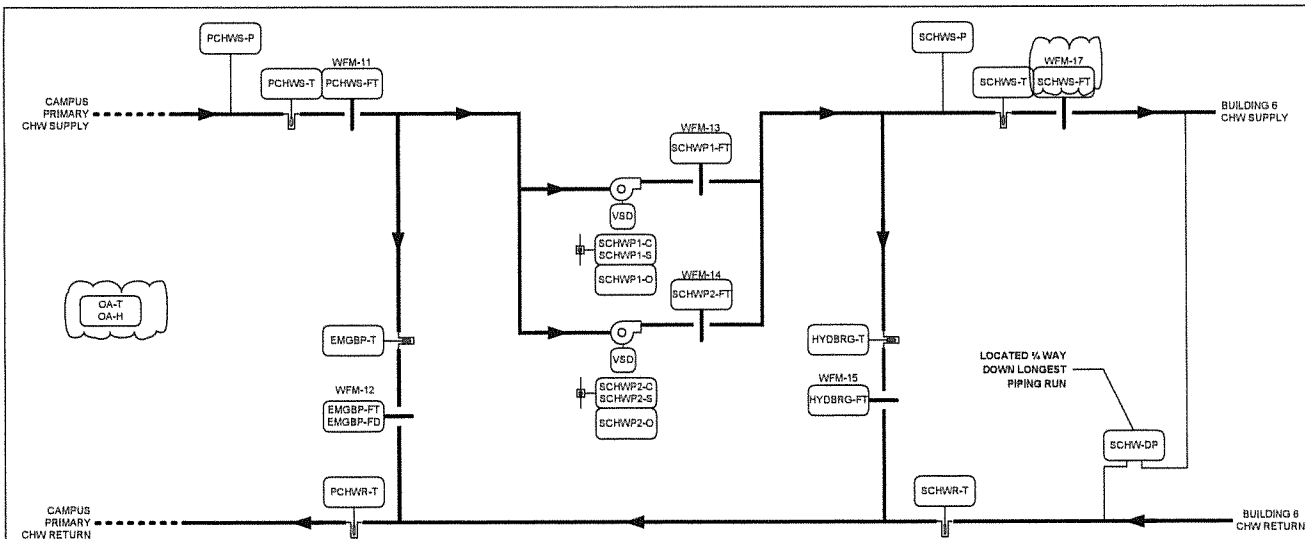
BILL OF MATERIALS			
Designation	Qty	Part Number	Description
<b>Field Devices:</b>			
CC-T	2	TE-6337P-1	SENSOR, T-PT-EQV, 10FT, AVG, 0.1K
	2	TE-4338P-1	SENSOR, T-PT-EQV, 20FT, AVG, 0.1K
	1	T81U-2	TRANSMITTER, 420MA, TER/TEA
CLG-O	1	VG1241FT+94JGGA	BLASS TRIM SPRING CLOSED M9210-GGA-3
COVER	4	KQV3	WATERPROOF ACTUATOR COVER 10x10 (KELE)
DA-T	1	NS-DT17083-0	8" DUCT TEMP SAB SENSOR
DA1-P	1	DPT2671-2R5D-D	PRESSURE SENSOR, DIFFERENTIAL, 0-2.5 IN WC
	1	FTG18A-600R	REMOTE MTO PROBE
DA2-P	1	DPT2671-2R5D-D	PRESSURE SENSOR, DIFFERENTIAL, 0-2.5 IN WC
	1	FTG18A-600R	REMOTE MTO PROBE
DAPH1-A	1	AFS-460	DIF, 0.4 - 12 INWG, DIP=MR, NC
	1	FTG18A-600R	REMOTE MTO PROBE
	1	RIB24P	DPDT, 20A, HC=24 VAC/DC, W/LED
FILT-DP	2	DPT2671-2R5D-D	PRESSURE SENSOR, DIFFERENTIAL, 0-2.5 IN WC
	4	FTG18A-600R	REMOTE MTO PROBE
HT-A	1	A70KA-1C	DUCT, BLB, SP=100-170 F (38-77 C), STG=2
	1	TE-6001-8	AVERAGING ELEMENT HOLDER
LT-A	3	A70HA-1C	DUCT, MLT, SP=15-55 F (-9-13 C), STG=2
	3	TE-6001-8	AVERAGING ELEMENT HOLDER
MA-T	2	TE-6337P-1	SENSOR, T-PT-EQV, 10FT, AVG, 0.1K
	2	TE-4338P-1	SENSOR, T-PT-EQV, 20FT, AVG, 0.1K
	1	T81U-2	TRANSMITTER, 420MA
	6	TE-6001-8	AVERAGING ELEMENT HOLDER
OA-T	1	KTO-81	OA SENSING ELEMENT
	1	TU81-2	TRANSMITTER, 420MA
OAF-2C	1	FE-1500	AIR FLOW MEASURING STATION
	1	DPT-4001 ULV	AIR FLOW TRANSMITTER (ULTRA LOW RANGE)
OAD-O	2	M9000-158	TANDEM MOUNTING BRKT
	2	M9220-GGA-3	20NM, SR, DPR, ACT, 0-10 VDC, 24 VAC
PH-O	1	VG7243LT+72CHGA	ZW, SS TRIM GLOBE VALVE, VA7820-HQA-2, SR
PH-T	4	TE-6337P-1	SENSOR, T-PT-EQV, 10FT, AVG, 0.1K
	1	T81U-2	TRANSMITTER, 420MA
	3	TE-6001-8	AVERAGING ELEMENT HOLDER
RAF-1A, RAF-1B	2	FE-1500	AIR FLOW MEASURING STATION
	2	DPT-4001	AIR FLOW TRANSMITTER
RA-H	1	HO2XV5X	DUCT HUMIDITY SENSOR 4-20mA, VERIS
RA-T	1	NS-DT17083-0	8" DUCT TEMP SAB SENSOR
RAD-O	1	M9220-GGA-3	20NM, SR, DPR, ACT, 0-10 VDC, 24 VAC
RAFLO-A	1	AFS-460	DIF, 0.4 - 12 INWG, DIP=MR, NC
	1	FTG18A-600R	REMOTE MTO PROBE
	1	RIB24P	DPDT, 20A, HC=24 VAC/DC, W/LED
	1	RIBUC	SEDT, 10A, HC=10-3A, VAC/DC, W/LED
	1	CDD-2A1G1-1	6P/1T CORE CURRENT SWITCH, ADJUSTABLE
			SENSOR LOCATED 1/4 WAY DOWN MEDIUM PRESSURE SUPPLY DUCT BETWEEN GND AND 1 <sup>ST</sup> FLOOR, WIRES ROUTED THROUGH CHASE TO FEC.

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Drawing Title		B TDP 1 Re-Submittal		04/14/10	DF
AHU-02 Steam Pre-Heat Flow Diagram		A TDP 1 Submittal		01/11/10	PH
Project Title		VAMC Alexandria Bldg 6 & 45 ESS IV Contract #W912DY-05-D-0014		TO #121	
Johnson Controls		Johnson Controls Inc. 4940 Corporate Dr Ste C Huntsville, AL 35895 Phone: (256) 217-2800 Fax: (256) 721-5908		6-AH-02-101	





**SEQUENCE OF OPERATION**

**GENERAL:** THE EXISTING CHILLED WATER SUPPLY FROM THE CENTRAL COOLING PLANT PROVIDES CHILLED WATER TO THE VFD SECONDARY PUMPING SYSTEM AT BUILDING 6. THE SECONDARY CHILLED WATER PUMPS ARE 100% REDUNDANT REQUIRING ONLY ONE PUMP AT A TIME TO OPERATE. UPON A CALL FOR COOLING FROM ANY AIR HANDLER, FAN COIL, OR BLOWER COIL, THE LEAD CHILLED WATER PUMP SHALL ENERGIZE AND THE RESPECTIVE VFD SHALL MODULATE THE PUMP TO MAINTAIN THE PRESSURIZATION SETPOINT (ADJ) AT THE DIFFERENTIAL PRESSURE SENSOR LOCATED 1/4 OF THE WAY DOWN THE LONGEST PIPING RUN. THE VFD WILL MODULATE AS REQUIRED TO MAINTAIN THE SYSTEM PRESSURE SETPOINT.

A HYDRONIC BRIDGE CIRCUIT DOWNSTREAM OF THE CHILLED WATER PUMPS WITH A FLOW METER, TEMPERATURE SENSOR AND MANUAL BALANCING VALVE SHALL BE UTILIZED TO BYPASS SECONDARY CHILLED WATER FLOW BACK TO THE PRIMARY LOOP AT MINIMUM VFD SETPOINT, WHILE COOLING COIL 2-WAY VALVES SHUT OFF AS COOLING LOAD DICTATES. MANUAL BALANCING VALVE SHALL BE SET AT A PRESSURE DROP TO MATCH REMAINDER OF BUILDING PIPING CIRCUIT AT MINIMUM FLOW. CHILLED WATER FLOWS WILL BE MEASURED AND TOTALIZED BY HIGH ACCURACY FLOW METERS AT EACH PUMP DISCHARGE, HYDRONIC BRIDGE BYPASS, AND COMMON SECONDARY CHW SUPPLY.

**LEAD/STANDBY PUMP CONTROL:** IF THE LEAD BUILDING SECONDARY CHILLED WATER PUMP FAILS TO OPERATE THE STANDBY PUMP SHALL BE AUTOMATICALLY STARTED AND THE SYSTEM SHALL RESUME NORMAL OPERATION. AN ALARM WILL BE GENERATED AT THE DDC PANEL TO NOTIFY OF PUMP FAILURE. THE LEAD/STANDBY STATUS OF THE PUMPS SHALL BE ROTATED EVERY 7 DAYS FOR EVEN RUNTIME.

**BILL OF MATERIALS**

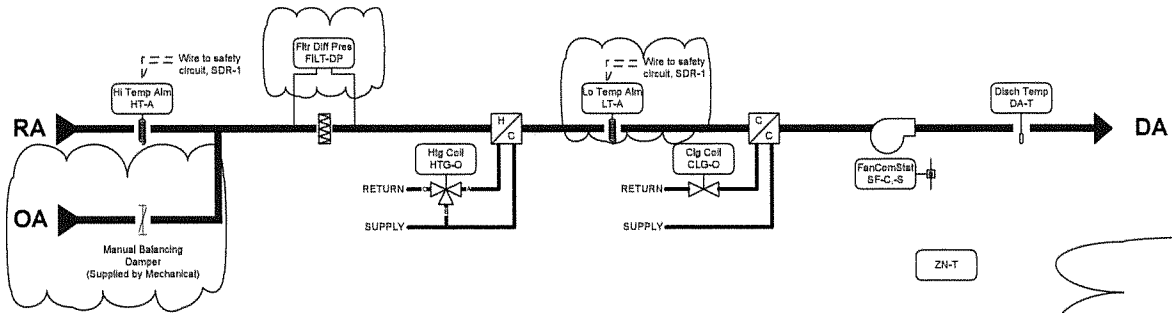
Designation	Qty	Part Number	Description
Field Devices:			
OA-T, OA-H	1	HQ30K-TT-2	OUTDOOR AIR TEMP/HUMID 4-20MA
EMGBP-T	1	TE-6300W-101	T-WELL 6" BRASS DIR MNT
	1	TEP-1000000	SENSOR, T-PT, 100 OHM PROBE
	1	T8IU-2	TRANSMITTER, 4-20MA
HYDRG-T	1	TE-6300W-101	T-WELL 6" BRASS DIR MNT
	1	TEP-1000000	SENSOR, T-PT, 100 OHM PROBE
	1	T8IU-2	TRANSMITTER, 4-20MA
PCHWR-T	1	TE-6300W-101	T-WELL 6" BRASS DIR MNT
	1	TEP-1000000	SENSOR, T-PT, 100 OHM PROBE
	1	T8IU-2	TRANSMITTER, 4-20MA
PCHWS-P	1	DPT2091C-100G	PRESSURE SENSOR, GAUGE 0-100 PSI, 4-20MA
PCHWS-T	1	TE-6300W-101	T-WELL 6" BRASS DIR MNT
	1	TEP-1000000	SENSOR, T-PT, 100 OHM PROBE
	1	T8IU-2	TRANSMITTER, 4-20MA
SCHWR-DP	1	DPT2301-05D0	PRESS SENS, DP, D-60 PSI MA, 0.25%
SCHWP-VFD	2	VSD15422A-NP600	VSD WBYPASS 15HP 480VAC TYPE 12 N2 COM
SCHWPx-C-S	2	CSD-CA1G1-1	SPLIT CORE CURRENT SWITCH, ADJUSTABLE
SCHWR-T	1	TE-6300W-101	T-WELL 6" BRASS DIR MNT
	1	TEP-1000000	SENSOR, T-PT, 100 OHM PROBE
	1	T8IU-2	TRANSMITTER, 4-20MA
SCHWS-P	1	DPT2091C-100G	PRESSURE SENSOR, GAUGE 0-100 PSI, 4-20MA
SCHWS-T	1	TE-6300W-101	T-WELL 6" BRASS DIR MNT
	1	TEP-1000000	SENSOR, T-PT, 100 OHM PROBE
	1	T8IU-2	TRANSMITTER, 4-20MA
WFM-17 SCHWS-FT	1	F-1210	FLOW METER, DUAL TURBINE, ANA OUT
	1	F-1299-STANLS	1200 OPTION, STAINLESS WETTED METAL
	1	F-HTAP-INSTL2	INSTALL KIT, HOT TAP
WFM-11 PCHWS-FT	1	F-1210	FLOW METER, DUAL TURBINE, ANA OUT
	1	F-1299-STANLS	1200 OPTION, STAINLESS WETTED METAL
	1	F-HTAP-INSTL2	INSTALL KIT, HOT TAP
WFM-12 EMGBP-FT	1	F-1299-STANLS	1200 OPTION, STAINLESS WETTED METAL
	1	F-HTAP-INSTL2	INSTALL KIT, HOT TAP
WFM-13 SCHWP1-FT	1	FB-1210	FLOW METER, BI-DIR ANALOG CUT
	1	F-1210	FLOW METER, DUAL TURBINE, ANA OUT
	1	F-1299-STANLS	1200 OPTION, STAINLESS WETTED METAL
	1	F-HTAP-INSTL2	INSTALL KIT, HOT TAP
WFM-14 SCHWP2-FT	1	F-1210	FLOW METER, DUAL TURBINE, ANA OUT
	1	F-1299-STANLS	1200 OPTION, STAINLESS WETTED METAL
	1	F-HTAP-INSTL2	INSTALL KIT, HOT TAP
WFM-15 HYDRG-FT	1	F-1210	FLOW METER, DUAL TURBINE, ANA OUT
	1	F-1299-STANLS	1200 OPTION, STAINLESS WETTED METAL
	1	F-HTAP-INSTL2	INSTALL KIT, HOT TAP

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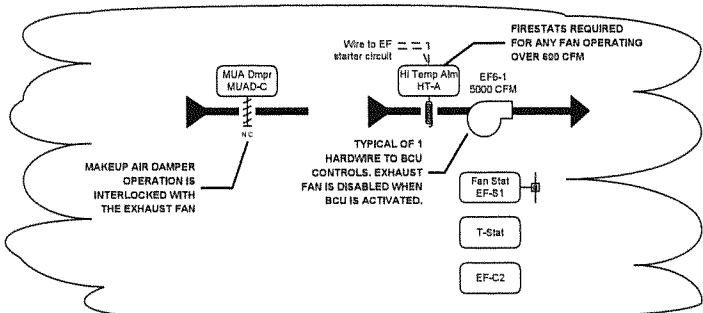
Drawing Title  
**CHWS Flow Diagram**

	B	TDP 1 Re-Submittal	04/12/10	DF
	A	TDP1 Submittal	01/11/10	PH
REFERENCE DIVISION	100	MECHANICAL	DATE	BY
Drawn	PH	DATE	01/11/10	
Project Title	VAMC Alexandria Bldg 6 & 45 ESS IV Contract #W912DY-05-D-0014			
Johnson Controls				
TO #121	6-CHW-101			



**BILL OF MATERIALS**

Designation	Qty	Part Number	Description
<b>Field Devices:</b>			
CLG-O	1	VG1241BG+956GGA	BRASS TRIM SPRING CLOSES M8206-GGA-2
DA-T	1	NS-DT7083-0	8" DUCT TEMP S&B SENSOR
FILT-DP	1	DPT2671-2R5D-D	PRESSURE SENSOR, DIFFERENTIAL, 0-2.5 IN. WC
HT-A	2	FTG18A-600R	REMOTE MTO PROBE
HTG-O	1	A70KA-1C	DUCT, BLB, SP#100-170 F (38-77 C), STG#2
LT-A	1	TE-6001-B	AVERAGING ELEMENT HOLDER
LT-A	1	VG1845BQ+936GGA	S5 TRIM SPRING CCW M8206-GGA-3
LT-A	1	A70HA-1C	DUCT, M.L.T, SP#15-25 F (-4-13 C), STG#2
SDR-1	5	TE-6001-B	AVERAGING ELEMENT HOLDER
SF-C-S	1	RIB2402D	DPDT, 10A @ 277VAC, COIL #24 VAC/DC WITH LED
ZN-T	1	H120	CSR, N.O., 24V, FRAC HP, N.O., SERIES
ZN-T	1	NS-BT97003-0	TE, F/C, DIS, ADJ, OCC, TS
<b>EF6-1 Field Devices:</b>			
MUAD-C	1	M9220-BAA-3	DAMPER ACTUATOR 20 NM SR 120VAC
EF-S1	1	CSB-CAT(G)-1	SFLT/ADJ LED 1.25A
EF-C2	1	RIBUC1	SPDT, 10A, HC=10-30 VAC/DC W/LED
T-STAT	1	T22JCC-1C	SFC, BLB, SP#40-90 F (-5-30 C), STG#1



**SEQUENCE OF OPERATION**

**START/STOP CONTROL:** THE BLOWER COIL UNIT SHALL OPERATE ON A SCHEDULE AS SET BY THE ECC. THE UNIT FAN SHALL BE STARTED AND STOPPED BY THE DDC SYSTEM THROUGH THE ECC. THE CONTROL LOOPS ARE ENERGIZED WHEN FAN RUN STATUS IS PROVEN BY THE CURRENT SENSING RELAY. STOPPING THE UNIT WILL DE-ENERGIZE THE CONTROL LOOPS AND SEND THE HOT WATER AND CHILLED WATER CONTROL VALVES TO THE CLOSED POSITION. EF6-1 OPERATES ONLY WHEN THE BCU IS OFF AND THE WALL MOUNTED THERMOSTAT IS ABOVE ZONE TEMPERATURE SETPOINT 86 (ADJ.). WHEN EF6-1 TURNS ON THE EXHAUST AIR DAMPER SHALL OPEN. EF6-1 IS COMMANDED OFF WHEN THE ZONE TEMPERATURE REACHES SETPOINT OR WHEN THE BCU TURNS ON. WHEN EF6-1 IS COMMANDED OFF THE EXHAUST AIR DAMPER SHALL CLOSE.

**TEMPERATURE CONTROL:** A ZONE TEMPERATURE SENSOR SENDS TEMPERATURE INFORMATION TO THE DDC SYSTEM. THE DDC SYSTEM THEN MODULATES THE CHILLED WATER AND HOT WATER CONTROL VALVES IN SEQUENCE TO MAINTAIN ZONE TEMPERATURE SETPOINT. UPON A RISE IN ZONE TEMPERATURE THE CHILLED WATER VALVE SHALL MODULATE OPEN TO MAINTAIN ZONE TEMPERATURE SETPOINT OF 86 DEG F (ADJ.). IF THE ZONE TEMPERATURE FALLS BELOW 70 DEG F SETPOINT (ADJ.) THE HOT WATER VALVE SHALL MODULATE OPEN TO MAINTAIN ZONE SETPOINT. IF THE UNIT FAILS TO OPERATE BETWEEN THE RANGE OF 70-75 DEG F (ADJ.) AN ALARM MESSAGE WILL BE SENT TO THE ECC AND BOTH CHILLED AND HOT WATER CONTROL VALVES SHALL CLOSE.

**SYSTEM SAFETIES:** A HIGH LIMIT THERMOSTAT IN THE RETURN AIR PATH WILL STOP THE UNIT UPON DETECTION OF TEMPERATURE ABOVE ITS SETPOINT OF 125 DEG F. A LOW LIMIT THERMOSTAT LOCATED BEFORE THE COILS WILL STOP THE UNIT UPON DETECTION OF AIR TEMPERATURE BELOW ITS SETPOINT OF 35 DEG F. FILTER STATUS SHALL BE MONITORED BY A DIFFERENTIAL PRESSURE SENSOR AT THE FILTER BANK.

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Drawing Title: **Blower Coil Unit Flow Diagram**

REV	DATE	DESCRIPTION	BY	DATE
B	04/16/10	TDP 1 Re-Submittal		DF
A	01/11/10	TDP 1 Submittal		PH

Project Title: **VAMC Alexandria Bldg 6 & 45 ESS IV Contract #V912DY-05-D-0014**

Johnson Controls

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**TO #121**

6-BCU-101

**SEQUENCE OF OPERATION**

**START-STOP CONTROL:** THE AIR HANDLING UNIT SHALL BE STARTED AND STOPPED AUTOMATICALLY AT THE ECC. THE HOA SWITCH SHALL BE KEPT IN THE AUTO POSITION - HAND AND OFF POSITIONS WILL BE USED FOR MAINTENANCE ONLY. UPON RECEIVING A START COMMAND THE SUPPLY FAN SHALL START ONLY AFTER ALL INTERNAL SAFETIES ARE PROVEN. ONCE FAN RUN STATUS IS PROVEN BY A CURRENT SENSING RELAY, THE CONTROLS SHALL OPERATE ACCORDING TO THE SEQUENCES AS DESCRIBED BELOW.

**MINIMUM OUTSIDE AIR FLOW CONTROL:** OUTSIDE AIR IS METERED TO MONITOR AND MAINTAIN A CONSTANT MINIMUM OUTSIDE AIR FLOW BY MODULATING THE RETURN AND OUTSIDE AIR DAMPERS UP TO THE MAXIMUM FLOW SETPOINT OF 1000 CFM (ADJUSTABLE).

**PREHEAT TEMPERATURE CONTROL:** A TEMPERATURE SENSOR IN THE PREHEAT COIL DISCHARGE WILL TRANSMIT TEMPERATURE CHANGES TO THE DDC. THE DDC SYSTEM WILL MODULATE THE 2 WAY STEAM PRE-HEAT CONTROL VALVE TO MAINTAIN PREHEAT TEMPERATURE SETPOINT (ADJ).

**DISCHARGE AIR TEMPERATURE CONTROL:** A TEMPERATURE SENSOR IN THE DISCHARGE AIR DUCT TRANSMITS TEMPERATURE CHANGES TO THE DDC. THE DDC MODULATES THE 2 WAY COOLING COIL CONTROL VALVE TO MAINTAIN DISCHARGE AIR TEMPERATURE SETPOINT OF 55 DEG F (ADJUSTABLE).

**STATIC PRESSURE AND SUPPLY FAN SPEED CONTROL:** THE VFD SHALL MODULATE THE SPEED OF THE SUPPLY FAN TO MAINTAIN DISCHARGE AIR STATIC PRESSURE TO ITS SETPOINT OF 1.0 IN WC (ADJUSTABLE) AS SENSED BY THE DUCT STATIC PRESSURE SENSOR LOCATED ¾ OF THE WAY DOWN THE LONGEST DUCT MAIN. AS THE DISCHARGE AIR STATIC PRESSURE INCREASES, THE SUPPLY FAN SPEED SHALL DECREASE TOWARDS ITS MINIMUM FREQUENCY. AS THE DISCHARGE AIR STATIC PRESSURE DECREASES THE SUPPLY FAN SPEED SHALL INCREASE. THE STATIC PRESSURE IS RESET BASED ON ACTUAL BUILDING LOAD BY POLLING ALL VAV TERMINAL UNITS

**DEHUMIDIFICATION CONTROL:** A DUCT HUMIDITY SENSOR (RA-H) SHALL MEASURE THE RETURN AIR HUMIDITY AT THE AHU. THE DDC SHALL AVERAGE THE POSITION OF THE VAV BOX AIR VALVES AND SHALL ADJUST THE AIR TEMPERATURE UP OR DOWN TO PROVIDE THE MOST EFFICIENT SUPPLY AIR TEMPERATURE TO SATISFY VAV BOX DURING OCCUPIED OPERATION. IF THE RETURN AIR HUMIDITY RISES ABOVE SETPOINT OF 60% (ADJ) THE SUPPLY AIR TEMPERATURE OF THE AHU WILL BE LOWERED TO KEEP THE RETURN AIR HUMIDITY BELOW SETPOINT. DISCHARGE AIR HUMIDITY IS ALSO MONITORED BY THE DDC WITH DUCT HUMIDITY SENSOR DA-H WHICH IS USED TO MAINTAIN DISCHARGE AIR HUMIDITY BELOW SETPOINT.

**SAFETIES:** THE UNIT SHALL STOP UPON ANY OF THE SAFETIES BEING TRIPPED REGARDLESS OF THE MODE OF OPERATION (AUTOMATIC, HAND OR BYPASS) (1) THE AIR HANDLER RETURN AIR AND DISCHARGE AIR SMOKE DETECTORS SHALL STOP THE UNIT AND CLOSE THE SMOKE DAMPERS UPON SENSING COMBUSTION PRODUCTS IN THE SYSTEM. THE SMOKE DETECTORS MUST BE MANUALLY RESET AFTER AN ALARM CONDITION IN ORDER FOR THE FAN TO RESTART AND THE SMOKE

DAMPERS TO OPEN. (2) A MIXED AIR TEMPERATURE SENSOR (MA-T) UPSTREAM OF THE COOLING COIL SIGNALS THE DDC UPON A DROP IN TEMPERATURE BELOW 45 DEG F WHICH WILL GENERATE AN ALARM TO THE ECC. A TEMPERATURE LOW LIMIT SWITCH (LT-A) SHALL STOP THE UNIT, CLOSE THE OUTSIDE AIR DAMPER, OPEN THE PREHEAT VALVE, AND SEND A CRITICAL ALARM TO THE ECC UPON SENSING A FALL IN TEMPERATURE BELOW SETPOINT (40 DEG F ADJ). THE LOW LIMIT SWITCHES MUST BE MANUALLY RESET AFTER AN ALARM CONDITION. (3) A TEMPERATURE HIGH LIMIT (FIRESTAT, HT-A) SHALL SHUTDOWN THE FAN AND SEND AN ALARM TO THE ECC UPON A RISE IN DISCHARGE AIR TEMPERATURE ABOVE 125 DEG F. THE HIGH LIMIT SWITCH MUST BE MANUALLY RESET AFTER AN ALARM CONDITION. (4) A DISCHARGE AIR HIGH STATIC PRESSURE SAFETY SWITCH (DAPH-A) LOCATED AT THE SUPPLY FAN DISCHARGE SHALL STOP THE UNIT UPON SENSING HIGH DISCHARGE DUCT STATIC ABOVE 3 IN STATIC PRESSURE (ADJ) TO PREVENT OVER PRESSURIZING THE DUCTWORK. STATIC PRESSURE SWITCH IS HARDWIRED TO THE VFD AND UNIT IS SHUTDOWN IN HAND, AUTO, OR BYPASS MODE. THE HIGH STATIC PRESSURE SAFETIES MUST BE MANUALLY RESET AFTER AN ALARM CONDITION. (5) UPON FAILURE OF THE VFD THE SUPPLY FAN SHALL BE CONTROLLED MANUALLY AT THE DDC PANEL OR THE ECC THROUGH THE BYPASS STARTER. FAN SHALL BE OPERATED AT CONSTANT SPEED.

**MONITORING:** THE DDC SYSTEM MONITORS THE DIFFERENTIAL PRESSURE ACROSS EACH FILTER AND GENERATES AN ALARM IF THE DIFFERENTIAL PRESSURE INCREASES ABOVE THE SETPOINT OF 0.75 IN WC (ADJ) TO PROVIDE NOTIFICATION OF A DIRTY FILTER.

**SHUTDOWN:** STOPPING THE UNIT WILL DE-ENERGIZE THE CONTROL LOOPS AND SEND THE CONTROL VALVES TO THE CLOSED POSITION. THE OUTSIDE AIR DAMPER WILL CLOSE AND THE RETURN AIR DAMPER WILL OPEN.

**UNIT HEATER CONTROL:** A ZONE TEMPERATURE SENSOR MOUNTED IN THE ATTIC SPACE TRANSMITS TEMPERATURE READINGS TO THE DDC SYSTEM. UPON A FALL IN ZONE TEMPERATURE BELOW SETPOINT THE DDC SYSTEM COMMANDS THE UNIT HEATER ON AND OPENS THE UNIT HEATER CONTROL VALVE TO ALLOW HOT WATER TO FLOW THROUGH THE UNITS HEATING COIL UNTIL THE ZONE HAS REACHED THE SETPOINT TEMPERATURE (ADJ). IF THE UNIT HEATER FAILS TO OPERATE WHEN COMMANDED AN ALARM SHALL BE GENERATED AT THE ECC AND THE HEATING CONTROL VALVE SHALL CLOSE.

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Drawing Title  
**AHU-03 Sequence of Operation**

Project Title  
**VAMC Alexandria Bldg 6 & 45  
ESS IV Contract  
#W912DY-05-D-0014**

B		TOP 1 Re-Submittal		04/15/10	DF
A		TOP 1 Submittal		01/11/10	PH
REVISIONS		REVISIONS		DATE	BY
VT	RB	PH	DATE	01/11/10	BY
Project Location		CONTRACT NUMBER			
Johnson Controls Inc. 4840 Corporate Dr Ste C Huntsville, AL 35895 Phone: (256) 217-2800 Fax: (256) 721-5908		<b>TO #121</b> DRAWING NUMBER <b>6-AH-03-110</b>			