

DEPARTMENT OF VETERANS AFFAIRS
WILLIAM S. MIDDLETON
MEMORIAL VETERANS HOSPITAL - MADISON, WI
CONSOLIDATE ICU PROJECT 8A/8B
VA Project No. 607-394
KS Project No. 211033.00

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MEDICAL EQUIPMENT INVENTORY & SPECIFICATION
Project: William S. Middleton Memorial Veterans Hospital - Consolidate ICUs - 8A/8B

Project No. 211033.00

MOUNTING KEY:

C = CEILING **D** = DESKTOP **ST** = STORAGE
CAB = CABINET **F** = FLOOR **UCT** = UNDER COUNTER
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12/3/2012

ADDN 2; 7/22/13

NEW ROOM NO	ITEM NO	NEW/REUSE	QUANTITY	EQUIPMENT NAME	MANUFACTURER & MODEL#	SIZE (W x D x H)	SUPPLIED BY		INSTALLED BY		MOUNTING	ELECTRIC REQ'MTS		PLUMBING REQ'MTS			NOTES
							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
Surgery Support & Public Spaces (A & D Wings)																	
B8062 Family Waiting & Nourishment																	
B8060	112	N	1	Refrigerator - Undercounter	Follett	24w x 25.5d x 31.5h	X			X	UCT		115V				ADA
	127	N	1	Coffee Maker	Bunn or similar		X			X	CT			X		X	
		N	7	Cafe Chair			X		X		F						
		N	3	Table - Café			X		X		F						
		N	4	Settee			X		X		F						
		N	9	Lounge Chair			X		X		F						
		N	1	Table			X		X		F						
		N	2	Side Chair			X		X		F						
B8058 Greeter																	
			1	Computer Workstation			X		X		D						
			1	Task Chair			X		X		F						
A8001 Imaging Support																	
			1	Computer Workstation			X		X		D						Owner to confirm equipment specifications
			1	Digitizer			X		X		D						Owner to confirm equipment specifications
			1	Portable X-Ray			X		X		F						Owner to confirm equipment specifications
			1	Computer Workstation			X		X		D						
			1	Task Chair			X		X		F						
A8002 Consult																	
		N	1	Computer			X		X		W						
		N	2	Lounge Chair			X		X		F						
		N	1	Settee			X		X		F						
		N	1	Table			X		X		F						
		N	6	Side Chair			X		X		F						
A8003 ICU Equipment Storage																	
		R	1	Stretcher			X		X		F						currently in SICU corridor
		R	1	Stretcher			X		X		F						currently in SICU corridor
		R	1	Oxygen Tank Cart - Full Tanks		18w x 27d x 40h	X		X		F						
		R	1	EZ Way Patient standing lift			X		X		F						currently in SICU corridor
		R	1	Wheelchair			X		X		F						currently in SICU corridor
		R	1	Wheelchair			X		X		F						currently in SICU corridor

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
A8011 Conference																	
		N	1	LCD Monitor - 50"			X			X	W						
		N	2	Workstation, Computer			X		X		D						
		N	2	Task Chair			X		X		F						
		N	14	Stacking Chair			X		X		F						
		N	12	Conference Chair			X		X		F						
		N	4	Conference Table			X		X		F						
		N	1	Smartboard	SMART		X			X	W						
		N	1	Projector, Multimedia/Data			X			X	C						
		N	1	Video Teleconferencing System			X			X				Video conferencing unit consisting of a camera, microphone, video/audio compression components and a component cart.			
A8015 Housekeeping																	
		N	1	Janitor Cart			X		X		F						
		N	1	Mop Bucket			X		X		F						
		N	1	Shelf w/ mop holders	Bobrick	36" L		X		X	W						
		N	1	Chemical Dispenser (wall mtd)			X		X		W						
	121	N	1	Shelving Unit	Metro	48w x 24d x 72h	X		X		F						
A8017 OR Vendor Office																	
		N	2	Computer Workstation			X		X		D						
		N	2	Task Chair			X		X								
		N	2	Folding Guest Chair			X		X								wall hung w/ hook
		N	2	Wall Hook				X		X	W						
	121	N	3	Shelving Unit	Metro	48w x 18d x 72h	X		X		F						
	170	N	1	Equipment Cart		24w x 36d x 36h	X		X		F						
A8019 Staff Toilets - Men's																	
		N	2	Soiled Linen Hamper			X		X		F						
A8021 Vestibule																	
		N	1	Personal Protection Supply Cart			X		X		F						Owner to confirm equipment specifications
	161	N	2	Scrub Valet - Dispenser			X		X		F						Owner to confirm equipment specifications
A8027 Staff Lockers - Men's																	
	162	N	1	Scrub Valet - Return			X		X		F						Owner to confirm equipment specifications

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
A8026 Vestibule																	
		N	1	Personal Protection Supply Cart			X		X		F						Owner to confirm equipment specifications
	161	N	2	Scrub Valet - Dispenser			X		X		F						Owner to confirm equipment specifications
A8030 Staff Lockers - Women's																	
	162	N	1	Scrub Valet - Return			X		X		F						Owner to confirm equipment specifications
A8036 Staff Toilets - Women's																	
		N	2	Soiled Linen Hamper			X		X		F						
A8029 Sterile Supply/Cart Assembly																	
			6	Case Cart		42w x 29d x ?h	X		X		F						
	120	N	13	Shelving Unit (solid shelves)	Metro	48w x 24d x 72h	X		X		F						
	120	N	6	Shelving Unit (solid shelves)	Metro	48w x 18d x 72h	X		X		F						
	107	N	10	Top Track Shelving Units	Metro	48w x 24d x 72h		X		X	F						solid shelves
			2	Task Chair - High			X		X		F						
			2	Task Chair - High			X		X		F						
			1	Pedestal File			X		X		F						
			1	Printer			X		X		D						
	164		1	PPE cabinet - SSTL			X		X		F						Owner to confirm equipment specifications
	118	N	1	Pass Thru Window Assembly	Steris	36w x 36h x 5d		X		X	W						
A8035 Sterilizers																	
					Steris 400 Ster. Prevac		X		X		F		208V				Single hinged door model, Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
	106	N	2	Steam Sterilizer		see cut sheets					F						

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
A8037 Prep/Pack																	
	105	N	4	Assembly Workstation	TBJ SPD		X			X	F		X				height adjustable, shallow drawer
		N	4	Task Chair - High			X		X		F						
		N	3	Workstation, Computer			X		X		D						ceiling hung
				Cart, Mobile			X		X		F						
	167	R	2	Heat Sealer			X		X		CT						Owner to confirm equipment specifications
				Loading Cart			X		X		F						Owner to confirm equipment specifications
		R	1	Printer			X		X		D						
		R	1	Label Printer			X		X		D						
	166	N	5	Incubator			X		X		CT						Emergency power
		N	2	Lateral File			X		X		F						
			1	Linen Cart			X		X		F						
			1	Supply Cart			X		X		F						flat, SSTL shelves
		N	1	Computer			X		X		D						
		N	1	Workstation	TBJ SPD		X			X	F						height adjustable, upper shelf, SSTL
		N	1	PPE cabinet - SSTL			X		X		F						solid shelves
	120	N	2	Shelving Unit (solid shelves)	Metro	48w x 24d x 72h	X		X		F						
	115	N	3	Instrument Storage Cabinet	Pedigo	47w x 18d x 72h		X		X	F						
A8042 Anesthesia Training																	
		N	10	Stackable Chair			X		X		F						
		N	1	Task Chair - High			X		X		F						
		R	2	Stretcher			X		X		F						
		R	2	Mannequin			X		X		F						
A8046 OR Equipment Storage																	
	120	N	3	Shelving Unit (solid shelves)	Metro	48w x 24d x 72h	X		X		F						
A8052 Anesthesia Storage																	
	121	N	4	Shelving Unit	Metro	48w x 24d x 72h	X		X		F						
A8041 Housekeeping																	
		N	1	Janitor Cart			X		X		F						
		N	1	Mop Bucket			X		X		F						
		N	1	Shelf w/ mop holders	Bobrick	36" L		X		X	W						
		N	1	Chemical Dispenser (wall mtd)			X		X		W						
	121	N	1	Shelving Unit	Metro	48w x 24d x 72h	X		X		F						

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
D8013 Clean Instrument Holding																	
			1	Equipment Cart (SSTL)		42w x 29d x 36h	X		X		F						
	120	N	3	Shelving Unit (solid shelves)	Metro	48w x 24d x 72h	X		X		F						
D8015 Decontamination																	
	102	N	2	Washer-Disinfector	Steris Reliance HamoVision	see cut sheets	X		X		F		480 V				Steam, Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
	108	N	1	Washer Detergent	Steris Prolystica	see cut sheets	X	X		X	F						on shelf
	104	N	2	3 Bay Sink (height adjustable)	TBJ SPD	see cut sheets		X		X	F		X				
	109	N	2	Chemical Dosing System	Steris Acu Sing	see cut sheets	X	X		X	W						
	103	N	3	Ultrasonic Cleaner	Steris Caviwave Pro 17W	see cut sheets	X		X		F		208V				20 gallon tank, Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
	122	N	1	Shelving Unit	Metro	60w x 24d x 72h	X		X		F						solid bottom shelf
		N	2	Loading Cart			X		X		F						
		N	1	Waste Can - 44 gallon			X		X		F						
		N	2	Sorting Table (SSTL)			X			X	F						shallow drawer
		N	2	Workstation, Computer							C						ceiling hung
	113	N	1	Cidex station			X		X		CT						on cart
	113	N	1	Cidex tube			X		X		W						
		R	1	Metal cabinet w/ glass doors	existing	36w x 24d x 72h	X		X		F						relocate from exist SPD on ground floor
		N	1	Linen Hamper			X		X		F						
	110	R	2	Portable Suction Unit	Ohio Medical Care-E-Vac 3	8w x 6h x 8d					CT		110/240				on shelf above triple bay sink
		R	2	Olympus Leak Tester		4w x 6h x 6d	X	X		X	CT						on shelf above triple bay sink
	118	N	1	Pass Thru Window Assembly	Steris	36w x 36h x 5d		X		X	W						
D8019 Decon Ante Room																	
		N	1	Linen Hamper			X		X		F						
D8023 Cart Washer																	
	101	N	1	Cart Washer-Disinfector	Belimed Cart Washer	see cut sheets	X		X		F		480 V				CS750S Steam or Equal, Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
D8025 Clean Cart Holding																	

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
D8030	Storage																

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
Intensive Care Unit 1 (B Wing West)																	
B8032 ICU Patient Room																	
B8034			1	Patient Bed			X		X		F						Owner to confirm equipment specifications
B8038		N	1	Prefabricated Headwall Unit	Compass or equal			X		X	W						see interior elevations
B8044		N	1	Prefabricated Footwall Unit	Compass or equal			X		X	W						see interior elevations
			1	Physiological Monitor	Philips		X		X		W						mtd on headwall w/ arm
			1	Sphygmomanometer			X		X		W						mtd on headwall
			1	Thermometer			X		X		W						mtd on headwall
			1	Pulse Oximeter			X		X		W						mtd on headwall
		N	1	Sharps			X	X		X	W						
		N	1	Glove Dispenser			X	X		X	W						
		N	1	System Clock			X		X		W						mtd on footwall, Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
		N	1	Soiled Linen Hamper			X		X		F						
		N	1	Television - 42"			X			X	W						
		N	1	Wall Bracket for TV			X			X	W						
		N	1	Markerboard			X	X		X	W						Marker Board is also noted as Patient Information on drawings. Corian shelf below board is Contractor Furnish and Contractor
		N	1	Flashlight - Rechargeable			X		X		W						
		N	1	Overbed Table			X		X		F						
		N	1	Patient Recliner			X		X		F						
		N	1	Sleeper Settee or Recliner (family)			X		X		F						
		N	1	Guest Chair (folding)			X		X		W						mtd on wall bracket
		N	1	Wall Bracket for guest chair			X	X		X	W						
		N	1	Task Chair - High (no casters)			X		X		F						
		N	1	Charting Computer			X		X								
		N	1	Mobile computer cart			X		X		F						for charting computer
	119	R	1	Patient Lift	Arjo Maxi Sky 600		X		X		C						Owner to confirm equipment specifications, Owner installation includes tracks and associated structural supports.
	117	N	1	Veteran Server	Systec or equal	15w x 24d x 72h		X		X							Owner to confirm equipment specifications

MEDICAL EQUIPMENT INVENTORY & SPECIFICATION

Project: William S. Middleton Memorial Veterans Hospital - Consolidate ICUs - 8A/8B Project No. 211033.00

MOUNTING KEY: C = CEILING D = DESKTOP ST = STORAGE 12/3/2012
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CT = COUNTERTOP P = PORTABLE W = WALL

NEW ROOM NO	ITEM NO.	NEW/REUSE	QUANTITY	EQUIPMENT NAME	MANUFACTURER & MODEL#	SIZE (W x D x H)	SUPPLIED BY		INSTALLED BY		MOUNTING	ELECTRIC REQ'MTS		PLUMBING REQ'MTS			NOTES
							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
B8040 ICU Bariatric Patient Room																	
			1	Patient Bed			X		X		F						Owner to confirm equipment specifications
		N	1	Prefabricated Headwall Unit	Compass or equal			X		X	W						see interior elevations
		N	1	Prefabricated Footwall Unit	Compass or equal			X		X	W						see interior elevations
			1	Physiological Monitor	Philips		X		X		W						mtd on headwall w/ arm
			1	Sphygmomanometer			X		X		W						mtd on headwall
			1	Thermometer			X		X		W						mtd on headwall
			1	Pulse Oximeter			X		X		W						mtd on headwall
		N	1	Sharps			X	X		X	W						
		N	1	Glove Dispenser			X	X		X	W						
		N	1	System Clock													mtd on footwall, Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
		N	1	Soiled Linen Hamper			X		X		F						
		N	1	Television - 42"			X			X	W						
		N	1	Wall Bracket for TV			X			X	W						
		N	1	Markerboard			X	X		X	W						Marker Board is also noted as Patient Information on drawings. Corian shelf below board is Contractor Furnish and Contractor
		N	1	Flashlight - Rechargeable			X		X		W						
		N	1	Overbed Table			X		X		F						
		N	1	Patient Recliner			X		X		F						
		N	1	Sleeper Settee or Recliner (family)			X		X		F						
		N	1	Guest Chair (folding)			X		X		W						mtd on wall bracket
		N	1	Wall Bracket for guest chair			X	X		X	W						
		N	1	Task Chair - High (no casters)			X		X		F						
		N	1	Charting Computer			X		X								
		N	1	Mobile computer cart			X		X		F						for charting computer
	119	N	1	Patient Lift	Arjo Maxi Sky 1000		X		X		C						Owner to confirm equipment specifications, Owner installation includes tracks and associated structural supports.
	117	N	1	Veteran Server	Systec or equal	15w x 24d x 72h				X							Owner to confirm equipment specifications

MEDICAL EQUIPMENT INVENTORY & SPECIFICATION

Project: William S. Middleton Memorial Veterans Hospital - Consolidate ICUs - 8A/8B Project No. 211033.00

MOUNTING KEY: 12/3/2012
ADDN 2; 7/22/13

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NEW ROOM NO	ITEM NO.	NEW/REUSE	QUANTITY	EQUIPMENT NAME	MANUFACTURER & MODEL#	SIZE (W x D x H)	SUPPLIED BY		INSTALLED BY		MOUNTING	ELECTRIC REQ'MTS		PLUMBING REQ'MTS			NOTES
							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
B8026 ICU Patient Room - Negative Isolation																	
B8028			1	Patient Bed			X		X		F					Owner to confirm equipment specifications	
B8046		N	1	Prefabricated Headwall Unit	Compass or equal			X		X	W					see interior elevations	
		N	1	Prefabricated Footwall Unit	Compass or equal			X		X	W					see interior elevations	
			1	Physiological Monitor	Philips		X		X		W					mtd on headwall w/ arm	
			1	Sphygmomanometer			X		X		W					mtd on headwall	
			1	Thermometer			X		X		W					mtd on headwall	
			1	Pulse Oximeter			X		X		W					mtd on headwall	
		N	1	Sharps			X	X		X	W						
		N	1	Glove Dispenser			X	X		X	W						
		N	1	System Clock			X		X		W					mtd on footwall, Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment	
		N	1	Soiled Linen Hamper			X		X		F						
		N	1	Television - 42"			X			X	W						
		N	1	Wall Bracket for TV			X			X	W						
		N	1	Markerboard			X	X		X	W					Marker Board is also noted as Patient Information on drawings. Corian shelf below board is Contractor Furnish and Contractor	
		N	1	Flashlight - Rechargeable			X		X		W						
		N	1	Overbed Table			X		X		F						
		N	1	Patient Recliner			X		X		F						
		N	1	Sleeper Settee or Recliner (family)			X		X		F						
		N	1	Guest Chair (folding)			X		X		W					mtd on wall bracket	
		N	1	Wall Bracket for guest chair			X	X		X	W						
		N	1	Task Chair - High (no casters)			X		X		F						
		N	1	Charting Computer			X		X								
		N	1	Mobile computer cart			X		X		F					for charting computer	
	119	N	1	Patient Lift	Arjo Maxi Sky 1000		X		X		C					Owner to confirm equipment specifications, Owner installation includes tracks and associated structural supports.	
	117	N	1	Veteran Server	Systec or equal	15w x 24d x 72h				X						Owner to confirm equipment specifications	
B8030 Charting - Decentralized																	
B8042		N	2	Computer Workstation			X		X		D						
B8048		N	2	Task Chair - High (w/ casters)			X		X		F						
B8036 Charting - Decentralized																	
		N	1	Computer Workstation			X		X		D						

MEDICAL EQUIPMENT INVENTORY & SPECIFICATION

Project: William S. Middleton Memorial Veterans Hospital - Consolidate ICUs - 8A/8B													Project No. 211033.00				
MOUNTING KEY: <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div> C = CEILING CAB = CABINET CT = COUNTERTOP </div> <div> D = DESKTOP F = FLOOR P = PORTABLE </div> <div> ST = STORAGE UCT = UNDER COUNTER W = WALL </div> </div>																	
NEW ROOM NO	ITEM NO.	NEW/REUSE	QUANTITY	EQUIPMENT NAME	MANUFACTURER & MODEL#	SIZE (W x D x H)	SUPPLIED BY		INSTALLED BY		MOUNTING	ELECTRIC REQ'MTS		PLUMBING REQ'MTS			NOTES
							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
		N	1	Task Chair - High (w/ casters)			X		X		F						
B8037 Family Room																	
		N		Lounge Chair			X		X		F						
		N		Settee			X		X		F						

MEDICAL EQUIPMENT INVENTORY & SPECIFICATION

Project: William S. Middleton Memorial Veterans Hospital - Consolidate ICUs - 8A/8B Project No. 211033.00

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NEW ROOM NO	ITEM NO.	NEW/REUSE	QUANTITY	EQUIPMENT NAME	MANUFACTURER & MODEL#	SIZE (W x D x H)	SUPPLIED BY		INSTALLED BY		MOUNTING	ELECTRIC REQ'MTS		PLUMBING REQ'MTS			NOTES
							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
B8033 Soiled Utility																	
		R	1	Trash Can - 44 gallon			X		X		F						
		N	1	Sharps (wall)				X		X	W						
		N	1	Gloves				X		X	W						
		R	2	Soiled Linen Hamper			X		X		F						
		R	2	Red bag waste can			X		X		F						
		R	2	Sharps containers			X		X		F						
B8041 Nourishment																	
	125	N	1	Refrigerator/Freezer		24w x 24d x 33h	X			X	F						
	126	R	1	Microwave		21w x 24d x 12h	X			X	CT						
	114	N	1	Ice Maker	Follett	21w x 24d x 47h	X			X	CT		115V				Air cooled
	116	N	1	Water Filter	Follett	16w x 4d x 20h	X			X	W						
	127	N	1	Coffee Maker	Bunn or similar		X			X	CT						
B8043 Nurse Station																	
	132	R	1	Crash Cart w/ Defib (beige)		28w x 22d x 38h	X		X		F						currently in CCU corridor
	131	R	1	ECG		18w x 40h x 28d	X		X		F						currently in CCU corridor
	133	R	1	Anesthesia Cart		24w x 24d x 44h	X		X		F						currently in CCU corridor
		R	1	Patient Information Board		36w x 30h	X	X		X	W						
		R	1	Central Monitor Station			X		X		D						
		R	1	Central Monitor printer		6w x 9d x 5h	X		X		D						
		R	1	Patient Order Monitor		10w x 11h x 5d	X		X		D						
		R	1	Intellivue Printer		12w x 12d x 12h	X		X		D						
		R	1	HP Laser Jet Printer		16w x 17d x 16h	X		X		D						
		R	2	Lateral File		20d x 36w	X		X		F						
		N	1	Clock													Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
		R	2	Paper Recycling Bin			X		X		W						
		N	1	OR Code Blue			X		X		W						
		R	14	Computer Workstation			X		X		UCT						
		N	14	Task Chair			X		X		F						
		N	10	Pedestal Files			X		X		F						
		R	1	Patient Order Monitor		10w x 11h x 5d	X		X		D						
		R	2	Monitor - Unit Clerk			X		X		D						
		R	1	Scanner - small		24w x 12d x 12h	X		X		D						
	135	R	1	Copier		41w x 26d x 46h	X		X		F						
				Systems Furniture			X		X		F						see plan

MEDICAL EQUIPMENT INVENTORY & SPECIFICATION

Project: William S. Middleton Memorial Veterans Hospital - Consolidate ICUs - 8A/8B															Project No. 211033.00														
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NEW ROOM NO	ITEM NO.	NEW/REUSE	QUANTITY	EQUIPMENT NAME	MANUFACTURER & MODEL#	SIZE (W x D x H)	SUPPLIED BY		INSTALLED BY		MOUNTING	ELECTRIC REQ'MTS		PLUMBING REQ'MTS			NOTES												
							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN													
B8053 Alcove - Med Prep																													
	152	R	1	Medication Dispenser	Med Select	19w x 20d x 38h	X		X		F																		
	152	R	1	Medication Dispenser w/ Monitor	Med Select	19W x 28D x 70H	X		X		F						Monitor on left												
B8055 Med Prep																													
	121	R	1	Shelving Unit	Metro	48w x 24d x 72h	X		X		F																		
	111	N	1	Refrigerator	Follett	24w x 26d x 35h	X			X	UCT																		
		N	1	Hook Strip		36w		X		X	W																		
		N	2	Sharps				X		X	W																		
		N	1	Gloves				X		X	W																		
		R	2	Recycling Bin			X		X		F																		
		R	1	Computer Workstation			X		X		CT																		
B8057 Clean Utility																													
	123	R	1	Shelving Unit	Metro	60w x 24d x 72h	X		X		F																		
	121	R	4	Shelving Unit	Metro	48w x 24d x 72h	X		X		F																		
	151	R	2	Small supply cart		38w x 22d x 36h	X		X		F																		
		R	1	Hazardous Waste			X		X		F																		
B8059 Equipment Room																													
	124	R	1	Blanket Warmer		30w x 27d x 36h	X		X		F																		
	142	R	1	Cortrak Monitor		18w x 18d x 60h	X		X		F						currently in CCU corridor												
	143	R	1	Wireless Monitor		18w x 18d x 60h	X		X		F						currently in CCU corridor												
	144	R	2	Bladderscan		21w x 21d x 36h	X		X		F																		
	145	R	1	Bronch Tower		24w x 26d x 72h	X		X		F						currently in CCU corridor												
	146	R	1	Ultrasound		21w x 24 d x 60h	X		X		F						currently in CCU corridor												
	149	R	1	Maxi Move Patient Lift	Arjo		X		X		F																		
	123	N	1	Shelving Unit	Metro	60w x 18d x 72h	X		X		F																		
	130	R	1	I-Med Consent COW		26w x 30d x 54h	X		X		F						currently in CCU corridor												
	150	R	1	Crash Cart (red)		34w x 26d x 48h	X		X		F																		
		R	1	IV Pole w/ Pumps			X	X		X	W																		
		N	1	Hooks for transfer boards																									
B8061 Clean Linen																													
	123	N	1	Shelving Unit	Metro	60w x 24d x 72h	X		X		F																		
	121	N	1	Shelving Unit	Metro	48w x 24d x 72h	X		X		F																		
	147	R	1	Comfort Cleanse Warmer (white)		28w x 14d x 18h	X		X		CT																		
	148	R	1	Comfort Cleanse Warmer (black)		28w x 15d x 20h					CT																		

MEDICAL EQUIPMENT INVENTORY & SPECIFICATION

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN		
B8054 Respiratory Therapy Storage																		
	141	R	1	RT Supply Shelving Unit	Metro	36w x 24d x 72h	X		X		F							
	123	R	1	Shelving Unit		60w x 24d x 72h	X		X		F							currently in CCU
		R	1	Oxygen Tank Cart - Full Tanks		18w x 27d x 40h	X		X		F							currently in CCU
		R	1	Oxygen Tank Cart - Empty Tanks		12w x 18d x 36h	X		X		F						currently in SICU	
	137	R	1	Ventilator		24w x 31d x 53h	X		X		F						currently in SICU	
	137	R	1	Ventilator		24w x 31d x 53h	X		X		F						currently in SICU	
	138	R	1	PICC Cart		32w x 28d x 38h	X		X		F						currently in SICU	
	139	R	1	Neuro Cart		32w x 22d x 37h	X		X		F							
	140	R	1	Hemodynamic Cart		32w x 22d x 37h	X		X		F							
	136	R	2	Ventilator		23w x 26d x 68h	X		X		F							
		R	1	Oxygen Tank Cart - Empty Tanks		12w x 18d x 36h	X		X		F							
		R	1	Non-invasive Vent CPAP														
B8056 ICU Equipment Storage																		
		R	1	Portable Scale		24w x 60h x 30d	X		X		F							
		R	2	Stretcher	Stryker Zoom		X		X		F							
		R	1	Stretcher		87w x 32d	X		X		F							
		R	1	Stretchair		29w x 48d	X		X		F							
		R	1	Stretchair		29w x 48d	X		X		F							
		R	1	Dr Peaslee Monitor		28w x 28d x 60h	X		X		F							

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
Intensive Care Unit 2 (B Wing East)																	
B8002 ICU Protective Environment Room w/ Boom																	
B8004			1	Patient Bed			X		X		F						Owner to confirm equipment specifications
	169	N	1	Equipment Boom - 2 Arms	Trumpf (design basis)		X	X		X	C						Owner to confirm equipment specifications
		N	1	Prefabricated Footwall Unit	Compass or equal			X		X	W						
			1	Physiological Monitor	Philips		X		X		Boom						
			1	Sphygmomanometer			X		X		Boom						
			1	Thermometer			X		X		Boom						
			1	Pulse Oximeter			X		X		Boom						currently in SICU corridor
		N	1	Sharps			X	X		X	W						
		N	1	Glove Dispenser			X	X		X	W						
		N	1	System Clock			X		X		W						Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
		N	1	Soiled Linen Hamper			X		X		F						
		N	1	Television - 42"			X			X	W						
		N	1	Wall Bracket for TV			X			X	W						
		N	1	Markerboard			X	X		X	W						Marker Board is also noted as Patient Information on drawings. Corian shelf below board is Contractor Furnish and Contractor Installed.
		N	1	Flashlight - Rechargeable			X		X		W						
		N	1	Overbed Table			X		X		F						
		N	1	Patient Recliner			X		X		F						
		N	1	Sleeper Settee or Recliner (family)			X		X		F						see plan
		N	1	Guest Chair (folding)			X		X		W						
		N	1	Wall Bracket for guest chair			X	X		X	W						
		N	1	Task Chair - High (no casters)			X		X		F						
		N	1	Charting Computer			X		X		Boom						
	117	N	1	Veteran Server	Systec or equal	15w x 24d x 72h		X		X							Owner to confirm equipment specifications

MEDICAL EQUIPMENT INVENTORY & SPECIFICATION
Project: William S. Middleton Memorial Veterans Hospital - Consolidate ICUs - 8A/8B Project No. 211033.00
MOUNTING KEY: 12/3/2012
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NEW ROOM NO	ITEM NO.	NEW/REUSE	QUANTITY	EQUIPMENT NAME	MANUFACTURER & MODEL	SIZE (W x D x H)	SUPPLIED BY		INSTALLED BY		MOUNTING	ELECTRIC REQ.'MTS		PLUMBING REQ.'MTS			NOTES
							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
B8008 ICU Bariatric Protective Environment Patient Room																	
			1	Patient Bed			X		X		F						Owner to confirm equipment specifications
		N	1	Prefabricated Headwall Unit	Compass or equal			X		X	W						see interior elevations
		N	1	Prefabricated Footwall Unit	Compass or equal			X		X	W						see interior elevations
			1	Physiological Monitor	Philips		X		X		W						mtd on headwall w/ arm
			1	Sphygmomanometer			X		X		W						mtd on headwall
			1	Thermometer			X		X		W						mtd on headwall
			1	Pulse Oximeter			X		X		W						mtd on headwall
		N	1	Sharps			X	X		X	W						
		N	1	Glove Dispenser			X	X		X	W						
		N	1	System Clock			X		X		W						mtd on footwall, Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
		N	1	Soiled Linen Hamper			X		X		F						
		N	1	Television - 42"			X			X	W						
		N	1	Wall Bracket for TV			X			X	W						
		N	1	Markerboard			X	X		X	W						Marker Board is also noted as Patient Information on drawings. Corian shelf below board is Contractor Furnish and Contractor Installed.
		N	1	Flashlight - Rechargeable			X		X		W						
		N	1	Overbed Table			X		X		F						
		N	1	Patient Recliner			X		X		F						
		N	1	Sleeper Settee or Recliner (family)			X		X		F						
		N	1	Guest Chair (folding)			X		X		W						mtd on wall bracket
		N	1	Wall Bracket for guest chair			X	X		X	W						
		N	1	Task Chair - High (no casters)			X		X		F						
		N	1	Charting Computer			X		X								
		N	1	Mobile computer cart			X		X		F						for charting computer
	119	N	1	Patient Lift	Arjo Maxi Sky 1000		X		X		C						Owner to confirm equipment specifications, Owner installation includes tracks and associated structural supports.
	117	N	1	Veteran Server	Systec or equal	15w x 24d x 72h		X		X							Owner to confirm equipment specifications

MEDICAL EQUIPMENT INVENTORY & SPECIFICATION
Project: William S. Middleton Memorial Veterans Hospital - Consolidate ICUs - 8A/8B Project No. 211033.00
MOUNTING KEY: 12/3/2012
 C = CEILING D = DESKTOP ST = STORAGE ADDN 2; 7/22/13
 CAB = CABINET F = FLOOR UCT = UNDER COUNTER
 CT = COUNTERTOP P = PORTABLE W = WALL

NEW ROOM NO	ITEM NO.	NEW/REUSE	QUANTITY	EQUIPMENT NAME	MANUFACTURER & MODEL	SIZE (W x D x H)	SUPPLIED BY		INSTALLED BY		MOUNTING	ELECTRIC REQ.'MTS		PLUMBING REQ.'MTS			NOTES
							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
B8010	ICU Patient Room - Protective Environment																
B8014			1	Patient Bed			X		X		F						Owner to confirm equipment specifications
B8016		N	1	Prefabricated Headwall Unit	Compass or equal			X		X	W						
B8020		N	1	Prefabricated Footwall Unit	Compass or equal			X		X	W						
			1	Physiological Monitor	Philips		X		X		W						
			1	Sphygmomanometer			X		X		W						
			1	Thermometer			X		X		W						
			1	Pulse Oximeter			X		X		W						currently in SICU corridor
		N	1	Sharps			X	X		X	W						
		N	1	Glove Dispenser			X	X		X	W						
		N	1	System Clock			X		X		W						mtd on footwall, Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
		N	1	Soiled Linen Hamper			X		X		F						
		N	1	Television - 42"			X			X	W						
		N	1	Wall Bracket for TV			X			X	W						
		N	1	Markerboard			X	X		X	W						Marker Board is also noted as Patient Information on drawings. Corian shelf below board is Contractor Furnish and Contractor Installed.
		N	1	Flashlight - Rechargeable			X		X		W						
		N	1	Overbed Table			X		X		F						
		N	1	Patient Recliner			X		X		F						
		N	1	Sleeper Settee or Recliner (family)			X		X		F						see plan
		N	1	Guest Chair (folding)			X		X		W						
		N	1	Wall Bracket for guest chair			X	X		X	W						
		N	1	Task Chair - High (no casters)			X		X		F						
		N	1	Charting Computer			X		X								
		N	1	Mobile computer cart			X		X		F						
	119	R	1	Patient Lift	Arjo Maxi Sky 600		X		X		C						Owner to confirm equipment specifications, Owner installation includes tracks and associated structural supports.
	117	N	1	Veteran Server	Systec or equal	15w x 24d x 72h		X		X							Owner to confirm equipment specifications

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
B8022 ICU Patient Room																	
			1	Patient Bed			X		X								Owner to confirm equipment specifications
		N	1	Prefabricated Headwall Unit	Compass or equal			X		X							see interior elevations
		N	1	Prefabricated Footwall Unit	Compass or equal			X		X							see interior elevations
			1	Physiological Monitor	Philips		X		X		W						mtd on headwall w/ arm
			1	Sphygmomanometer			X		X		W						mtd on headwall
			1	Thermometer			X		X		W						mtd on headwall
			1	Pulse Oximeter			X		X		W						mtd on headwall
		N	1	Sharps			X	X		X	W						
		N	1	Glove Dispenser			X	X		X	W						
		N	1	System Clock			X		X		W						mtd on footwall, Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment
		N	1	Soiled Linen Hamper			X		X								
		N	1	Television - 42"			X			X	W						
		N	1	Wall Bracket for TV			X			X	W						
		N	1	Markerboard			X	X		X	W						Marker Board is also noted as Patient Information on drawings. Corian shelf below board is Contractor Furnish and Contractor Installed.
		N	1	Flashlight - Rechargeable			X		X								
		N	1	Overbed Table			X		X								
		N	1	Patient Recliner					X								
		N	1	Sleeper Settee or Recliner (family)					X								
		N	1	Guest Chair (folding)			X		X								mtd on wall bracket
		N	1	Wall Bracket for guest chair			X	X		X	W						
		N	1	Charting Computer			X		X								
		N	1	Mobile computer cart			X		X								for charting computer
	119	N	1	Patient Lift	Arjo Maxi Sky 1000		X		X		C						Owner to confirm equipment specifications, Owner installation includes tracks and associated structural supports.
	117	N	1	Veteran Server	Systec or equal	15w x 24d x 72h		X		X	F						Owner to confirm equipment specifications
B8006 Charting - Decentralized																	
B8012		N	2	Computer Workstation			X		X		D						
B8018		N	2	Task Chair - High			X		X		F						see plan
B8024																	

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
B8001 Staff Lounge																	
	125	N	2	Refrigerator		full size, 19-21 CF	X			X	F						
	126	N	2	Microwave			X			X	CT						
	127	N	1	Coffee Maker	Bunn or similar		X			X	CT			X		X	
	134	N	1	Toaster Oven			X				CT						
		N		Table			X		X		F						
		N		Stacking Chair			X		X		F						
		N	80	Mailslots				X		X	F						See interior elevations
		N	20	Box Lockers				X		X	F						See interior elevations
		N	1	Computer Workstation			X		X		D						
		N	1	Pedestal File			X		X		F						
B8005 Family Room																	
				Lounge Chair			X		X		F						
				Settee			X		X		F						
B8009 Nourishment																	
	125	N	1	Refrigerator			X			X	F						
	126	N	1	Microwave		21w x 24d x 12h	X			X	CT						
	114	N	1	Ice Maker	Follett	21w x 24d x 47h	X			X	CT		115				Air cooled
	116	N	1	Water Filter	Follett	16w x 4d x 20h	X			X	W						
	127	N	1	Coffee Maker	Bunn or similar		X			X	CT			X		X	

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
B8013 Nurse Station																	
	132	R	1	Crash Cart w/ Defib (beige)		28w x 22d x 38h	X		X		F						one power connection or 2?
	133	R	1	Anesthesia Cart		24w x 24d x 44h	X		X		F						
	131	N	1	ECG		18w x 40h x 28d	X		X		F						
		R	1	Supply Cart		24w x 22d x 37h	X		X		F						
		R	1	Printer			X		X		D						
		R	1	Central Monitor Station			X		X		D						
		R	1	Central Monitor printer		6w x 9d x 5h	X		X		D						
		N	1	Patient Information Board (Markerboard)				X		X	W						
		N	1	OR Code Blue			X	X	X	X	W						
		R	15	Computer Workstations			X		X		D						
		N	16	Task Chair			X		X		F						
		N	6	Pedestal File			X		X		F						
		N	1	Lateral File			X		X		F						
		N	1	Clock												Contractor to provide utility rough-ins and final hook-up for Owner installation of equipment	
		R	1	Patient Order Monitor		10w x 11h x 5d	X		X		D						
		R	1	Scanner - small		24w x 12d x 12h	X		X		D						
		R	2	Monitors - Unit Clerk			X		X		D						
	135	R	1	Copier		41w x 26d x 46h	X		X		F						
				Systems Furniture			X		X		F						
B8019 Alcove - Med Prep																	
	152	R	1	Medication Dispenser	Med Select	19w x 20d x 38h	X		X		F						
	152	R	1	Medication Dispenser w/ Monitor	Med Select	19w X 28d X 70h	X		X		F						Monitor on right
B8021 Med Prep																	
	121	R	1	Shelving Unit	Metro	48w x 24d x 72h	X		X		F						
		R	1	Label Holder		16w x 4d x 35h	X		X		W						
	111	N	1	Refrigerator	Follett	24w x 26d x 34h	X			X	CT						
		N	1	Hook Strip		36w	X				W						
		R	2	Recycling Bin			X				F						
		N	2	Sharps				X		X	W						
		N	1	Glove Dispenser				X		X	W						
		R	1	Computer Workstation			X		X		CT						

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							OWNER	CONTR	OWNER	CONTR		WATTS	VOLTAGE	CW	HW	DRAIN	
B8023 Clean Utility																	
	123	R	1	Shelving Unit	Metro	60w x 24d x 72h	X		X		F						
	121	R	4	Shelving Unit	Metro	48w x 24d x 72h	X		X		F						
	151	R	1	Small supply cart (gray)		38w x 22d x 36h	X		X		F						
		N	1	Markerboard/Tackboard				X		X	W						
B8025 Equipment Room																	
	129	R	1	Warming Cabinet		28w x 25d x 72h	X		X		F						
	130	R	1	I-Med Consent COW		26w x 30d x 54h	X		X		F						
	153	R	2	Isolation Supply Cart		28w x 20d x 64h	X		X		F						
	154	R	1	Ultrasound		24w x 24 d x 60h	X		X		F						
	155	R	1	Bair Hugger		14w x 16d x 24h	X		X		F						
	156	R	1	Cortrak Monitor		18w x 18d x 60h	X		X		F						
	157	R	1	Bladderscan		21w x 21d x 36h	X		X		F						
	158	R	1	Scale		26w x 28d x 50h	X		X		F						
	159	R	1	Vital Signs Monitor on cart		20w x 28d x 36h	X		X		F						
	160	R	1	Crash Cart (red)		34w x 26d x 48h	X		X		F						
	149	R	1	Maxi Move standing patient lift	Arjo		X		X		F						
		R	1	IV Pole w/ Pumps			X		X		F						
		R	1	IV Pole w/ Pumps			X		X		F						
B8027 Clean Linen																	
	120	N	1	Shelving Unit (solid shelves)	Metro	48w x 24d x 72h	X		X		F						
	122	N	1	Shelving Unit (solid shelves)	Metro	48w x 24d x 72h	X		X		F						
	128	R	1	Comfort Cleanse Warmer (white)		28w x 14d x 18h	X		X		CT						
B8029 Conference/Report																	
		N	1	LCD Monitor - 50"			X		X		W						
		N	1	Workstation, Computer			X		X		D						
		N		Stacking Chair			X		X		F						
		N		Conference Chair			X		X		F						
		N		Conference Table			X		X		F						
		N	1	Projector			X		X		C						
		N	1	Smart Board			X		X		W						

Abbreviation	Material	Spec Section	Abbreviation	Material	Spec Section	Abbreviation	Material	Spec Section
ACT	Acoustical Ceiling Tile	095100	PL	Plastic Laminate	062000			
BG	Bumper Guard	102600	RB	Rubber Wall Base	096513			
CG	Corner Guard	102600	RF	Rubber Flooring	096516			
CPT	Carpet	096800	RS	Roller Shade	122400			
CT	Curtain Track	102123	RT	Resilient Tile	096519			
DG	Decorative Glazing	088000	RWP	Rigid Wall Protection	102600			
ETR	Existing to Remain		SC	Sealed Concrete				
EXP	Exposed		SS	Solid Surface Material	062000			
GT	Grout	093013	SST	Stainless Steel				
GWB	Gypsum Wall Board	092900	STR	Stair Tread / Riser	096519			
HR	Handrail	102600	SV	Sheet Vinyl	096516			
MT	Mosaic Tile	093013	TFP	Tackable Fabric Panel	062000			
PA	Paint	099100	TS	Transition Strip				
PC	Privacy Curtain	102123	WC	Wall Covering	097216			
PCT	Porcelain Ceramic Tile	093013	WD	Wood	062000			
PCTB	Porcelain Tile Base	093013						

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
062000 Finish Carpentry				062000 Finish Carpentry			
	PL-1	Item:	Casework Laminate - Design Basis		PL-1	Item:	Casework Laminate - Or Equal
		Material:	Plastic Laminate			Material:	
		Manufacturer:	Formica			Manufacturer:	
		Pattern:				Pattern:	
		Color:	6208 - Glamour Cherry			Color:	
		Description:	Matte Finish			Description:	
	TFP-1	Item:	Tackable Fabric Panel - Design Basis		TFP-1	Item:	Tackable Fabric Panel - Or Equal
		Material:	Olefin			Material:	
		Manufacturer:	DL Couch - Source One			Manufacturer:	
		Pattern:	Jet Set			Pattern:	
		Color:	TPJ-10			Color:	
		Description:	54"W			Description:	
	SS-1	Item:	Solid Surface Sills & Countertops - Design Basis		SS-1	Item:	Solid Surface Sills & Countertops - Or Equal
		Material:	Solid Surface			Material:	
		Manufacturer:	DuPont			Manufacturer:	
		Pattern:	Corian			Pattern:	
		Color:	Raffia			Color:	
		Description:	1/2" Thick			Description:	
	SS-2	Item:	Solid Surface - Design Basis		SS-2	Item:	Solid Surface - Design Basis
		Material:	Solid Surface			Material:	
		Manufacturer:	DuPont			Manufacturer:	
		Pattern:	Corian			Pattern:	
		Color:	Bone			Color:	
		Description:	1/2" Thick			Description:	
	WD-1	Item:	Wood Detailing - Design Basis		WD-1	Item:	Wood Detailing - Or Equal
		Material:	Cherry			Material:	
		Manufacturer:				Manufacturer:	
		Pattern:	Rotary Cut			Pattern:	
		Color:				Color:	
		Description:	Stain to Match Architect's Sample.			Description:	
			Basis: Marshfield Door Systems,				
			Species: Cherry, Stain: Autumn 32-95				

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
088000 Glazing				088000 Glazing			
	DG-1	Item:	Decorative Glazing at Family Waiting - Design Basis		DG-1	Item:	Decorative Glazing at Family Waiting - Or Equal
		Material:	Kiln-Cast Glass			Material:	
		Manufacturer:	Meltdown Glass			Manufacturer:	
		Pattern:	MD 204 Strata			Pattern:	
		Color:				Color:	
		Description:	3/8" Thick, Tempered			Description:	
			Pattern Direction to Run Vertically				
093013 Ceramic/ Porcelain Tiling				093013 Ceramic/ Porcelain Tiling			
	PCT-1	Item:	Floor & Wall Tile - Design Basis		PCT-1	Item:	Floor & Wall Tile -Or Equal
		Material:	Porcelain			Material:	
		Manufacturer:	StonePeak			Manufacturer:	
		Pattern:	Limestone			Pattern:	
		Color:	USH1224001AC - Active Ivory			Color:	
		Description:	12"x24", Vertical Grid Installation			Description:	
			Grout: (Hydroment) - Epoxy				
	PCT-2	Item:	Floor Tile - Design Basis		PCT-2	Item:	Floor Tile - Or Equal
		Material:	Porcelain			Material:	
		Manufacturer:	StonePeak			Manufacturer:	
		Pattern:	Limestone			Pattern:	
		Color:	USH1212003 - Walnut			Color:	
		Description:	12"x12", Standard Grid Installation			Description:	
			Grout: (Hydroment) - Epoxy				
	PCT-3	Item:	Mosaic Wall Tile - Design Basis		PCT-3	Item:	Mosaic Wall Tile - Or Equal
		Material:	Porcelain			Material:	
		Manufacturer:	StonePeak			Manufacturer:	
		Pattern:	New Mosaics - Design 4			Pattern:	
		Color:	USH124D401 - Ivory			Color:	
		Description:	Approx. 12"x24"			Description:	
			Grout: (Hydroment) - Epoxy				

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
	PCT-4	Item:	Mosaic Wall Tile - Design Basis		PCT-4	Item:	Mosaic Wall Tile - Or Equal
		Material:	Porcelain			Material:	
		Manufacturer:	StonePeak			Manufacturer:	
		Pattern:	New Mosaics - Design 1			Pattern:	
		Color:	USH412D101 - Limestone			Color:	
		Description:	4"x12"			Description:	
			Grout: (Hydroment) - Epoxy				
	PCT-5	Item:	Wall Tile - Design Basis		PCT-5	Item:	Wall Tile - Or Equal
		Material:	Porcelain			Material:	
		Manufacturer:	StonePeak			Manufacturer:	
		Pattern:	Limestone			Pattern:	
		Color:	USH1212001AC - Active Ivory			Color:	
		Description:	12"x12", Standard Grid Installation			Description:	
			Grout: (Hydroment) - Epoxy				
095100 Acoustical Ceilings				095100 Acoustical Ceilings			
	ACT-1	Item:	Ceiling Tile - General Use - Design Basis		ACT-1	Item:	Ceiling Tile - General Use - Or Equal
		Material:	Mineral Fiber			Material:	
		Manufacturer:	Armstrong			Manufacturer:	
		Pattern:	Ultima #1911			Pattern:	
		Color:	White			Color:	
		Description:	24"x24"x3/4", 15/16" Beveled Tegal			Description:	
	ACT-2	Item:	Ceiling Tile - Scrubbable - Design Basis		ACT-2	Item:	Ceiling Tile - Scrubbable - Or Equal
		Material:	Mineral Fiber			Material:	
		Manufacturer:	Armstrong			Manufacturer:	
		Pattern:	Healthzone Ultima #1937			Pattern:	
		Color:	White			Color:	
		Description:	24"x24"x3/4", 15/16" Beveled Tegal			Description:	
	ACT-3	Item:	Ceiling Tile - Scrubbabl, Clipped - Design Basis		ACT-3	Item:	Ceiling Tile - Scrubbabl, Clipped - Or Equal
		Material:	Mineral Fiber			Material:	
		Manufacturer:	Armstrong			Manufacturer:	
		Pattern:	Healthzone Ultima #1937			Pattern:	
		Color:	White			Color:	
		Description:	24"x24"x3/4", 15/16"Beveled Tegal			Description:	
			System to be clipped/gasketed per spec.				

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
096513 Resilient Base and Accessories				096513 Resilient Base and Accessories			
	RB-1	Item:	Resilient Wall Base for Carpet - Design Basis		RB-1	Item:	Resilient Wall Base for Carpet - Or Equal
		Material:	Rubber (TDC)			Material:	
		Manufacturer:	Johnsonite			Manufacturer:	
		Pattern:	Tightlock for Carpet			Pattern:	
		Color:	80 - Fawn			Color:	
		Description:	6 1/4"H			Description:	
	RB-2	Item:	Resilient Wall Base for Resilient Flooring - Design Basis		RB-2	Item:	Resilient Wall Base for Resilient Flooring - Or Equal
		Material:	Rubber (TDCR)			Material:	
		Manufacturer:	Johnsonite			Manufacturer:	
		Pattern:	Tightlock for Resilient Flooring			Pattern:	
		Color:	80 - Fawn			Color:	
		Description:	6 1/4"H			Description:	
096516 Resilient Sheet Flooring				096516 Resilient Sheet Flooring			
	RF-1	Item:	Non-Directional Sheet Flooring - Design Basis		RF-1	Item:	Non-Directional Sheet Flooring - Or Equal
		Material:	Nora Vulcanized Rubber Compound 913			Material:	
		Manufacturer:	Nora			Manufacturer:	
		Pattern:	Noraplan, Environcare			Pattern:	
		Color:	2968 - Sweet Olive			Color:	
		Description:	3.0mm Thick, 4'W			Description:	
	RF-2	Item:	Non-Directional Sheet Flooring - Design Basis		RF-2	Item:	Non-Directional Sheet Flooring - Or Equal
		Material:	Nora Vulcanized Rubber Compound 913			Material:	
		Manufacturer:	Nora			Manufacturer:	
		Pattern:	Noraplan, Environcare			Pattern:	
		Color:	2787 - Driftwood			Color:	
		Description:	3.0mm Thick, 4'W			Description:	

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
	RF-3	Item:	Non-Directional Sheet Flooring - Design Basis		RF-3	Item:	Non-Directional Sheet Flooring - Or Equal
		Material:	Nora Vulcanized Rubber Compound 913			Material:	
		Manufacturer:	Nora			Manufacturer:	
		Pattern:	Noraplan, Environcare			Pattern:	
		Color:	2967 - Moor Grass			Color:	
		Description:	3.0mm Thick, 4'W			Description:	
	RF-4	Item:	Non-Directional Sheet Flooring - Design Basis		RF-4	Item:	Non-Directional Sheet Flooring - Or Equal
		Material:	Nora Vulcanized Rubber Compound 913			Material:	
		Manufacturer:	Nora			Manufacturer:	
		Pattern:	Noraplan, Environcare			Pattern:	
		Color:	2949 - Sage			Color:	
		Description:	3.0mm Thick, 4'W			Description:	
	SV-1	Item:	Wood-look Sheet Flooring - Design Basis		SV-1	Item:	Wood-look Sheet Flooring - Design Basis
		Material:	Vinyl			Material:	
		Manufacturer:	Teknoflor			Manufacturer:	
		Pattern:				Pattern:	
		Color:	73801 - Honey Oak			Color:	
		Description:	2.3 mm, 6' W			Description:	
	SV-2	Item:	Non-Directional Sheet Flooring - Design Basis		SV-2	Item:	Non-Directional Sheet Flooring - Or Equal
		Material:	Vinyl			Material:	
		Manufacturer:	Teknoflor			Manufacturer:	
		Pattern:	Moonscapes/ Granite II			Pattern:	
		Color:	8604 - Bianco Romano			Color:	
		Description:	2.3 mm, 6' W			Description:	

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
	SV-3	Item:	Wood-look Sheet Flooring - Design Basis		SV-3	Item:	Wood-look Sheet Flooring - Or Equal
		Material:	Vinyl			Material:	
		Manufacturer:	Teknoflor			Manufacturer:	
		Pattern:				Pattern:	
		Color:	52301 - Devon Pecan (LP)			Color:	
		Description:	2.3 mm, 6' W			Description:	
096519 Resilient Tile Flooring				096519 Resilient Tile Flooring			
	RT-1	Item:	Rubber Tile at Stair Landings - Design Basis		RT-1	Item:	Rubber Tile at Stair Landings - Or Equal
		Material:	Rubber			Material:	
		Manufacturer:	Nora			Manufacturer:	
		Pattern:	Norament-Grano (Art. 1880)			Pattern:	
		Color:	4896 - Ammonite			Color:	
		Description:	3.5mm, 39.5"x39.5", Hammered Text.			Description:	
	STR-1	Item:	Integrated Stair Tread & Riser - Design Basis		STR-1	Item:	Integrated Stair Tread & Riser - Or Equal
		Material:	Rubber			Material:	
		Manufacturer:	Nora			Manufacturer:	
		Pattern:	Norament Grano Stairtreads			Pattern:	
		Color:	Twilight			Color:	
		Description:	4'W & 6'W as required (To Match Existing.)			Description:	
096800 Carpeting				096800 Carpeting			
	CPT-1	Item:	Carpet Tile - Design Basis		CPT-1	Item:	Carpet Tile - Design Basis
		Material:	Post-Consumer Content Type 6,6 Nylon			Material:	
		Manufacturer:	Interface Flor			Manufacturer:	
		Pattern:	12349 - Paire Grass Glas Bac RE Tile			Pattern:	
		Color:	9312 - Savanna			Color:	
		Description:	19.69" x 19.69", Ashlar Installation			Description:	

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
	CPT-2	Item:	Carpet Tile - Design Basis		CPT-2	Item:	Carpet Tile - Or Equal
		Material:	Post-Consumer Content Type 6,6 Nylon			Material:	
		Manufacturer:	Interface Flor			Manufacturer:	
		Pattern:	12348 - Farmland Glas Bac RE Tile			Pattern:	
		Color:	9295 - Savanna			Color:	
		Description:	19.69" x 19.69", Ashlar Installation			Description:	
097216 Vinyl Coated Fabric Wall-Coverings				097216 Vinyl Coated Fabric Wall-Coverings			
	WC-1	Item:	Wall-Covering at Main Elevators - Design Basis		WC-1	Item:	Wall-Covering at Main Elevators - Or Equal
		Material:	Vinyl (w/ Clean Vinyl Technology)			Material:	
		Manufacturer:	Len-Tex Corporation			Manufacturer:	
		Pattern:	Allegria			Pattern:	
		Color:	3385-AL Nocturne			Color:	
		Description:	54"W, Contact: Diane Lovegren, (800) 621-4006			Description:	
	WC-2	Item:	Wall-Covering in Family Waiting - Design Basis		WC-2	Item:	Wall-Covering in Family Waiting - Or Equal
		Material:	Vinyl w/REcore Backing			Material:	
		Manufacturer:	MDC Bolta Contract			Manufacturer:	
		Pattern:	Golden Sedge			Pattern:	
		Color:	BB-GO-14 Shenandoah Brush			Color:	
		Description:	54"W, Contact: Diane Lovegren, (800) 621-4006			Description:	
	WC-3	Item:	Wall-Covering in Conference/ Consult- Design Basis		WC-3	Item:	Wall-Covering in Conference/ Consult- Or Equal
		Material:	Vinyl w/REcore Backing			Material:	
		Manufacturer:	MDC Bolta Contract			Manufacturer:	
		Pattern:	Golden Sedge			Pattern:	
		Color:	BB-GO-20 Viridian Frond			Color:	
		Description:	54"W, Contact: Diane Lovegren, (800) 621-4006			Description:	

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
099100 Painting				099100 Painting			
	PA-1	Item:	Paint - Design Basis		PA-1	Item:	Paint - Or Equal
		Material:				Material:	
		Manufacturer:	Sherwin Williams			Manufacturer:	
		Pattern:				Pattern:	
		Color:	SW 6147 - Panda White			Color:	
		Description:	LRV 77%			Description:	
	PA-2	Item:	Paint at Door Frames - Design Basis		PA-2	Item:	Paint at Door Frames - Or Equal
		Material:				Material:	
		Manufacturer:	Sherwin Williams			Manufacturer:	
		Pattern:				Pattern:	
		Color:	SW 7531 - Canvas Tan			Color:	
		Description:	LRV 64%, Sheen: Semi-Gloss			Description:	
	PA-3	Item:	Epoxy Paint at Walls - Design Basis		PA-3	Item:	Epoxy Paint at Walls - Or Equal
		Material:				Material:	
		Manufacturer:	Sherwin Williams			Manufacturer:	
		Pattern:				Pattern:	
		Color:	SW 6164 - Svelte Sage			Color:	
		Description:	LRV 42%			Description:	
	PA-4	Item:	Paint - Design Basis		PA-4	Item:	Paint - Or Equal
		Material:				Material:	
		Manufacturer:	Sherwin Williams			Manufacturer:	
		Pattern:				Pattern:	
		Color:	SW 6206 - Oyster Bay			Color:	
		Description:	LRV 43%			Description:	
	PA-5	Item:	Paint - Design Basis		PA-5	Item:	Paint - Or Equal
		Material:				Material:	
		Manufacturer:	Sherwin Williams			Manufacturer:	
		Pattern:				Pattern:	
		Color:	SW 0012 - Empire Gold			Color:	
		Description:	LRV 39%			Description:	

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
	PA-6	Item:	Paint - Design Basis		PA-6	Item:	Paint - Or Equal
		Material:				Material:	
		Manufacturer:	Sherwin Williams			Manufacturer:	
		Pattern:				Pattern:	
		Color:	SW 6129 - Restrained Gold			Color:	
		Description:	LRV 48%			Description:	
	PA-7	Item:	Epoxy Coating at Floor - Design Basis		PA-7	Item:	Epoxy Coating at Floor - Or Equal
		Material:				Material:	
		Manufacturer:	Tnemec Company, Inc.			Manufacturer:	
		Pattern:				Pattern:	
		Color:	14BL - Cadet Blue			Color:	
		Description:	Multi-step system, see spec.			Description:	
	PA-8	Item:	Epoxy Coating at Walls - Design Basis		PA-8	Item:	Epoxy Coating at Walls - Or Equal
		Material:				Material:	
		Manufacturer:	Sherwin Williams			Manufacturer:	
		Pattern:				Pattern:	
		Color:	SW 6147 - Panda White			Color:	
		Description:	LRV 77%, Epoxy for Moisture Control			Description:	
	PA-9	Item:	Paint in Stairwells - Design Basis		PA-9	Item:	Paint in Stairwells - Or Equal
		Material:				Material:	
		Manufacturer:	Multispec			Manufacturer:	
		Pattern:	Fine Fleck			Pattern:	
		Color:	MS90-9871			Color:	
		Description:	(To Match Existing.)			Description:	
	PA-10	Item:	Paint at Handrails in Stairwells - Design Basis		PA-10	Item:	Paint at Handrails in Stairwells - Or Equal
		Material:				Material:	
		Manufacturer:				Manufacturer:	
		Pattern:				Pattern:	
		Color:				Color:	
		Description:	(To Match Existing.)			Description:	
			*Extended lead time. See Gen. Note F.				
102123 Cubicle Curtain Tracks				102123 Cubicle Curtain Tracks			
	CT-1	Item:	Curtain Track System - Design Basis		CT-1	Item:	Curtain Track System - Or Equal

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
		Manufacturer:	On the Right Track Systems, Inc.			Manufacturer:	
		Description:	To be used wherever PC-1 is specified.			Description:	
	PC-1	Item:	Privacy Curtain - Design Basis		PC-1	Item:	Privacy Curtain - Or Equal
		Material:	Trevira CS Polyester			Material:	
		Manufacturer:	Architex			Manufacturer:	
		Pattern:	Remede. Rx 8001			Pattern:	
		Color:	Emerald Sea			Color:	
		Description:	72"W, Repeat: 81"V			Description:	
			w/ BioAm (Anti-Microbial Finish)				
			*See. Gen. Note O.				
102600 Wall and Door Protection				102600 Wall and Door Protection			
	BG-1	Item:	Bumper Guard - Design Basis		BG-1	Item:	Bumper Guard - Or Equal
		Material:	PETG+ Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2-1800 Silhouette			Pattern:	
		Color:	0154 - Clam Shell			Color:	
		Description:	8"H			Description:	
			*Extended lead time. See Gen. Note H.				
	BG-2	Item:	Bumper Guard - Design Basis		BG-2	Item:	Bumper Guard - Or Equal
		Material:	PETG+ Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2-1800 Silhouette			Pattern:	
		Color:	0353 - Sprout			Color:	
		Description:	8"H			Description:	
			*Extended lead time. See Gen. Note H.				

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
	BG-3	Item:	Bumper Guard - Design Basis		BG-3	Item:	Bumper Guard - Or Equal
		Material:	PETG+ Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2-1800 Silhouette			Pattern:	
		Color:	0285 - Wheat Field			Color:	
		Description:	8"H			Description:	
			*Extended lead time. See Gen. Note H.				
	BG-4	Item:	Bumper Guard - Design Basis		BG-4	Item:	Bumper Guard - Or Equal
		Material:	PETG+ Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2-1800 Silhouette			Pattern:	
		Color:	0107 - Pewter Gray			Color:	
		Description:	8"H			Description:	
			*Extended lead time. See Gen. Note H.				
	CG-1	Item:	Corner Guard - Design Basis		CG-1	Item:	Corner Guard - Or Equal
		Material:	PETG+ Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2-150			Pattern:	
		Color:	0154 - Clam Shell			Color:	
		Description:	8"H, 90 Degree, 3" Wing			Description:	
			*Extended lead time. See Gen. Note H.				
	CG-2	Item:	Corner Guard - Design Basis		CG-2	Item:	Corner Guard - Or Equal
		Material:	PETG+ Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2-150			Pattern:	
		Color:	0353 - Sprout			Color:	
		Description:	8"H, 90 Degree, 3" Wing			Description:	
			*Extended lead time. See Gen. Note H.				

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
	CG-3	Item:	Corner Guard - Design Basis		CG-3	Item:	Corner Guard - Or Equal
		Material:	PETG+ Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2-130			Pattern:	
		Color:	0353 - Sprout			Color:	
		Description:	8"H, 135 Degree, 3" Wing			Description:	
			*Extended lead time. See Gen. Note H.				
	CG-4	Item:	Corner Guard - Design Basis		CG-4	Item:	Corner Guard - Or Equal
		Material:	Stainless Steel			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	Model 180 Surface Mount			Pattern:	
		Color:	No. 4 Satin Finish			Color:	
		Description:	8"H, 3 1/2"Wing, 1/8" Radius			Description:	
	CG-5	Item:	Corner Guard - Design Basis		CG-5	Item:	Corner Guard - Or Equal
		Material:	Stainless Steel			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	Model 181 Surface Mount			Pattern:	
		Color:	No. 4 Satin Finish			Color:	
		Description:	8"H, 1 1/2"Wing, 1/8" Radius			Description:	
	CG-6	Item:	Corner Guard - Design Basis		CG-6	Item:	Corner Guard - Or Equal
		Material:	PETG+ Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2-150			Pattern:	
		Color:	0107 - Pewter Gray			Color:	
		Description:	8"H, 90 Degree, 3" Wing			Description:	
			*Extended lead time. See Gen. Note H.				

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
	CG-7	Item:	Corner Guard - Design Basis		CG-7	Item:	Corner Guard - Or Equal
		Material:	PETG+ Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2-160			Pattern:	
		Color:	0353 - Sprout			Color:	
		Description:	8"H, 90 Degree, 2" Wing			Description:	
			*Extended lead time. See Gen. Note H.				
	HR-1	Item:	Handrail - Design Basis		HR-1	Item:	Handrail - Or Equal
		Material:	Vinyl			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	2000W Handrail			Pattern:	
		Color:	0535 - Honey Nut			Color:	
		Description:	With Stainless Steel Mounting Brackets			Description:	
	RWP-1	Item:	Wall Protection - Design Basis		RWP-1	Item:	Wall Protection - Or Equal
		Material:	PETG Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2 Series Sheet			Pattern:	
		Color:	0154 - Clam Shell			Color:	
		Description:	4'x8' Sheet, 0.060" Thick			Description:	
			*Extended lead time. See Gen. Note H.				
	RWP-2	Item:	Wall Protection - Design Basis		RWP-2	Item:	Wall Protection - Or Equal
		Material:	PETG Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2 Series Sheet			Pattern:	
		Color:	0353 - Sprout			Color:	
		Description:	4'x8' Sheet, 0.060" Thick			Description:	
			*Extended lead time. See Gen. Note H.				

Spec Section	Key Code		Product Description - Design Basis	Spec Section	Key Code		Product Description - Or Equal
	RWP-3	Item:	Wall Protection - Design Basis		RWP-3	Item:	Wall Protection - Or Equal
		Material:	PETG Biopolymer Blend (PVC Free)			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	EnviroGT G2 Series Sheet			Pattern:	
		Color:	0285 - Wheat Field			Color:	
		Description:	4'x8' Sheet, 0.060" Thick			Description:	
			*Extended lead time. See Gen. Note H.				
	RWP-4	Item:	Door Protection - Design Basis		RWP-4	Item:	Door Protection - Or Equal
		Material:	Vinyl			Material:	
		Manufacturer:	InPro Corporation			Manufacturer:	
		Pattern:	Rigid Vinyl Sheet - Woodland 1			Pattern:	
		Color:	0535 - Honey Nut			Color:	
		Description:	4'x8' Sheet, 0.060" Thick			Description:	
122400 Window Shades				122400 Window Shades			
	RS-1	Item:	Roller Shade - Design Basis		RS-1	Item:	Roller Shade - Or Equal
		Manufacturer:	RollEase			Manufacturer:	
		Pattern:	R Series Galaxy Geared Clutches w/Phifer Sheerweave 4100			Pattern:	
		Color:	Q12 Pebblestone, 10% Openness			Color:	
		Description:	Stainless steel ball chain loops and commercial hold-down.			Description:	
	RS-2	Item:	Roller Shade - Outer Shade (Blackout)- Design Basis		RS-2	Item:	Roller Shade - Outer Shade (Blackout)- Or Equal
		Manufacturer:	RollEase			Manufacturer:	
		Pattern:	R Series Galaxy Geared Clutches w/Butler Panta-Flex Matte FR			Pattern:	
		Color:	934 Fawn			Color:	
		Description:	Stainless steel ball chain loops and commercial hold-down.			Description:	

Notes
General Notes
Room Finish Schedule to be read in combination with Room Finish Schedule Material Key, Finish Plans, Elevations and Details.
See sheet series AS-200 for Reflected Ceiling Plans denoting ceiling heights and ceiling material locations.
See sheet seies AS-310 for wall protection types and locations including bumper guards (BG), corner guards (CG), handrails (HR) and rigid wall protection (RWP).
Listed items' locations are not included in the Room Finish Schedule.
Standard paint sheen to be Eggshell, u.n.o.
All hollow metal door frames to be PA-2, semi-gloss finish, u.n.o.
All metal handrails in stairwells to be PT-10, shop-finished powdercoating.
All GWB at ceilings and soffits to be painted PA-1, u.n.o.
All corner guards and wall protection products (IPC, G-Series) have extended lead times of 20 business days; schedule procurement accordingly.
All rigid wall protection (RWP) to run 4'-0" above scheduled base to maintain standard product size, u.n.o.
Provide appropriate transition strips between all dissimilar flooring materials, including sheet ruber to sheet vinyl transitions. Color to match RB-1, u.n.o.
All solid surface countertops to have 1 1/2" built-up eased edge, u.n.o.
All window sills to be solid surface, SS-1, u.n.o.
All PCT on walls in toilet rooms to be full-height to ceiling, u.n.o.
Provide RS-1 at all exterior glazing.
PC-1 has 81" vertical pattern repeat. Curtain panels to be fabricated with top of pattern repeat (lightest portion) at attached mesh. Trim from bottom of pattern repeat as necessary to achieve desired curtain panel length.
Provide 2"x2" mosaic PCT to coordinate with specified floor tile when needed to slope to floor drains. Confirm any areas larger than 24"x24" with Architect.
*Hatching or shading in Room Finish Schedule or Material Key indicates a revision. If an existing item is changed, it will be either struck through "xxx" in the Material Key or appear in brackets "[xxxx]" in the Room Finish Schedule along with any revised information.

[illegible]

Room No.	Room Name	Floor	Base	Wall				Cabinetry			Ceiling	Notes	Revisions
				North	East	South	West	Top	Base	Wall			
A8054	STAIR 9	RT-1/ STR-1	RB-2	PA-9	PA-9	PA-9	PA-9	-	-	-	GWB		
EB1-08	STAIR 1	-	-	-	-	PA-9	PA-9	-	-	-	ACT-1/ GWB	9	
EB2-08	STAIR 2	-	-	PA-9	-	-	-	-	-	-	GWB	9	
EB3-08	STAIR 3	RT-1/ STR-1	RB-2	PA-9	PA-9	PA-9	PA-9	-	-	-	ACT-1		
EB3-09	STAIR 3	RT-1/ STR-1	RB-2	PA-9	PA-9	PA-9	PA-9	-	-	-	ACT-1		
ED7-08	STAIR 7	-	-	-	-	-	-	-	-	-	-	6	
ED8-08	STAIR 8	RT-1/ STR-1		PA-9	PA-9	PA-9	PA-9	-	-	-	ACT-1		

Room No.	Room Name	Floor	Base	Wall				Cabinetry			Ceiling	Notes	Revisions
				North	East	South	West	Top	Base	Wall			
A8001	IMAGING ALCOVE	SV-2	SV-2	PA-3	PA-3	PA-3	PA-3	SS-1	-	-	ACT-2	1	
A8002	CONSULT	CPT-1	RB-1	PA-1	WC-3	PA-1	PA-1	-	-	-	ACT-1/ GWB		
A8003	ICU EQUIP	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	
A8004	RN MGR	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8005	PUBLIC / STAFF TLT - FEMALE	PCT-2	PCT-1	PCT-1,4	PCT-1,4	PCT-1,4	PCT-1,4	SS-1	PL-1	-	GWB	2, 4	
A8006	RN MGR	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8007	PUBLIC / STAFF TLT - MALE	PCT-2	PCT-1	PCT-1,4	PCT-1,4	PCT-1,4	PCT-1,4	SS-1	PL-1	-	GWB	2, 4	
A8008	PHARMACIST	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8010	INTENS. OFFICE	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8011	CONFERENCE	CPT-1	RB-1	WC-3	PA-1	PA-1	PA-1		-	-	ACT-1/ GWB		
A8012	CLINICAL SPECIALIST	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8013	ELEC	SC	RB-2	PA-1	PA-1	PA-1	PA-1	-	-	-	EXP		
A8014	ANESTH. MD/RN OFFICE	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8015	HSKP	PCT-2	PCT-1	PCT-1	PCT-1	PCT-1	PCT-1	-	PL-1	SST	GWB	2	
A8016	ANESTHESIA ADMIN	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8017	OR VENDOR OFFICE	SV-1,2	SV-2	PA-1	PA-1	PA-1	PA-1		-	-	ACT-1	1, 10	
A8018	CHIEF ANESTH. OFFICE	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8019	MEN'S TOILETS	PCT-2	PCT-1	PCT-1,4	PCT-1,4	PCT-1,4	PCT-1,4	SS-1	PL-1	-	GWB	2, 4	

Room No.	Room Name	Floor	Base	Wall				Cabinetry			Ceiling	Notes	Revisions
				North	East	South	West	Top	Base	Wall			
A8020	ANESTH. MD OFFICE	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8021	VESTIBULE	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1	1	
A8022	ANESTH. MD OFFICE	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8024	ANESTH. MD OFFICE	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8026	VESTIBULE	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1	1	
A8027	MEN'S LOCKERS	SV-1,2	SV-2	PA-1	PA-1	PA-1	PA-1	SST	-	-	ACT-1	1	
A8028	CORRIDOR	SV-1,2	SV-2	PA-3	-	PA-3	PA-3	-	-	-	ACT-1	1	
A8028A	UTILITY CLOSET	SV-2	RB-2	PA-1	PA-1	PA-1	PA-1	-	-	-	EXP		
A8029	STERILE SUPPLY/ CLEAN STORAGE/ CART ASSEMBLY	RF-1,2,3,4	RF-2	PA-6	PA-6	PA-6	PA-6	SST	-	SST	GWB	1	
A8030	WOMEN'S LOCKERS	SV-1,2	SV-2	PA-1	PA-1	PA-1	PA-1	SST	-	-	ACT-1	1	
A8035	STERILIZERS	PA-7	RB-2	PA-8	PA-8	PA-8	PA-8	-	-	-	EXP		
A8036	WOMEN'S TOILETS	PCT-2	PCT-1	PCT-1,4	PCT-1,4	PCT-1,4	PCT-1,4	SS-1	PL-1	-	GWB	2, 4	
A8037	PREP/ PACK	RF-1,2,3,4	RF-2	PA-6	PA-6	PA-6	PA-6	SST	-	SST	GWB	1	
A8041	HSKP	PCT-2	PCT-1	PCT-1	PCT-1	PCT-1	PCT-1	-	PL-1	SST	GWB	2	
A8042	ANESTHESIA TRAINING	RF-1,2	RF-2	PA-1	PA-1	PA-1	PA-1	SS-1	PL-1	PL-1	ACT-1	1	
A8044	CORRIDOR	RF-1,2	RF-2	PA-3	PA-3	PA-3	-	-	-	-	ACT-1/ GWB	1	
A8046	OR EQUIP. STORAGE	RF-2	RF-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	
A8048	EDU/ CNL	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1		
A8050	OR SERV. COORD.	CPT-2	RB-1	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1	10	
A8052	ANESTH STORAGE	RF-2	RF-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	

Room No.	Room Name	Floor	Base	Wall				Cabinetry			Ceiling	Notes	Revisions
				North	East	South	West	Top	Base	Wall			
B8001	STAFF LOUNGE	SV-1,2	SV-2	PA-4	PA-1	PA-1	PA-4	SS-1	PL-1	PL-1	ACT-1	1	
B8002	PROT. ENVIRON. PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-1/ PCT-5	PA-1	PA-4	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8	
B8004	PROT. ENVIRON. PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-4	PA-1	PA-1/ PCT-5	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8	
B8005	FAMILY ROOM	CPT-2	RB-1	PA-5	WC-2	PA-5	PA-5	-	-	-	ACT-1		
B8006	CHARTING	SV-2	SV-2	PA-3	PA-3	-	PA-3	SS-1	-	-	GWB	1	
B8007	VISITOR/STAFF TOILET	PCT-2	PCT-1	PCT-1,4	PCT-1,4	PCT-1,4	PCT-1,4	-	-	-	GWB	2, 4	
B8008	BARIATRIC PROT. ENVIRON. PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-1/ PCT-5	PA-1	PA-4	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8	
B8009	NOURISHMENT	SV-1,2	SV-2	PA-1	PA-1	PA-1	PA-1	SS-1	PL-1	PL-1	ACT-2	1	
B8010	PROT. ENVIRON. PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-4	PA-1	PA-1/ PCT-5	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8	
B8012	CHARTING	SV-2	SV-2	PA-3	PA-3	-	PA-3	SS-1	-	-	GWB	1	
B8013	NURSE STATION	SV-1,2,3	SV-2	-	PA-3	PA-3	PA-3	-	-	-	ACT-1/ GWB	1	
B8014	PROT. ENVIRON. PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-1/ PCT-5	PA-1	PA-4	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8	
B8016	PROT. ENVIRON. PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-4	PA-1	PA-1/ PCT-5	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8	
B8018	CHARTING	SV-2	SV-2	PA-3	PA-3	-	PA-3	SS-1	-	-	GWB	1	
B8019	MED PREP ALCOVE	SV-2	SV-2	PA-3	PA-3	PA-1	PA-1	-	-	-	ACT-2	1	
B8020	PROT. ENVIRON. PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-1/ PCT-5	PA-1	PA-4	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8	

Room No.	Room Name	Floor	Base	Wall				Cabinetry			Ceiling	Notes	Revisions
				North	East	South	West	Top	Base	Wall			
B8021	MED PREP	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	SS-1	PL-1	PL-1	ACT-2	1	
B8022	PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-4	PA-1	PA-1/ PCT-5	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8, 11	
B8023	CLEAN UTILITY	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	
B8024	CHARTING	SV-2	SV-2	PA-3	PA-3	-	PA-3	SS-1	-	-	GWB	1	
B8025	EQUIPMENT	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	
B8026	NEG. ISOLATION PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-1/ PCT-5	PA-1	PA-4	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8	
B8027	CLEAN LINEN	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	
B8028	NEG. ISOLATION PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-4	PA-1	PA-1/ PCT-5	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8	
B8029	CONFERENCE/ REPORT	CPT-2	RB-1	WC-3	PA-1	PA-1	PA-1	SS-1	-	-	ACT-1		
B8030	CHARTING	SV-2	SV-2	PA-3	PA-3	-	PA-3	SS-1	-	-	GWB	1	
B8032	PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-1/ PCT-5	PA-1	PA-4	SS-2	PL-1	-	ACT-2/ GWB	1, 3, 5, 7, 8	
B8033	SOILED UTILITY	SV-2	SV-2	PCT-1	PCT-1	PCT-1	PCT-1	SS-1	-	PL-1	GWB	1	
B8034	PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-4	PA-1	PA-1/ PCT-5	SS-2	PL-1	-	ACT-2/ GWB	1, 3, 5, 7, 8	
B8035	ELEC.	SC	RB-2	PA-1	PA-1	PA-1	PA-1	-	-	-	EXP		
B8036	CHARTING	SV-2	SV-2	PA-3	PA-3	-	PA-3	SS-1	-	-	GWB	1	
B8037	FAMILY ROOM	CPT-2	RB-1	PA-5	PA-5	PA-5	WC-2	-	-	-	ACT-1		
B8038	PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-1/ PCT-5	PA-1	PA-4	SS-2	PL-1	-	ACT-2/ GWB	1, 3, 5, 7, 8	
B8039	VISITOR/STAFF TOILET	PCT-2	PCT-1	PCT-1,4	PCT-1,4	PCT-1,4	PCT-1,4	-	-	-	GWB	2, 4	
B8040	BARIATRIC PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-4	PA-1	PA-1/ PCT-5	SS-2	PL-1	-	ACT-2/ GWB	1, 3, 5, 7, 8	

Room No.	Room Name	Floor	Base	Wall				Cabinetry			Ceiling	Notes	Revisions
				North	East	South	West	Top	Base	Wall			
B8041	NOURISHMENT	SV-1,2	SV-2	PA-1	PA-1	PA-1	PA-1	SS-1	PL-1	PL-1	ACT-2	1	
B8042	CHARTING	SV-2	SV-2	PA-3	PA-3	-	PA-3	SS-1	-	-	GWB	1	
B8043	NURSE STATION	SV-1,2,3	SV-2	-	PA-3	PA-3	PA-3	-	-	-	ACT-1/ GWB	1	
B8044	PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-1/ PCT-5	PA-1	PA-4	SS-2	PL-1	-	ACT-2/ GWB	1, 3, 5, 7, 8	
B8046	NEG. ISOLATION PATIENT ROOM	SV-1,2	SV-2	PA-1/ PCT-5	PA-4	PA-1	PA-1/ PCT-5	SS-2	PL-1	-	ACT-3/ GWB	1, 3, 5, 7, 8	
B8048	CHARTING	SV-2	SV-2	PA-3	PA-3	-	PA-3	SS-1	-	-	GWB	1	
B8050	CORRIDOR	SV-1,2,3	SV-2	PA-3	PA-3	PA-3	PA-3	SS-1	PL-1	-	ACT-1/ GWB	1	
B8052	CORRIDOR	SV-1,2,3	SV-2	PA-3	PA-3	PA-3	PA-3	SS-1	PL-1	-	ACT-1/ GWB	1	
B8053	MED PREP ALCOVE	SV-2	SV-2	PA-3	PA-3	PA-1	PA-1	-	-	-	ACT-2	1	
B8054	RT/ IABP STORAGE	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	
B8055	MED PREP	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	SS-1	PL-1	PL-1	ACT-2	1	
B8056	ICU EQUIP. STORAGE	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	
B8057	CLEAN UTILITY	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	
B8058	GREETER	CPT-1/ SV-3	RB-1,2	WC-2	WC-2	-	-	-	-	-	ACT-1/ GWB		
B8059	EQUIPMENT	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	
B8060	FAMILY WAITING	CPT-1	RB-1	PA-5	PCT-3/ WC-2	WC-2/ PA-5	PCT-3/WC-2	-	-	-	ACT-1/ GWB		

Room No.	Room Name	Floor	Base	Wall				Cabinetry			Ceiling	Notes	Revisions
				North	East	South	West	Top	Base	Wall			
B8061	CLEAN LINEN	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-2	1	
B8062	LOCKERS/ NOURISH	SV-1	RB-2	PA-5	-	WC-2	PCT-3	SS-1	PL-1	-	ACT-1/ GWB		
B8063	HSKP	-	-	-	-	-	-	-	-	-	-	6	
B8064	DUMBWAITER	SV-2	SV-2	PA-1	PA-1	PA-1	PA-1	-	-	-	ACT-1	1	
B8065	MECHANICAL	-	-	-	-	-	-	-	-	-	-	6	
B8066	ELEVATOR LOBBY	SV-1,2,3	SV-2	WC-2/ PA-3		WC-1/ PA-3	PA-3	-	-	-	ACT-1/ GWB	1	
B8067	MED GAS STORAGE	-	-	-	-	-	-	-	-	-	-	6	
B8069	CORRIDOR	SV-1,2	SV-2	-	WC-1/ PA-3	PA-3	PA-3	-	-	-	ACT-1/ GWB	1	
B8071	MECHANICAL	-	-	-	-	-	-	-	-	-	-	6	
B8073	DATA	SC	RB-2	PA-1	PA-1	PA-1	PA-1	-	-	-	EXP		

Room No.	Room Name	Floor	Base	Wall				Cabinetry			Ceiling	Notes	Revisions
				North	East	South	West	Top	Base	Wall			
D8013	CLEAN INST HOLDING	RF-2	RF-2	PA-1	PA-1	PA-1	PA-1	SST	-	-	ACT-3	1	
D8015	DECONTAMINATION	RF-1,2,3,4	RF-2	PA-6	PA-6	PA-6	PA-6	-	-	SST	GWB	1	
D8016	MECHANICAL	EXP	EXP	EXP	PA-8	PA-8	PA-8	-	-	-	EXP		
D8016A	MANIFOLD	EXP	EXP	PA-8	PA-8	PA-8	PA-8	-	-	-	EXP		1
D8019	ANTEROOM	RF-2	RF-2	PA-1	PA-1	PA-1	PA-1	-	PL-1	-	GWB	1	
D8020	CORRIDOR	RF-1,2	RF-2	PA-3	PA-3	PA-3	PA-3	-	-	-	ACT-1	1	
D8021	TOILET/ SHOWER	PCT-2	PCT-1	PCT-1	PCT-1	PCT-1	PCT-1	-	-	-	GWB	2	
D8023	CART WASHER	PA-7	RB-2	PA-8	PA-8	PA-8	PA-8	-	-	-	EXP		
D8025	CLEAN CART HOLDING	RF-2	RF-2	PA-1	PA-1	PA-1	PA-1	-	-	-	GWB	1	
D8028	CORRIDOR	RF-1,2	RF-2	PA-3	PA-3	PA-3	PA-3	-	-	-	ACT-1	1	
D8030	STORAGE	RF-2	RB-2	EXP	PA-1	PA-1	PA-1	-	-	-	EXP		
D8035	MECH	PA-7	RB-2	PA-8	PA-8	PA-8	PA-8	-	-	-	EXP		
ED8201	MECHANICAL	-	-	-	-	-	-	-	-	-	-	6	
ED8202	MECHANICAL	-	-	-	-	-	-	-	-	-	-	6	
ED8203A	TELEPHONE	-	-	-	-	-	-	-	-	-	-	6	
ED8203B	ELEC	-	-	-	-	-	-	-	-	-	-	6	
ED8205	CORRIDOR	RF-1,2	RF-1	PA-3	PA-3	PA-3	PA-3	-	-	-	ACT-1	1	
ED8208		-	-	-	-	-	-	-	-	-	-	6	
ED8209	CLEAN CART LIFT/ STAGING	-	-	-	-	-	-	-	-	-	-	6	

SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide (a) direct-digital control system(s) as indicated on the project documents, point list, interoperability tables, drawings, and as described in these specifications. Include a complete and working direct-digital control system. Include all engineering, programming, controls and installation materials, installation labor, commissioning and start-up, training, final project documentation and warranty. Work related to this section shall be the responsibility of the Systems Integrator and the Controls Contractor.
- B. The responsibilities of the Control System Integrator shall be comprised of Network Area Controller's (NAC) connected to the telecommunication network as well as networking software and work associated with integration of new control panels to the NAC' s. System will be integrated into the existing Virtual Server provided by the VA IT Department. Tridium Niagara AX network platform has been sole sourced for implementation.
- C. Controls contractor shall be responsible for the remaining scope of the work as outlined in the specifications and on the drawings.
 - 1. The direct-digital control system(s) shall be native BACnet. All controllers, devices and components shall be listed by BACnet Testing Laboratories. All controller, devices and components shall be accessible using a Web browser interface and shall communicate exclusively using the ASHRAE Standard 135 BACnet communications protocol without the use of gateways, unless otherwise allowed by this Section of the technical specifications, specifically shown on the design drawings and specifically requested otherwise by the VA.
 - 2. The work administered by this Section of the technical specifications shall include all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, warranty, specified services and items required for complete and fully functional Controls Systems.

3. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The contractor administered by this Section of the technical specifications shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the ECC shall have no effect on the field controllers, including those involved with global strategies.
4. The control system shall accommodate:
 - a. 1 Engineering Control Center(s) and the control system shall accommodate
 - b. 5 web-based Users simultaneously, and the access to the system should be limited with security privileges as specified by the VA.
- D. Some products are furnished but not installed by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the installation of the products. These products could include the following:
 1. Control valves.
 2. Flow switches.
 3. Flow meters.
 4. Sensor wells and sockets in piping.
- E. Some products are installed but not furnished by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the procurement of the products. These products could include the following:
 1. Factory-furnished accessory thermostats and sensors furnished with unitary equipment.
- F. Leave existing direct-digital control system intact and in place. Provide a new ASHRAE Standard 135 BACnet-compliant ECC in the same room as the existing system's ECC, and provide a new standalone BACnet-compliant control system serving the work in this project. No interoperability is required.

- G. This campus will be standardized on standard ASHRAE Standard 135, BACnet/IP Control System supported by a preselected controls service company. This entity is referred to as the "Control System Integrator" in this Section of the technical specifications. The Control System integrator is responsible for ECC system graphics and expansion. It also prescribes control system-specific commissioning/ verification procedures to the Control Contractor administered by this Section of the technical specification. It lastly provides limited assistance to the Control Contractor administered by this Section of the technical specification in its commissioning/verification work.
- H. The General Contractor of this project shall directly hire the Control System Integrator in a contract separate from the contract procuring the controls contractor administered by this Section of the technical specifications.
- I. The Control Contractor administered by this Section of the technical specifications shall coordinate all work with the Control System Integrator. The contractor administered by this Section of the technical specifications shall integrate the ASHRAE Standard 135, BACnet/IP control network(s) with the Control System Integrator's area control through an Ethernet connection provided by the Control System Integrator.
- J. The Control Contractor administered by this Section of the technical specifications shall provide a peer-to-peer networked, stand-alone, distributed control system. This direct digital control (DDC) system shall include one portable operator terminal - laptop, one digital display unit, microprocessor-based controllers, instrumentation, end control devices, wiring, piping, software, and related systems. This contractor is responsible for all device mounting and wiring.

Responsibility Table:

Item/Task	Control Contractor	Control System Integrator	VA
ECC expansion		X	
ECC programming		X	
Devices, controllers, control panels and equipment	X		
Point addressing: all hardware and software points including setpoint, calculated point, data point (analog/ binary), and reset schedule point	X		
Point mapping		X	
Network Programming	X		
ECC Graphics		X	
Controller programming and sequences	X		

Item/Task	Control Contractor	Control System Integrator	VA
Integrity of LAN communications		X	
Electrical wiring	X		
Operator system training	X	X	
LAN connections to devices	X		
LAN connections to ECC		X	
IP addresses			X
Overall system verification		X	
Controller and LAN system verification	X	X	

- K. The direct-digital control system shall start and stop equipment, move (position) damper actuators and valve actuators, and vary speed of equipment to execute the mission of the control system. Use electricity as the motive force for all damper and valve actuators.

1.2 RELATED WORK

- A. Section 23 21 13, Hydronic Piping.
- B. Section 23 22 13, Steam and Condensate Heating Piping.
- C. Section 23 31 00, HVAC Ducts and Casings.
- D. Section 23 36 00, Air Terminal Units.
- E. Section 23 73 00, Indoor Central-Station Air-Handling Units.
- F. Section 26 05 11, Requirements for Electrical Installations.
- G. Section 26 05 21, Low-Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- H. Section 26 05 26, Grounding and Bonding for Electrical Systems.
- I. Section 26 05 33, Raceway and Boxes for Electrical Systems.
- J. Section 26 27 26, Wiring Devices.
- K. Section 28 31 00, Fire Detection and Alarm.

1.3 DEFINITION

- A. Algorithm: A logical procedure for solving a recurrent mathematical problem; A prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps.
- B. ARCNET: ANSI/ATA 878.1 - Attached Resource Computer Network. ARCNET is a deterministic LAN technology; meaning it's possible to determine the maximum delay before a device is able to transmit a message.
- C. Analog: A continuously varying signal value (e.g., temperature, current, velocity etc).

- D. BACnet: A Data Communication Protocol for Building Automation and Control Networks , ANSI/ASHRAE Standard 135. This communications protocol allows diverse building automation devices to communicate data over and services over a network.
- E. BACnet/IP: Annex J of Standard 135. It defines and allows for using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP sub-networks that share the same BACnet network number.
- F. BACnet Internetwork: Two or more BACnet networks connected with routers. The two networks may sue different LAN technologies.
- G. BACnet Network: One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.
- H. BACnet Segment: One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.
- I. BACnet Broadcast Management Device (BBMD) : A communications device which broadcasts BACnet messages to all BACnet/IP devices and other BBMDs connected to the same BACnet/IP network.
- J. BACnet Interoperability Building Blocks (BIBBs) : BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. These are prescribed in terms of an "A" and a "B" device. Both of these devices are nodes on a BACnet internetwork.
- K. BACnet Testing Laboratories (BTL) : The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.
- L. Baud: It is a signal change in a communication link. One signal change can represent one or more bits of information depending on type of transmission scheme. Simple peripheral communication is normally one bit per Baud. (e.g., Baud rate = 78,000 Baud/sec is 78,000 bits/sec, if one signal change = 1 bit).
- M. Binary: A two-state system where a high signal level represents an "ON" condition and an "OFF" condition is represented by a low signal level.
- N. BMP or bmp: Suffix, computerized image file, used after the period in a DOS-based computer file to show that the file is an image stored as a series of pixels.
- O. Bus Topology: A network topology that physically interconnects workstations and network devices in parallel on a network segment.

- P. Control Unit (CU) : Generic term for any controlling unit, stand-alone, microprocessor based, digital controller residing on secondary LAN or Primary LAN, used for local controls or global controls
- Q. Deadband: A temperature range over which no heating or cooling is supplied, i.e., 22-25 degrees C (72-78 degrees F), as opposed to a single point change over or overlap).
- R. Device: a control system component that contains a BACnet Device Object and uses BACnet to communicate with other devices.
- S. Device Object: Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.
- T. Device Profile: A specific group of services describing BACnet capabilities of a device, as defined in ASHRAE Standard 135-2008, Annex L. Standard device profiles include BACnet Operator Workstations (BOWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS) . Each device used in new construction is required to have a PICS statement listing which service and BIBBs are supported by the device.
- U. Diagnostic Program: A software test program, which is used to detect and report system or peripheral malfunctions and failures. Generally, this system is performed at the initial startup of the system.
- V. Direct Digital Control (DDC) : Microprocessor based control including Analog/Digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices in order to achieve a set of predefined conditions.
- W. Distributed Control System: A system in which the processing of system data is decentralized and control decisions can and are made at the subsystem level. System operational programs and information are provided to the remote subsystems and status is reported back to the Engineering Control Center. Upon the loss of communication with the Engineering Control center, the subsystems shall be capable of operating in a stand-alone mode using the last best available data.

- X. Download: The electronic transfer of programs and data files from a central computer or operation workstation with secondary memory devices to remote computers in a network (distributed) system.
- Y. DXF: An AutoCAD 2-D graphics file format. Many CAD systems import and export the DXF format for graphics interchange.
- Z. Electrical Control: A control circuit that operates on line or low voltage and uses a mechanical means, such as a temperature sensitive bimetal or bellows, to perform control functions, such as actuating a switch or positioning a potentiometer.
- AA. Electronic Control: A control circuit that operates on low voltage and uses a solid-state components to amplify input signals and perform control functions, such as operating a relay or providing an output signal to position an actuator.
- BB. Engineering Control Center (ECC) : The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.
- CC. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.
- DD. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.
- EE. Gateway: Communication hardware connecting two or more different protocols. It translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.
- FF. GIF: Abbreviation of Graphic interchange format.
- GG. Graphic Program (GP) : Program used to produce images of air handler systems, fans, chillers, pumps, and building spaces. These images can be animated and/or color-coded to indicate operation of the equipment.
- HH. Graphic Sequence of Operation: It is a graphical representation of the sequence of operation, showing all inputs and output logical blocks.
- II. I/O Unit: The section of a digital control system through which information is received and transmitted. I/O refers to analog input (AI), digital input (DI), analog output (AO) and digital output (DO).

Analog signals are continuous and represent temperature, pressure, flow rate etc, whereas digital signals convert electronic signals to digital pulses (values), represent motor status, filter status, on-off equipment etc.

- JJ. I/P: a method for conveying and routing packets of information over LAN paths. User Datagram Protocol (UDP) conveys information to "sockets" without confirmation of receipt. Transmission Control Protocol (TCP) establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.
- KK. JPEG: A standardized image compression mechanism stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard.
- LL. Local Area Network (LAN) : A communication bus that interconnects operator workstation and digital controllers for peer-to-peer communications, sharing resources and exchanging information.
- MM. Network Repeater: A device that receives data packet from one network and rebroadcasts to another network. No routing information is added to the protocol.
- NN. MS/TP: Master-slave/token-passing (ISO/IEC 8802, Part 3). It is not an acceptable LAN option for VA health-care facilities. It uses twisted- pair wiring for relatively low speed and low cost communication.
- OO. Native BACnet Device: A device that uses BACnet as its primary method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.
- PP. Network Number: A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.
- QQ. Object: The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.
- RR. Object Identifier: An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.
- SS. Object Properties: Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object

properties.

- TT. Operating system (OS) : Software, which controls the execution of computer application programs.
- UU. PCX: File type for an image file. When photographs are scanned onto a personal computer they can be saved as PCX files and viewed or changed by a special application program as Photo Shop.
- VV. Peripheral: Different components that make the control system function as one unit. Peripherals include monitor, printer, and I/O unit.
- WW. Peer-to-Peer: A networking architecture that treats all network stations as equal partners- any device can initiate and respond to communication with other devices.
- XX. PICS: Protocol Implementation Conformance Statement, describing the BACnet capabilities of a device. All BACnet devices have published PICS.
- YY. PID: Proportional, integral, and derivative control, used to control modulating equipment to maintain a setpoint.
- ZZ. Repeater: A network component that connects two or more physical segments at the physical layer.
- AAA. Router: A component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.
- BBB. Sensors: Devices measuring state points or flows, which are then transmitted back to the DDC system.
- CCC. Thermostats: Devices measuring temperatures, which are used in control of standalone or unitary systems and equipment not attached to the DDC system.

1.4 QUALITY ASSURANCE

A. Criteria:

1. Single Source Responsibility of subcontractor: The Contractor shall obtain hardware and software supplied under this Section and delegate the responsibility to a single source controls installation subcontractor. The controls subcontractor shall be responsible for the complete design, installation, and commissioning of the system. The controls subcontractor shall be in the business of design, installation and service of such building automation control systems similar in size and complexity.

2. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.
3. The controls subcontractor shall provide a list of no less than five similar projects which have building control systems as specified in this Section. These projects must be on-line and functional such that the Department of Veterans Affairs (VA) representative would observe the control systems in full operation.
4. The controls subcontractor shall have in-place facility within 50 miles with technical staff, spare parts inventory for the next five (5) years, and necessary test and diagnostic equipment to support the control systems.
5. The controls subcontractor shall have minimum of three years experience in design and installation of building automation systems similar in performance to those specified in this Section. Provide evidence of experience by submitting resumes of the project manager, the local branch manager, project engineer, the application engineering staff, and the electronic technicians who would be involved with the supervision, the engineering, and the installation of the control systems. Training and experience of these personnel shall not be less than three years. Failure to disclose this information will be a ground for disqualification of the supplier.
6. Provide a competent and experienced Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Contractor employees in order to provide professional engineering, technical and management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor.

B. Codes and Standards:

1. All work shall conform to the applicable Codes and Standards.
2. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.

1.5 PERFORMANCE

- A. The system shall conform to the following:

1. Graphic Display: The system shall display up to four (4) graphics on a single screen with a minimum of twenty (20) dynamic points per graphic. All current data shall be displayed within ten (10) seconds of the request.
2. Graphic Refresh: The system shall update all dynamic points with current data within eight (8) seconds. Data refresh shall be automatic, without operator intervention.
3. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be two (2) seconds. Analog objects shall start to adjust within two (2) seconds.
4. Object Scan: All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or work-station will be current, within the prior six (6) seconds.
5. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed (10) seconds.
6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every (5) seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. Multiple Alarm Annunciations: All workstations on the network shall receive alarms within five (5) seconds of each other.
8. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every one (1) second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
9. Reporting Accuracy: Listed below are minimum acceptable reporting end-to-end accuracies for all values reported by the specified system:

Measured Variable	Reported Accuracy
Ducted air temperature	± 0.5 C _±
Outdoor air temperature	± 1.0 C _±
Dew Point	± 1.5 C _±
Water temperature	± 0.5 C _±

Measured Variable	Reported Accuracy
Relative humidity	±2% RH
Air flow (measuring stations)	±5% of reading
Air pressure(ducts)	±25Pa [±0.1"w.c.]

Note 1: for both absolute and differential pressure

10. Control stability and accuracy: Control sequences shall maintain measured variable at setpoint within the following tolerances:

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 in. w.g.)	0-1.5 kPa (0-6 in. w.g.)
Airflow	±10% of full scale	
Duct Temperature	±1.5°C (±3°F)	
Humidity	±5% RH	

11. Extent of direct digital control: control design shall allow for at least the points indicated on the points lists on the drawings.

1.6 WARRANTY

- A. Labor and materials for control systems shall be warranted for a period as specified under Warranty in FAR clause 52.246-21.
- B. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no cost or reduction in service to the owner. The system includes all computer equipment, transmission equipment, and all sensors and control devices.
- C. The on-line support service shall allow the Controls supplier to dial out over telephone lines to or connect via (through password-limited access) VPN through the internet monitor and control the facility's building automation system. This remote connection to the facility shall be within two (2) hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekend and holidays. If the problem cannot be resolved with on-line support services, the Controls supplier shall dispatch the qualified personnel to the job site to resolve the problem within 24 hours after the problem is reported.
- D. Controls and Instrumentation subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final commissioning, training of facility operators and acceptance of the project by VA.

1.7 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's literature and data for all components including the following:

1. A wiring diagram for each type of input device and output device including DDC controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, including but not limited to, control relays, motor starters, electric or electronic actuators, and temperature pressure, flow and humidity sensors and transmitters.
2. A diagram of each terminal strip, including digital controller terminal strips, terminal strip location, termination numbers and the associated point names.
3. Control dampers and control valves schedule, including the size and pressure drop.
4. Catalog cut sheets of all equipment used. This includes, but is not limited to software (by manufacturer and by third parties), DDC controllers, panels, peripherals, airflow measuring stations and associated components, and auxiliary control devices such as sensors, actuators, and control dampers. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted. Each submitted piece of literature and drawings should clearly reference the specification and/or drawings that it supposed to represent.
5. Sequence of operations for each HVAC system and the associated control diagrams. Equipment and control labels shall correspond to those shown on the drawings.
6. Color prints of proposed graphics with a list of points for display.
7. Furnish a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet-compliant device.
8. Schematic wiring diagrams for all control, communication and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
9. An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number,

and product data sheet number.

10. Riser diagrams of wiring between central control unit and all control panels.
11. Scaled plan drawings showing routing of LAN and locations of control panels, controllers, routers, gateways, ECC, and larger controlled devices.
12. Construction details for all installed conduit, cabling, raceway, cabinets, and similar. Construction details of all penetrations and their protection.
13. Quantities of submitted items may be reviewed but are the responsibility of the contractor administered by this Section of the technical specifications.

C. Product Certificates: Compliance with Article, QUALITY ASSURANCE.

D. Licenses: Provide licenses for all software residing on and used by the Controls Systems and transfer these licenses to the Owner prior to completion.

E. As Built Control Drawings:

1. Furnish three (3) copies of as-built drawings for each control system. The documents shall be submitted for approval prior to final completion.
2. Furnish one (1) stick set of applicable control system prints for each mechanical system for wall mounting. The documents shall be submitted for approval prior to final completion.
3. Furnish one (1) CD-ROM in CAD DWG and/or .DXF format for the drawings noted in subparagraphs above.

F. Operation and Maintenance (O/M) Manuals):

1. Submit in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS.
2. Include the following documentation:
 - a. General description and specifications for all components, including logging on/off, alarm handling, producing trend reports, overriding computer control, and changing set points and other variables.

- b. Detailed illustrations of all the control systems specified for ease of maintenance and repair/replacement procedures, and complete calibration procedures.
 - c. One copy of the final version of all software provided including operating systems, programming language, operator workstation software, and graphics software.
 - d. Complete troubleshooting procedures and guidelines for all systems.
 - e. Complete operating instructions for all systems.
 - f. Recommended preventive maintenance procedures for all system components including a schedule of tasks for inspection, cleaning and calibration. Provide a list of recommended spare parts needed to minimize downtime.
 - g. Training Manuals: Submit the course outline and training material to the Owner for approval three (3) weeks prior to the training to VA facility personnel. These persons will be responsible for maintaining and the operation of the control systems, including programming. The Owner reserves the right to modify any or all of the course outline and training material.
 - h. Licenses, guaranty, and other pertaining documents for all equipment and systems.
- G. Submit Performance Report to Resident Engineer prior to final inspection.

1.8 INSTRUCTIONS

- A. Instructions to VA operations personnel: Perform in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS, and as noted below.
- 1. First Phase shall be completed by Controls Contractor: Formal instructions to the VA facilities personnel for a total of 16 hours, given in multiple training sessions (each no longer than four hours in length), conducted sometime between the completed installation and prior to the performance test period of the control system, at a time mutually agreeable to the Contractor and the VA.
 - 2. Second Phase shall be completed by Control System Integrator: This phase of training shall comprise of on the job training during start-up, checkout period, and performance test period. VA facilities personnel will work with the Contractor's installation and test personnel on a daily basis during start-up and checkout period. During the performance test period, controls subcontractor

will provide 16 hours of instructions, given in multiple training sessions (each no longer than four hours in length), to the VA facilities personnel.

- B. The O/M Manuals shall contain approved submittals as outlined in Article 1.7, SUBMITTALS. The Controls subcontractor will review the manual contents with VA facilities personnel during second phase of training.
- C. Training shall be given by direct employees of the subcontractor.

1.9 PROJECT CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)

- A. The ECC and peripheral devices and system support equipment shall be designed to operate in ambient condition of 20 to 35 C (65 to 90 F) at a relative humidity of 20 to 80% non-condensing.
- B. The CUs used outdoors shall be mounted in NEMA 4 waterproof enclosures, and shall be rated for operation at -40 to 65 C (-40 to 150 F).
- C. All electronic equipment shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.
- D. Sensors and controlling devices shall be designed to operate in the environment, which they are sensing or controlling.

1.10 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
 - Standard 135-10.....BACNET Building Automation and Control Networks
- C. American Society of Mechanical Engineers (ASME):
 - B16.18-01..... Cast Copper Alloy Solder Joint Pressure Fittings.
 - B16.22-01.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. American Society of Testing Materials (ASTM):
 - B32-08..... Standard Specification for Solder Metal
 - B88-09.....Standard Specifications for Seamless Copper Water Tube
 - B88M-09..... Standard Specification for Seamless Copper Water Tube (Metric)
 - B280-08.....Standard Specification for Seamless Copper Tube for Air-Conditioning and Refrigeration Field Service
 - D2737-03.....Standard Specification for Polyethylene (PE) Plastic Tubing

- E. Federal Communication Commission (FCC):
Rules and Regulations Title 47 Chapter 1-2001 Part 15: Radio Frequency Devices.
- F. Institute of Electrical and Electronic Engineers (IEEE):
802 .3-11Information Technology-Telecommunications and Information Exchange between Systems-Local and Metropolitan Area Networks- Specific Requirements-Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access method and Physical Layer Specifications
- G. National Fire Protection Association (NFPA):
70-11 National Electric Code
90A-09 Standard for Installation of Air-Conditioning and Ventilation Systems
- H. Underwriter Laboratories Inc (UL):
94-10Tests for Flammability of Plastic Materials for Parts and Devices and Appliances
294-10 Access Control System Units
486A/486B-10 Wire Connectors
555S-11 Standard for Smoke Dampers
916-10 Energy Management Equipment
1076-10 Proprietary Burglar Alarm Units and Systems

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Spare parts shall be available for at least five years after completion of this contract.

2.2 CONTROLS SYSTEM ARCHITECTURE

- A. General
 - 1. The Controls Systems shall consist of multiple Nodes and associated equipment connected by industry standard digital and communication network arrangements.
 - 2. The building controllers and principal communications network equipment shall be standard products of recognized major manufacturers available through normal PC and computer vendor channels - not "Clones" assembled by a third-party subcontractor.
 - 3. The networks shall, at minimum, comprise, as necessary, the following:
 - a. Network computer processing, data storage and BACnet-compliant communication equipment including Servers and digital data

processors.

- b. BACnet-compliant routers, bridges, switches, hubs, modems, gateways, interfaces and similar communication equipment.
- c. Active processing BACnet-compliant building controllers connected to other BACnet-compliant controllers together with their power supplies and associated equipment.
- d. Addressable elements, sensors, transducers and end devices.
- e. Third-party equipment interfaces and gateways as described and required by the Contract Documents.
- f. Other components required for a complete and working Control Systems as specified.

B. The Specifications for the individual elements and component subsystems shall be minimum requirements and shall be augmented as necessary by the Contractor to achieve both compliance with all applicable codes, standards and to meet all requirements of the Contract Documents.

C. Network Architecture

- 1. The Controls communication network shall utilize BACnet communications protocol operating over a standard Ethernet LAN and operate at a minimum speed of 100 Mb/sec.
- 2. The networks shall utilize only copper and optical fiber communication media as appropriate and shall comply with applicable codes, ordinances and regulations
- 3. All necessary telephone lines, ISDN lines and internet Service Provider services and connections will be provided by the VA.

D. Third Party Interfaces:

- 1. The Controls Contractor administered by this Section of the technical specifications shall include necessary hardware, equipment, software and programming to allow data communications between the controls system interface and building systems supplied by the Control System Integrator.
- 2. Other manufacturers and contractors supplying other associated systems and equipment shall provide their necessary hardware, software and start-up at their cost and shall cooperate fully with the contractor administered by this Section of the technical specifications in a timely manner and at their cost to ensure complete functional integration.

E. Servers:

1. Existing VA servers shall be utilized with the VA providing a virtual server for the building automation system interface software. VA shall provide data storage server(s) to archive historical data including trends, alarm and event histories and transaction logs. Control Systems Integrator shall coordinate with VA to access size of storage requirements.
2. Equip these server(s) with sole source Tridium Niagara AX network integration platform.
3. Access to all information on the data storage server(s) shall be through the same browser functionality used to access individual nodes. When logged onto a server the operator will be able to also interact with any other controller on the control system as required for the functional operation of the controls systems.
4. These server(s) shall be utilized for controls systems application configuration, for archiving, reporting and trending of data, for operator transaction archiving and reporting, for network information management, for alarm annunciation, for operator interface tasks, for controls application management and similar. These server(s) shall utilize IT industry standard data base platforms which utilize a database declarative language designed for managing data in relational database management systems (RDBMS) such as SQL.

2.3 COMMUNICATION

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135-2008, BACnet.
 1. The Data link / physical layer protocol (for communication) acceptable to the VA throughout its facilities is Ethernet (ISO 8802-3) and BACnet/IP.
 2. The MS/TP data link / physical layer protocol is not acceptable to the VA in any new BACnet network or sub-network in its healthcare or lab facilities.
- B. Each controller shall have a communication port for connection to an operator interface.
- C. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, reports, system software, and custom programs shall be viewable and editable from each internetwork controller.
 2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified control system operation. An authorized operator shall be able to edit cross-controller links by typing a standard object address.
- D. System shall be expandable to accommodate the campus mechanical system components.
- E. ECCs and Controllers with real-time clocks shall use the BACnet Time Synchronization service. The system shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight savings and standard time as applicable.

2.4 ENGINEERING CONTROL CENTER (ECC)

- A. The ECC shall reside on a high-speed network with controllers as shown on system drawings. The ECC and each standard browser connected to server shall be able to access all system information Re-use existing VA Workstation.
- B. ECC and controllers shall communicate using BACnet protocol. ECC and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ASHRAE/ANSI 135-2008, BACnet Annex J.
- C. ECC Software:
1. Provide for automatic system database save and restore on the ECC' s hard disk a copy of the current database of each Controller. This database shall be updated whenever a change is made in any system panel. In the event of a database loss in a building management panel, the ECC shall automatically restore the database for that panel. This capability may be disabled by the operator.
 2. Provide for manual database save and restore. An operator with proper clearance shall be able to save the database from any system panel. The operator also shall be able to clear a panel database and manually initiate a download of a specified database to any panel in

the system.

3. Provide a method of configuring the system. This shall allow for future system changes or additions by users with proper clearance.
4. Operating System. Furnish a concurrent multi-tasking operating system. The operating system also shall support the use of other common software applications. Acceptable operating systems are Windows XP, Windows System 7, Linux, and UNIX.
5. System Graphics. The operator workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.
6. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in industry standard formats such as PCX, TIFF, and GEM. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Designer or AutoCAD.
7. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.
8. The Controls Systems Operator Interfaces shall be user friendly, readily understood and shall make maximum use of colors, graphics, icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the displays by authorized users at the ECC. The operating system shall be Windows XP or better, and shall support the third party software.

9. Provide graphical user software, which shall minimize the use of keyboard through the use of the mouse and "point and click" approach to menu selection.
10. The software shall provide a multi-tasking type environment that will allow the user to run several applications simultaneously. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able automatically export data to and work in Microsoft Word, Excel, and other Windows based software programs, while concurrently on-line system alarms and monitoring information.
11. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
12. User access shall be protected by a flexible and Owner re-definable software-based password access protection. Password protection shall be multi-level and partition able to accommodate the varied access requirements of the different user groups to which individual users may be assigned. Provide the means to define unique access privileges for each individual authorized user. Provide the means to on-line manage password access control under the control of a project specific Master Password. Provide an audit trail of all user activity on the Controls Systems including all actions and changes.
13. The system shall be completely field-programmable from the common operator's keyboard thus allowing hard disk storage of all data automatically. All programs for the CUs shall be able to be downloaded from the hard disk. The software shall provide the following functionality as a minimum:
 - a. Point database editing, storage and downloading of controller databases.
 - b. Scheduling and override of building environmental control systems.
 - c. Collection and analysis of historical data.
 - d. Alarm reporting, routing, messaging, and acknowledgement.
 - e. Definition and construction of dynamic color graphic displays.
 - f. Real-time graphical viewing and control of environment.

- g. Scheduling trend reports.
 - h. Program editing.
 - i. Operating activity log and system security.
 - j. Transfer data to third party software.
14. Provide functionality such that using the least amount of steps to initiate the desired event may perform any of the following simultaneously:
- a. Dynamic color graphics and graphic control.
 - b. Alarm management.
 - c. Event scheduling.
 - d. Dynamic trend definition and presentation.
 - e. Program and database editing.
 - f. Each operator shall be required to log on to the system with a user name and password to view, edit or delete the data. System security shall be selectable for each operator, and the password shall be able to restrict the operator's access for viewing and changing the system programs. Each operator shall automatically be logged off the system if no keyboard or mouse activity is detected for a selected time.
15. Graphic Displays:
- a. The workstation shall allow the operator to access various system schematics and floor plans via a graphical penetration scheme, menu selection, or text based commands. Graphic software shall permit the importing of AutoCAD or scanned pictures in the industry standard format (such as PCX, BMP, GIF, and JPEG) for use in the system.
 - b. System Graphics shall be project specific and schematically correct for each system. (ie: coils, fans, dampers located per equipment supplied with project.) Standard system graphics that do not match equipment or system configurations are not acceptable. Operator shall have capability to manually operate the entire system from each graphic screen at the ECC. Each system graphic shall include a button/tab to a display of the applicable sequence of operation.
 - c. Dynamic temperature values, humidity values, flow rates, and status indication shall be shown in their locations and shall automatically update to represent current conditions without

operator intervention and without pre-defined screen refresh values.

- d. Color shall be used to indicate status and change in status of the equipment. The state colors shall be user definable.
 - e. A clipart library of HVAC equipment, such as chillers, boilers, air handling units, fans, terminal units, pumps, coils, standard ductwork, piping, valves and laboratory symbols shall be provided in the system. The operator shall have the ability to add custom symbols to the clipart library.
 - f. A dynamic display of the site-specific architecture showing status of the controllers, the ECC and network shall be provided.
 - g. The windowing environment of the workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of graphic associated with an alarm to be viewed without interrupting work in progress. The graphic system software shall also have the capability to split screen, half portion of the screen with graphical representation and the other half with sequence of operation of the same HVAC system.
16. Trend reports shall be generated on demand or pre-defined schedule and directed to monitor display, printers or disk. As a minimum, the system shall allow the operator to easily obtain the following types of reports:
- a. A general list of all selected points in the network.
 - b. List of all points in the alarm.
 - c. List of all points in the override status.
 - d. List of all disabled points.
 - e. List of all points currently locked out.
 - f. List of user accounts and password access levels.
 - g. List of weekly schedules.
 - h. List of holiday programming.
 - i. List of limits and dead bands.
 - j. Custom reports.
 - k. System diagnostic reports, including, list of digital controllers on the network.
 - l. List of programs.

17. Scheduling and Override:

- a. Provide override access through menu selection from the graphical interface and through a function key.
- b. Provide a calendar type format for time-of-day scheduling and overrides of building control systems. Schedules reside in the ECC. The digital controllers shall ensure equipment time scheduling when the ECC is off-line. The ECC shall not be required to execute time scheduling. Provide the following spreadsheet graphics as a minimum:
 - 1) Weekly schedules.
 - 2) Zone schedules, minimum of 100 zones.
 - 3) Scheduling up to 365 days in advance.
 - 4) Scheduled reports to print at workstation.

18. Collection and Analysis of Historical Data:

- a. Provide trending capabilities that will allow the operator to monitor and store records of system activity over an extended period of time. Points may be trended automatically on time based intervals or change of value, both of which shall be user definable. The trend interval could be five (5) minutes to 120 hours. Trend data may be stored on hard disk for future diagnostic and reporting. Additionally trend data may be archived to network drives or removable disk media for off-site retrieval.
- b. Reports may be customized to include individual points or predefined groups of at least six points. Provide additional functionality to allow pre-defined groups of up to 250 trended points to be easily accessible by other industry standard word processing and spreadsheet packages. The reports shall be time and date stamped and shall contain a report title and the name of the facility.
- c. System shall have the set up to generate spreadsheet reports to track energy usage and cost based on weekly or monthly interval, equipment run times, equipment efficiency, and/or building environmental conditions.
- d. Provide additional functionality that will allow the operator to view real time trend data on trend graph displays. A minimum of 20 points may be graphed regardless of whether they have been predefined for trending. In addition, the user may pause the graph and take snapshots of the screens to be stored on the workstation disk for future reference and trend analysis. Exact

point values may be viewed and the graph may be printed. Operator shall be able to command points directly on the trend plot by double clicking on the point.

19. Alarm Management:

- a. Alarm routing shall allow the operator to send alarm notification to selected printers or operator workstation based on time of day, alarm severity, or point type.
- b. Alarm notification shall be provided via two alarm icons, to distinguish between routine, maintenance type alarms and critical alarms. The critical alarms shall display on the screen at the time of its occurrence, while others shall display by clicking on their icon.
- c. Alarm display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message in English language. The operator shall be able to sort out the alarms.
- d. Alarm messages shall be customized for each point to display detailed instructions to the operator regarding actions to take in the event of an alarm.
- e. An operator with proper security level access may acknowledge and clear the alarm. All that have not been cleared shall be archived at workstation disk.

20. Remote Communications: The system shall have the ability to dial out in the event of an alarm. Receivers shall include operator workstations, e-mail addresses, and alpha-numeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself.

21. System Configuration:

- a. Network control strategies shall not be restricted to a single digital controller, but shall be able to include data from all other network devices to allow the development of global control strategies.
- b. Provide automatic backup and restore of all digital controller databases on the workstation hard disk. In addition to all backup data, all databases shall be performed while the workstation is on-line without disturbing other system operations.

2.5 DOT (NOT USED)

2.6 BACnet PROTOCOL ANALYZER (NOT USED)

2.7 NETWORK AND DEVICE NAMING CONVENTION

A. Network Numbers

1. BACnet network numbers shall be based on a "facility code, network" concept. The "facility code" is the VAMC' s or VA campus' assigned numeric value assigned to a specific facility or building. The "network" typically corresponds to a "floor" or other logical configuration within the building. BACnet allows 65535 network numbers per BACnet internet work.
2. The network numbers are thus formed as follows: "Net #" = "FFFNN" where:
 - a. FFF = Facility code (see below)
 - b. NN = 00-99 This allows up to 100 networks per facility or building

B. Device Instances

1. BACnet allows 4194305 unique device instances per BACnet internet work. Using Agency's unique device instances are formed as follows: "Dev #" = "FFFNNDD" where
 - a. FFF and N are as above and
 - b. DD = 00-99, this allows up to 100 devices per network.
2. Note Special cases, where the network architecture of limiting device numbering to DD causes excessive subnet works. The device number can be expanded to DDD and the network number N can become a single digit. In NO case shall the network number N and the device number D exceed 4 digits.
3. Facility code assignments:
4. 000-400 Building/facility number
5. Note that some facilities have a facility code with an alphabetic suffix to denote wings, related structures, etc. The suffix will be ignored. Network numbers for facility codes above 400 will be assigned in the range 000-399.

C. Device Names

1. Name the control devices based on facility name, location within a facility, the system or systems that the device monitors and/or controls, or the area served. The intent of the device naming is to be easily recognized. Names can be up to 254 characters in length, without embedded spaces. Provide the shortest descriptive, but

unambiguous, name. For example, in building #123 prefix the number with a "B" followed by the building number, if there is only one chilled water pump "CHWP-1", a valid name would be "B123.CHWP.1.STARTSTOP". If there are two pumps designated "CHWP-1", one in a basement mechanical room (Room 0001) and one in a penthouse mechanical room (Room PH01), the names could be "B123.R0001.CHWP.1.STARTSTOP" or "B123.RPH01.CHWP.1.STARTSTOP". In the case of unitary controllers, for example a VAV box controller, a name might be "B123.R101.VAV". These names should be used for the value of the "Object_Name" property of the BACnet Device objects of the controllers involved so that the BACnet name and the EMCS name are the same.

2.8 BACNET DEVICES

A. All BACnet Devices - controllers, gateways, routers, actuators and sensors shall conform to BACnet Device Profiles and shall be BACnet Testing Laboratories (BTL) -Listed as conforming to those Device Profiles. Protocol Implementation Conformance Statements (PICSs), describing the BACnet capabilities of the Devices shall be published and available of the Devices through links in the BTL website.

1. BACnet Building Controllers, historically referred to as NACs, shall conform to the BACnet B-BC Device Profile, and shall be BTL-Listed as conforming to the B-BC Device Profile. The Device's PICS shall be submitted.
2. BACnet Advanced Application Controllers shall conform to the BACnet B-AAC Device Profile, and shall be BTL-Listed as conforming to the B-AAC Device Profile. The Device's PICS shall be submitted.
3. BACnet Application Specific Controllers shall conform to the BACnet B-ASC Device Profile, and shall be BTL-Listed as conforming to the B-ASC Device Profile. The Device's PICS shall be submitted.
4. BACnet Smart Actuators shall conform to the BACnet B-SA Device Profile, and shall be BTL-Listed as conforming to the B-SA Device Profile. The Device's PICS shall be submitted.
5. BACnet Smart Sensors shall conform to the BACnet B-SS Device Profile, and shall be BTL-Listed as conforming to the B-SS Device Profile. The Device's PICS shall be submitted.
6. BACnet routers and gateways shall conform to the BACnet B-OTH Device Profile, and shall be BTL-Listed as conforming to the B-OTH Device Profile. The Device's PICS shall be submitted.

2.9 CONTROLLERS

- A. General. Provide an adequate number of BTL-Listed B-BC building controllers and an adequate number of BTL-Listed B-AAC advanced application controllers to achieve the performance specified in the Part 1 Article on "System Performance." Each of these controllers shall meet the following requirements.
1. The controller shall have sufficient memory to support its operating system, database, and programming requirements.
 2. The building controller shall share data with the ECC and the other networked building controllers. The advanced application controller shall share data with its building controller and the other networked advanced application controllers.
 3. The operating system of the controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
 4. Controllers that perform scheduling shall have a real-time clock.
 5. The controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall: assume a predetermined failure mode, and generate an alarm notification.
 6. The controller shall communicate with other BACnet devices on the internetwork using the BACnet Read (Execute and Initiate) and Write (Execute and Initiate) Property services.
 7. Communication.
 - a. Each controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications. Each building controller also shall perform BACnet routing if connected to a network of custom application and application specific controllers.
 - b. The controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator's terminal.
 8. Keypad. A local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. Provide a system security password shall be available to prevent unauthorized use of the keypad and display.

9. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
 10. Memory. The controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
 11. The controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Controller operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
- B. Provide BTL-Listed B-ASC application specific controllers for each piece of equipment for which they are constructed. Application specific controllers shall communicate with other BACnet devices on the internetwork using the BACnet Read (Execute) Property service.
1. Each B-ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
 2. Each B-ASC will contain sufficient I/O capacity to control the target system.
 3. Communication.
 - a. Each controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications. Each building controller also shall perform BACnet routing if connected to a network of custom application and application specific controllers.
 - b. Each controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator's tool. This connection shall be extended to a space temperature sensor port where shown.
 4. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
 5. Memory. The application specific controller shall use nonvolatile memory and maintain all BIOS and programming information in the event of a power loss.

6. Immunity to power and noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
7. Transformer. Power supply for the ASC must be rated at a minimum of 125% of ASC power consumption and shall be of the fused or current limiting type.

C. Direct Digital Controller Software

1. The software programs specified in this section shall be commercially available, concurrent, multi-tasking operating system and support the use of software application that operates under DOS or Microsoft Windows.
2. All points shall be identified by up to 30-character point name and 16-character point descriptor. The same names shall be used at the ECC.
3. All control functions shall execute within the stand-alone control units via DDC algorithms. The VA shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters.
4. All controllers shall be capable of being programmed to utilize stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the central or another CU, or by loss of bus communication. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a sensor-failed message at the ECC. Each ACU and RCU shall have capability for local readouts of all functions. The UCUs shall be read remotely.
5. All DDC control loops shall be able to utilize any of the following control modes:
 - a. Two position (on-off, slow-fast) control.
 - b. Proportional control.
 - c. Proportional plus integral (PI) control.
 - d. Proportional plus integral plus derivative (PID) control. All PID programs shall automatically invoke integral wind up prevention routines whenever the controlled unit is off, under manual

control of an automation system or time initiated program.e.
Automatic tuning of control loops.

6. System Security: Operator access shall be secured using individual password and operator's name. Passwords shall restrict the operator to the level of object, applications, and system functions assigned to him. A minimum of six (6) levels of security for operator access shall be provided.
7. Application Software: The controllers shall provide the following programs as a minimum for the purpose of optimizing energy consumption while maintaining comfortable environment for occupants. All application software shall reside and run in the system digital controllers. Editing of the application shall occur at the ECC or via a portable operator's terminal, when it is necessary, to access directly the programmable unit.
 - a. Economizer: An economizer program shall be provided for VAV systems. This program shall control the position of air handler relief, return, and outdoors dampers. If the outdoor air dry bulb temperature and humidity fall below changeover set point the energy control center will modulate the dampers to provide 100 percent outdoor air. The operator shall be able to override the economizer cycle and return to minimum outdoor air operation at any time.
 - b. Night Setback/Morning Warm up Control: The system shall provide the ability to automatically adjust set points for this mode of operation.
 - c. Optimum Start/Stop (OSS): Optimum start/stop program shall automatically be coordinated with event scheduling. The OSS program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by the time of occupancy, and it shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period and still maintain desired comfort conditions. The OSS program shall consider both outside weather conditions and inside zone conditions. The program shall automatically assign longer lead times for weekend and holiday shutdowns. The program shall poll all zones served by the associated AHU and shall select the warmest and coolest zones. These shall be used in the start time calculation. It shall be possible to assign occupancy start times on a per air handler unit basis. The program shall meet the local code requirements

for minimum outdoor air while the building is occupied.

Modification of assigned occupancy start/stop times shall be possible via the ECC.

- d. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or a group of points according to a stored time. This program shall provide the capability to individually command a point or group of points. When points are assigned to one common load group it shall be possible to assign variable time advances/delays between each successive start or stop within that group. Scheduling shall be calendar based and advance schedules may be defined up to one year in advance. Advance schedule shall override the day-to-day schedule. The operator shall be able to define the following information:
- 1) Time, day.
 - 2) Commands such as on, off, auto.
 - 3) Time delays between successive commands.
 - 4) Manual overriding of each schedule.
 - 5) Allow operator intervention.
- e. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the ECC based on time and events. An alarm shall be able to start programs, login the event, print and display the messages. The system shall allow the operator to prioritize the alarms to minimize nuisance reporting and to speed operator's response to critical alarms. A minimum of six (6) priority levels of alarms shall be provided for each point.
- f. Remote Communications: The system shall have the ability to dial out in the event of an alarm to the ECC and alpha-numeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system using dial up communications. Remote access shall allow the operator to function the same as local access.
- g. Maintenance Management (PM): The program shall monitor equipment status and generate maintenance messages based upon the operators defined equipment run time, starts, and/or calendar date limits. A preventative maintenance alarm shall be printed indicating maintenance requirements based on pre-defined run time. Each preventive message shall include point description, limit criteria and preventative maintenance instruction assigned to

that limit. A minimum of 480-character PM shall be provided for each component of units such as air handling units.

2.10 SPECIAL CONTROLERS (NOT USED)

2.11 SENSORS (AIR, PRESSURE, WATER AND STEAM)

- A. Sensors' measurements shall be read back to the DDC system, and shall be visible by the ECC.
- B. Temperature and Humidity Sensors shall be electronic, vibration and corrosion resistant for wall, immersion, and/or duct mounting. Provide all remote sensors as required for the systems.
 - 1. Temperature Sensors: thermistor type for terminal units and Resistance Temperature Device (RTD) with an integral transmitter type for all other sensors.
 - a. Duct sensors shall be rigid or averaging type as shown on drawings. Averaging sensor shall be a minimum of 1 linear ft of sensing element for each sq ft of cooling coil face area.
 - b. Immersion sensors shall be provided with a separable well made of stainless steel, bronze or monel material. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
 - c. Outdoor air temperature sensors shall have watertight inlet fittings and be shielded from direct sunlight.
 - d. Wire: Twisted, shielded-pair cable.
 - e. Output Signal: 4-20 ma.
 - 2. Humidity Sensors: Bulk polymer sensing element type.
 - a. Duct and room sensors shall have a sensing range of 20 to 80 percent with accuracy of ± 2 to 5 percent RH, including hysteresis, linearity, and repeatability.
 - b. Outdoor humidity sensors shall be furnished with element guard and mounting plate and have a sensing range of 0 to 100 percent RH.
 - c. 4-20 ma continuous output signal.
- C. Static Pressure Sensors: Non-directional, temperature compensated.
 - 1. 4-20 ma output signal.
 - 2. 0 to 5 inches wg for duct static pressure range.
 - 3. 0 to 0.25 inch wg for Building static pressure range.

D. Flow switches:

1. Shall be either paddle or differential pressure type.
 - a. Paddle-type switches (liquid service only) shall be UL Listed, SPDT snap-acting, adjustable sensitivity with NEMA 4 enclosure.
 - b. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap acting, NEMA 4 enclosure, with scale range and differential suitable for specified application.

E. Current Switches: Current operated switches shall be self powered, solid state with adjustable trip current as well as status, power, and relay command status LED indication. The switches shall be selected to match the current of the application and output requirements of the DDC systems.

F. Room Differential Pressure Sensor and Monitor: The differential pressure in negative and positive isolation rooms shall be monitored. One sensor per room shall measure and display pressure differential through a sampling tube installed in the wall separating the room from the adjacent space, and display the value on its associated monitor. Audible and visual alarms able to be silenced shall alert users of conditions outside setting tolerances. The sensor shall meet the following as a minimum:

1. Operating range: -0.25 to +0.25 inches of water column.
2. Resolution: 5 percent of reading.
3. Accuracy: +/- 10 percent of reading +/- 0.005 inches of water column.
4. Analog output: 0-10 VDC or 4-20 ma.
5. Housing: Molded plastic with flush mounted color touch screen password protected.
6. Model Manufacturer: TSI Pressura model RPM 20.

2.12 CONTROL CABLES

A. General:

1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Comply with Sections 27 05 26 and 26 05 26.
2. Cable conductors to provide protection against induction in circuits. Crosstalk attenuation within the System shall be in excess

of -80 dB throughout the frequency ranges specified.

3. Minimize the radiation of RF noise generated by the System equipment so as not to interfere with any audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.
4. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs.
5. Label system's cables on each end. Test and certify cables in writing to the VA before conducting proof-of-performance testing. Minimum cable test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges used. Make available all cable installation and test records at demonstration to the VA. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.

6. Power wiring shall not be run in conduit with communications trunk wiring or signal or control wiring operating at 100 volts or less.
- B. Analogue control cabling shall be not less than No. 18 AWG solid, with thermoplastic insulated conductors as specified in Section 26 05 21.
- C. Copper digital communication cable between the ECC and the B-BC and BAAC controllers shall be 100BASE-TX Ethernet, Category 5e or 6, not less than minimum 24 American Wire Gauge (AWG) solid, Shielded Twisted Pair (STP) or Unshielded Twisted Pair (UTP), with thermoplastic insulated conductors, enclosed in a thermoplastic outer jacket, as specified in Section 27 15 00.
 1. Other types of media commonly used within IEEE Std 802.3 LANs (e.g., 10Base-T and 10Base-2) shall be used only in cases to interconnect with existing media.
- D. Optical digital communication fiber, if used, shall be Multimode or Singlemode fiber, 62.5/125 micron for multimode or 10/125 micron for singlemode micron with SC or ST connectors as specified in TIA-568-C.1. Terminations, patch panels, and other hardware shall be compatible with the specified fiber and shall be as specified in Section 27 15 00. Fiber-optic cable shall be suitable for use with the 100Base-FX or the 100Base-SX standard (as applicable) as defined in IEEE Std 802.3.

2.13 FINAL CONTROL ELEMENTS AND OPERATORS

- A. Fail Safe Operation: Control valves and dampers shall provide "fail safe" operation in either the normally open or normally closed position as required for freeze, moisture, and smoke or fire protection.
- B. Spring Ranges: Range as required for system sequencing and to provide tight shut-off.
- C. Power Operated Control Dampers (other than VAV Boxes): Factory fabricated, balanced type dampers. All modulating dampers shall be opposed blade type and gasketed. Blades for two-position, duct-mounted dampers shall be parallel, airfoil (streamlined) type for minimum noise generation and pressure drop.
 1. Leakage: maximum leakage in closed position shall not exceed 7 L/S (15 CFMs) differential pressure for outside air and exhaust dampers and 200 L/S/ square meter (40 CFM/sq. ft.) at 50 mm (2 inches) differential pressure for other dampers.

2. Frame shall be galvanized steel channel with seals as required to meet leakage criteria.
3. Blades shall be galvanized steel or aluminum, 200 mm (8 inch) maximum width, with edges sealed as required.
4. Bearing shall be nylon, bronze sleeve or ball type.
5. Hardware shall be zinc-plated steel. Connected rods and linkage shall be non-slip. Working parts of joints shall be brass, bronze, nylon or stainless steel.
6. Maximum air velocity and pressure drop through free area the dampers:
 - a. Smoke damper in air handling unit: 305 meter per minute (1000 fpm).
 - b. Duct mounted damper: 600 meter per minute (2000 fpm).
 - c. Maximum static pressure loss: 50 Pascal (0.20 inches water gage).

D. Control Valves:

1. Valves shall be rated for a minimum of 150 percent of system operating pressure at the valve location but not less than 900 kPa (125 psig).
2. Valves 50 mm (2 inches) and smaller shall be bronze body with threaded or flare connections.
3. Valves 60 mm (2 1/2 inches) and larger shall be bronze or iron body with flanged connections.
4. Brass or bronze seats except for valves controlling media above 100 degrees C (210 degrees F), which shall have stainless steel seats.
5. Flow characteristics:
 - a. Three way modulating valves shall be globe pattern. Position versus flow relation shall be linear relation for steam or equal percentage for water flow control.
 - b. Two-way modulating valves shall be globe pattern. Position versus flow relation shall be linear for steam and equal percentage for water flow control.
 - c. Two-way 2-position valves shall be ball, gate or butterfly type.
6. Maximum pressure drop:
 - a. Two position steam control: 20 percent of inlet gauge pressure.

b. Modulating Steam Control: 80 percent of inlet gauge pressure (acoustic velocity limitation).

c. Modulating water flow control, greater of 3 meters (10 feet) of water or the pressure drop through the apparatus.

7. Two position water valves shall be line size.

E. Damper and Valve Operators and Relays:

1. Electric operator shall provide full modulating control of dampers and valves. A linkage and pushrod shall be furnished for mounting the actuator on the damper frame internally in the duct or externally in the duct or externally on the duct wall, or shall be furnished with a direct-coupled design. Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motors shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.

a. Minimum valve close-off pressure shall be equal to the system pump's dead-head pressure, minimum 50 psig for valves smaller than 4 inches.

2. Electronic damper operators: Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motors shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.

3. See drawings for required control operation.

2.14 AIR FLOW CONTROL

A. Airflow and static pressure shall be controlled via digital controllers with inputs from airflow control measuring stations and static pressure inputs as specified. Controller outputs shall be analog or pulse width modulating output signals. The controllers shall include the capability to control via simple proportional (P) control, proportional plus integral (PI), proportional plus integral plus derivative (PID), and on-off. The airflow control programs shall be factory-tested programs that are documented in the literature of the control manufacturer.

B. Air Flow Measuring Station -- Electronic Thermal Type:

1. Air Flow Sensor Probe:

- a. Each air flow sensor shall contain two individual thermal sensing elements. One element shall determine the velocity of the air stream while the other element shall compensate for changes in temperature. Each thermal flow sensor and its associated control circuit and signal conditioning circuit shall be factory calibrated and be interchangeable to allow replacement of a sensor without recalibration of the entire flow station. The sensor in the array shall be located at the center of equal area segment of the duct and the number of sensors shall be adequate to accommodate the expected velocity profile and variation in flow and temperature. The airflow station shall be of the insertion type in which sensor support structures are inserted from the outside of the ducts to make up the complete electronic velocity array.
- b. Thermal flow sensor shall be constructed of hermetically sealed thermistors or nickel chromium or reference grade platinum wire, wound over an epoxy, stainless steel or ceramic mandrel and coated with a material suitable for the conditions to be encountered. Each dual sensor shall be mounted in an extruded aluminum alloy strut.

2. Air Flow Sensor Grid Array:

- a. Each sensor grid shall consist of a lattice network of temperature sensors and linear integral controllers (ICs) situated inside an aluminum casing suitable for mounting in a duct. Each sensor shall be mounted within a strut facing downstream of the airflow and located so that it is protected on the upstream side. All wiring shall be encased (out of the air stream) to protect against mechanical damage.
- b. The casing shall be made of welded aluminum of sufficient strength to prevent structural bending and bowing. Steel or iron composite shall not be acceptable in the casing material.
- c. Pressure drop through the flow station shall not exceed 4 Pascal (0.015" W.G.) at 1,000 meter per minute (3,000 FPM).

- C. Static Pressure Measuring Station: shall consist of one or more static pressure sensors and transmitters along with relays or auxiliary devices as required for a complete functional system. The span of the transmitter shall not exceed two times the design static pressure at the point of measurement. The output of the transmitter

shall be true representation of the input pressure with plus or minus 25 Pascal (0.1 inch) W.G. of the true input pressure:

1. Static pressure sensors shall have the same requirements as Airflow Measuring Devices except that total pressure sensors are optional, and only multiple static pressure sensors positioned on an equal area basis connected to a network of headers are required.
 2. For systems with multiple major trunk supply ducts, furnish a static pressure transmitter for each trunk duct. The transmitter signal representing the lowest static pressure shall be selected and this shall be the input signal to the controller.
 3. The controller shall receive the static pressure transmitter signal and CU shall provide a control output signal to the supply fan capacity control device. The control mode shall be proportional plus integral (PI) (automatic reset) and where required shall also include derivative mode.
 4. In systems with multiple static pressure transmitters, provide a switch located near the fan discharge to prevent excessive pressure during abnormal operating conditions. High-limit switches shall be manually-reset.
- D. Constant Volume Control Systems shall consist of an air flow measuring station along with such relays and auxiliary devices as required to produce a complete functional system. The transmitter shall receive its air flow signal and static pressure signal from the flow measuring station and shall have a span not exceeding three times the design flow rate. The CU shall receive the transmitter signal and shall provide an output to the fan volume control device to maintain a constant flow rate. The CU shall provide proportional plus integral (PI) (automatic reset) control mode and where required also inverse derivative mode. Overall system accuracy shall be plus or minus the equivalent of 2 Pascal (0.008 inch) velocity pressure as measured by the flow station.
- E. Airflow Synchronization:
1. Systems shall consist of an air flow measuring station for each supply and return duct, the CU and such relays, as required to provide a complete functional system that will maintain a constant flow rate difference between supply and return air to an accuracy of $\pm 10\%$. In systems where there is no suitable location for a flow measuring station that will sense total supply or return flow, provide multiple flow stations with a differential pressure transmitter for each station. Signals from the multiple transmitters

shall be added through the CU such that the resultant signal is a true representation of total flow.

2. The total flow signals from supply and return air shall be the input signals to the CU. This CU shall track the return air fan capacity in proportion to the supply air flow under all conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to Resident Engineer for resolution before proceeding for installation.
2. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
3. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
4. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
5. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
6. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
7. Install equipment level and plum.

B. Electrical Wiring Installation:

1. All wiring cabling shall be installed in conduits. Install conduits and wiring in accordance with Specification Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Conduits carrying control wiring and cabling shall be dedicated to the control wiring and cabling; these conduits shall not carry power wiring. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.
2. Install analog signal and communication cables in conduit and in accordance with Specification Section 26 05 21. Install digital communication cables in conduit and in accordance with Specification Section 27 15 00, Communications Horizontal Cabling.

3. Install conduit and wiring between operator workstation(s), digital controllers, electrical panels, indicating devices, instrumentation, miscellaneous alarm points, thermostats, and relays as shown on the drawings or as required under this section.
 4. Install all electrical work required for a fully functional system and not shown on electrical plans or required by electrical specifications. Where low voltage (less than 50 volt) power is required, provide suitable Class B transformers.
 5. Install all system components in accordance with local Building Code and National Electric Code.
 - a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.
 - b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 300 mm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.
 - c. Cable Runs: Keep cable runs as short as possible. Allow extra length for connecting to the terminal board. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.
 - d. Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, panel cabinets, etc.
 6. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.
 7. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.
 8. Grounding: ground electrical systems per manufacturer's written requirements for proper and safe operation.
- C. Install Sensors and Controls:
1. Temperature Sensors:
 - a. Install all sensors and instrumentation according to manufacturer's written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and

servicing of them without special skills and tools.

- b. Calibrate sensors to accuracy specified, if not factory calibrated.
- c. Use of sensors shall be limited to its duty, e.g., duct sensor shall not be used in lieu of room sensor.
- d. Install room sensors permanently supported on wall frame. They shall be mounted at 1.5 meter (5.0 feet) above the finished floor.
- e. Mount sensors rigidly and adequately for the environment within which the sensor operates. Separate extended-bulb sensors from contact with metal casings and coils using insulated standoffs.
- f. Sensors used in mixing plenum, and hot and cold decks shall be of the averaging of type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
- g. All pipe mounted temperature sensors shall be installed in wells.
- h. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.
- i. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.

2. Pressure Sensors:

- a. Install duct static pressure sensor tips facing directly downstream of airflow.
- b. Install high-pressure side of the differential switch between the pump discharge and the check valve.
- c. Install snubbers and isolation valves on steam pressure sensing devices.

3. Actuators:

- a. Mount and link damper and valve actuators according to manufacturer's written instructions.
- b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed position.

- c. Check operation of valve/actuator combination to confirm that actuator modulates valve smoothly in both open and closed position.

4. Flow Switches:

- a. Install flow switch according to manufacturer's written instructions.
- b. Mount flow switch a minimum of 5 pipe diameters up stream and 5 pipe diameters downstream or 600 mm (2 feet) whichever is greater, from fittings and other obstructions.
- c. Assure correct flow direction and alignment.
- d. Mount in horizontal piping-flow switch on top of the pipe.

D. Installation of network:

1. Ethernet:

- a. The network shall employ Ethernet LAN architecture, as defined by IEEE 802.3. The Network Interface shall be fully Internet Protocol (IP) compliant allowing connection to currently installed IEEE 802.3, Compliant Ethernet Networks.
- b. The network shall directly support connectivity to a variety of cabling types. As a minimum provide the following connectivity: 100 Base TX (Category 5e cabling) for the communications between the ECC and the B-BC and the B-AAC controllers.

2. Third party interfaces: Contractor shall integrate real-time data from building systems by other trades and databases originating from other manufacturers as specified and required to make the system work as one system.

E. Installation of digital controllers and programming:

- 1. Provide a separate digital control panel for each major piece of equipment, such as air handling unit, chiller, pumping unit etc. Points used for control loop reset such as outdoor air, outdoor humidity, or space temperature could be located on any of the remote control units.
- 2. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25 percent of available memory free for future use.
- 3. System point names shall be modular in design, permitting easy operator interface without the use of a written point index.

4. Provide software programming for the applications intended for the systems specified, and adhere to the strategy algorithms provided.
5. Provide graphics for each piece of equipment and floor plan in the building. This includes each chiller, cooling tower, air handling unit, fan, terminal unit, boiler, pumping unit etc. These graphics shall show all points dynamically as specified in the point list.

3.2 SYSTEM VALIDATION AND DEMONSTRATION

A. As part of final system acceptance, a system demonstration is required (see below). Prior to start of this demonstration, the contractor is to perform a complete validation of all aspects of the controls and instrumentation system.

B. Validation

1. Prepare and submit for approval a validation test plan including test procedures for the performance verification tests. Test Plan shall address all specified functions of the ECC and all specified sequences of operation. Explain in detail actions and expected results used to demonstrate compliance with the requirements of this specification. Explain the method for simulating the necessary conditions of operation used to demonstrate performance of the system. Test plan shall include a test check list to be used by the Installer's agent to check and initial that each test has been successfully completed. Deliver test plan documentation for the performance verification tests to the owner's representative 30 days prior to start of performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.
2. After approval of the validation test plan, installer shall carry out all tests and procedures therein. Installer shall completely check out, calibrate, and test all connected hardware and software to insure that system performs in accordance with approved specifications and sequences of operation submitted. Installer shall complete and submit Test Check List.

C. Demonstration

1. System operation and calibration to be demonstrated by the installer in the presence of the Architect or VA's representative on random samples of equipment as dictated by the Architect or VA's representative. Should random sampling indicate improper commissioning, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the VA.

2. Demonstrate to authorities that all required safeties and life safety functions are fully functional and complete.
3. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.
4. The following witnessed demonstrations of field control equipment shall be included:
 - a. Observe HVAC systems in shut down condition. Check dampers and valves for normal position.
 - b. Test application software for its ability to communicate with digital controllers, operator workstation, and uploading and downloading of control programs.
 - c. Demonstrate the software ability to edit the control program off-line.
 - d. Demonstrate reporting of alarm conditions for each alarm and ensure that these alarms are received at the assigned location, including operator workstations.
 - e. Demonstrate ability of software program to function for the intended applications-trend reports, change in status etc.
 - f. Demonstrate via graphed trends to show the sequence of operation is executed in correct manner, and that the HVAC systems operate properly through the complete sequence of operation, e.g., seasonal change, occupied/unoccupied mode, and warm-up condition.
 - g. Demonstrate hardware interlocks and safeties functions, and that the control systems perform the correct sequence of operation after power loss and resumption of power loss.
 - h. Prepare and deliver to the VA graphed trends of all control loops to demonstrate that each control loop is stable and the set points are maintained.
 - i. Demonstrate that each control loop responds to set point adjustment and stabilizes within one (1) minute. Control loop trend data shall be instantaneous and the time between data points shall not be greater than one (1) minute.
5. Witnessed demonstration of ECC functions shall consist of:
 - a. Running each specified report.
 - b. Display and demonstrate each data entry to show site specific customizing capability. Demonstrate parameter changes.
 - c. Step through penetration tree, display all graphics, demonstrate

dynamic update, and direct access to graphics.

- d. Execute digital and analog commands in graphic mode.
- e. Demonstrate DDC loop precision and stability via trend logs of inputs and outputs (6 loops minimum).
- f. Demonstrate EMS performance via trend logs and command trace.
- g. Demonstrate scan, update, and alarm responsiveness.
- h. Demonstrate spreadsheet/curve plot software, and its integration with database.
- i. Demonstrate on-line user guide, and help function and mail facility.
- j. Demonstrate digital system configuration graphics with interactive upline and downline load, and demonstrate specified diagnostics.
- k. Demonstrate multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
- l. Demonstrate class programming with point options of beep duration, beep rate, alarm archiving, and color banding.

- - - E N D - - -

SECTION 23 73 00
INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Air handling units including integral components specified herein.
- B. Definitions: Air Handling Unit (AHU): A factory fabricated and tested assembly of modular sections consisting of multiple plenum fans with direct-drive, coils, filters, and other necessary equipment to perform one or more of the following functions of circulating, cleaning, heating, cooling, humidifying, dehumidifying, and mixing of air. Design capacities of units shall be as scheduled on the drawings.

1.2 RELATED WORK

- A. General mechanical requirements and items, which are common to more than one section of Division 23: Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- B. Sound and vibration requirements: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- C. Piping and duct insulation: Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
- D. Piping and valves: Section 23 21 13 / 23 22 13, HYDRONIC PIPING / STEAM AND CONDENSATE HEATING PIPING.
- E. Heating and cooling coils and pressure requirements: Section 23 82 16, AIR COILS.
- F. Return and exhaust fans: Section 23 34 00, HVAC FANS.
- G. Requirements for flexible duct connectors, sound attenuators and sound absorbing duct lining, and air leakage: Section 23 31 00, HVAC DUCTS and CASINGS.
- H. Air filters and filters' efficiency: Section 23 40 00, HVAC AIR CLEANING DEVICES.
- I. HVAC controls: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- J. Testing, adjusting and balancing of air and water flows: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- K. Types of motors: Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
- L. Types of motor starters: Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.
- M. General Commissioning: Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS
- N. HVAC Commissioning: Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS

1.3 QUALITY ASSURANCE

- A. Refer to Article, Quality Assurance, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- B. Air Handling Units Certification
 - 2. Air Handling Units with Plenum Fans:
 - b. Air handling Units with Multiple Fans in an Array shall be tested and rated in accordance with AHRI 430 and AHRI 260.
- C. Heating, Cooling, and Air Handling Capacity and Performance Standards: AHRI 430, AHRI 410, ASHRAE 51, and AMCA 210.
- D. Performance Criteria:
 - 1. The fan BHP shall include all system effects for all fans and v-belt drive losses for housed centrifugal fans.
 - 2. The fan motor shall be selected within the rated nameplate capacity, without relying upon NEMA Standard Service Factor.
 - 3. Select the fan operating point as follows:
 - b. Air Foil, Backward Inclined, or Tubular Fans Including Plenum Fans: At or near the peak static efficiency but at an appropriate distance from the stall line.
 - 4. Operating Limits: AMCA 99 and Manufacturer's Recommendations.
- E. Units shall be factory-fabricated, assembled, and tested by a manufacturer, in business of manufacturing similar air-handling units for at least five (5) years.

1.4. SUBMITTALS:

- A. The contractor shall, in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish a complete submission for all air handling units covered in the project. The submission shall include all information listed below. Partial and incomplete submissions shall be rejected without reviews.
- B. Manufacturer's Literature and Data:
 - 1. Submittals for AHUs shall include fans, drives, motors, coils, humidifiers, mixing box with outside/return air dampers, filter housings, blender sections, and all other related accessories. The contractor shall provide custom drawings showing total air handling unit assembly including dimensions, operating weight, access sections, flexible connections, door swings, controls penetrations, electrical disconnect, lights, duplex receptacles, switches, wiring, utility connection points, unit support system, vibration isolators, drain pan, pressure drops through each component (filter, coil etc).
 - 2. Submittal drawings of section or component only will not be acceptable. Contractor shall also submit performance data including performance test results, charts, curves or certified computer

- selection data; data sheets; fabrication and insulation details. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements. This data shall be submitted in hard copies and in electronic version compatible to AutoCAD version used by the VA at the time of submission.
3. Submit sound power levels in each octave band for the inlet and discharge of the fan and at entrance and discharge of AHUs at scheduled conditions. In absence of sound power ratings refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
 4. Provide fan curves showing Liters/Second (cubic feet per minute), static pressure, efficiency, and horsepower for design point of operation and at maximum design Liters/Second (cubic feet per minute).
 5. Submit total fan static pressure, external static pressure, for AHU including total, inlet and discharge pressures, and itemized specified internal losses and unspecified internal losses. Refer to air handling unit schedule on drawings.
- C. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS. Include instructions for lubrication, filter replacement, motor and drive replacement, spare part lists, and wiring diagrams.
- D. Submit written test procedures two weeks prior to factory testing. Submit written results of factory tests for approval prior to shipping.
- E. Submit shipping information that clearly indicates how the units will be shipped in compliance with the descriptions below.
1. Units shall be shipped in one (1) piece where possible and in shrink wrapping to protect the unit from dirt, moisture and/or road salt.
 2. If not shipped in one (1) piece, provide manufacturer approved shipping splits where required for installation or to meet shipping and/or job site rigging requirements in modular sections. Indicate clearly that the shipping splits shown in the submittals have been verified to accommodate the construction constraints for rigging as required to complete installation and removal of any section for replacement through available access without adversely affecting other sections.
 3. If shipping splits are provided, each component shall be individually shrink wrapped to protect the unit and all necessary hardware (e.g.

- bolts, gaskets etc.) will be included to assemble unit on site (see section 2.1.A4).
4. Lifting lugs will be provided to facilitate rigging on shipping splits and joining of segments. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI)/(ARI):
 410-01.....Standard for Forced-Circulation Air-Heating and Air-Cooling Coils
 430-09.....Central Station Air Handling Units
- C. Air Movement and Control Association International, Inc. (AMCA):
 210-07.....Laboratory Methods of Testing Fans for Rating
- D. American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc. (ASHRAE):
 170-2008.....Ventilation of Health Care Facilities
- E. American Society for Testing and Materials (ASTM):
 ASTM B117-07a.....Standard Practice for Operating Salt Spray (Fog) Apparatus
 ASTM D1654-08.....Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
 ASTM D1735-08.....Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
 ASTM D3359-08.....Standard Test Methods for Measuring Adhesion by Tape Test
- F. Military Specifications (Mil. Spec.):
 MIL-P-21035B-2003.....Paint, High Zinc Dust Content, Galvanizing Repair (Metric)
- G. National Fire Protection Association (NFPA):
 NFPA 90A.....Standard for Installation of Air Conditioning and Ventilating Systems, 2009
- H. Energy Policy Act of 2005 (P.L.109-58)

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS

- A. General:

1. AHUs shall be fabricated from insulated, solid double-wall galvanized steel without any perforations in draw-through configuration. Casing shall be fabricated as specified in section 2.1.C.2. Galvanizing shall be hot dipped conforming to ASTM A525 and shall provide a minimum of 0.275 kg of zinc per square meter (0.90 oz. of zinc per square foot) (G90). Aluminum constructed units, subject to VA approval, may be used in place of galvanized steel. The unit manufacturer shall provide published documentation confirming that the structural rigidity of aluminum air-handling units is equal or greater than the specified galvanized steel.
2. The contractor and the AHU manufacturer shall be responsible for ensuring that the unit will not exceed the allocated space shown on the drawings, including required clearances for service and future overhaul or removal of unit components. All structural, piping, wiring, and ductwork alterations of units, which are dimensionally different than those specified, shall be the responsibility of the contractor at no additional cost to the government.
3. AHUs shall be fully assembled by the manufacturer in the factory in accordance with the arrangement shown on the drawings. The unit shall be assembled into the largest sections possible subject to shipping and rigging restrictions. The correct fit of all components and casing sections shall be verified in the factory for all units prior to shipment. All units shall be fully assembled, tested, and then split to accommodate shipment and job site rigging. On units not shipped fully assembled, the manufacturer shall tag each section and include air flow direction to facilitate assembly at the job site. Lifting lugs or shipping skids shall be provided for each section to allow for field rigging and final placement of unit.
4. The AHU manufacturer shall provide the necessary gasketing, caulking, and all screws, nuts, and bolts required for assembly. The manufacturer shall provide a factory-trained and qualified local representative at the job site to supervise the assembly and to assure that the units are assembled to meet manufacturer's recommendations and requirements noted on the drawings. Provide documentation to the Contracting Officer that the local representative has provided services of similar magnitude and complexity on jobs of comparable size. If a local representative cannot be provided, the manufacturer shall provide a factory representative.
5. Gaskets: All door and casing and panel gaskets and gaskets between air handling unit components, if joined in the field, shall be high

quality which seal air tight and retain their structural integrity and sealing capability after repeated assembly and disassembly of bolted panels and opening and closing of hinged components. Bolted sections may use a more permanent gasketing method provided they are not disassembled.

6. Structural Rigidity: Provide structural reinforcement when required by span or loading so that the deflection of the assembled structure shall not exceed 1/200 of the span based on a differential static pressure of 1991 PA (8 inch WG) or higher.

B. Base:

1. Provide a heavy duty steel base for supporting all major AHU components. Bases shall be constructed of wide-flange steel I-beams, channels, or minimum 200 mm (8 inch) high 3.5 mm (10 Gauge) steel base rails. Welded or bolted cross members shall be provided as required for lateral stability. Contractor shall provide supplemental steel supports as required to obtain proper operation heights for cooling coil condensate drain trap and steam coil condensate return trap as shown on drawings.
2. AHUs shall be completely self supporting for installation on concrete housekeeping pad, steel support pedestals, or suspended as shown on drawings.
3. The AHU bases not constructed of galvanized steel shall be cleaned, primed with a rust inhibiting primer, and finished with rust inhibiting exterior enamel.

C. Casing (including wall, floor and roof):

1. General: AHU casing shall be constructed as solid double wall, galvanized steel insulated panels without any perforations, integral of or attached to a structural frame. The thickness of insulation, mode of application and thermal breaks shall be such that there is no visible condensation on the exterior panels of the AHU located in the non-conditioned spaces.
2. Casing Construction:

Table 2.1.C.2

Outer Panel	0.8 mm (22 Gage) Minimum
Inner Panel	0.8 mm (22 Gage) Minimum
Insulation	Foam
Thickness	50 mm (2 inch) Minimum
Density	48 kg/m ³ (3.0 lb/ft ³) Minimum
Total R Value	2.3 m ² .K/W (13.0 ft ² .°F.hr/Btu) Minimum

3. Casing Construction (Contractor's Option):

Table 2.1.C.3

Outer Panel	1.3 mm (18 Gage) Minimum
Inner Panel	1.0 mm (20 Gage) Minimum
Insulation	Fiberglass
Thickness	50 mm (2 inch) Minimum
Density	24 kg/m ³ (1.5 lb/ft ³) Minimum
Total R Value	1.4 m ² .K/W (8.0 ft ² .°F.hr/Btu) Minimum

4. Blank-Off: Provide blank-offs as required to prevent air bypass between the AHU sections, around coils, and filters.
5. Casing panels shall be secured to the support structure with stainless steel or zinc-chromate plated screws and gaskets installed around the panel perimeter. Panels shall be completely removable to allow removal of fan, coils, and other internal components for future maintenance, repair, or modifications. Welded exterior panels are not acceptable.
6. Access Doors: Provide in each access section and where shown on drawings. Show single-sided and double-sided access doors with door swings on the floor plans. Doors shall be a minimum of 50 mm (2 inch) thick with same double wall construction as the unit casing. Doors shall be a minimum of 600 mm (24 inches) wide, unless shown of different size on drawings, and shall be the full casing height up to a maximum of 1850 mm (6 feet). Doors shall be gasketed, hinged, and latched to provide an airtight seal. The access doors for fan sections, mixing box, humidifier and coil sections shall include a minimum 150 mm x 150 mm (6 inch x 6 inch) double thickness window, with air space between the glass panes tightly sealed, reinforced glass or Plexiglas window in a gasketed frame.
 - a. Hinges: Manufacturers standard, designed for door size, weight and pressure classifications. Hinges shall hold door completely rigid with minimum 45 kg (100 lb) weight hung on latch side of door.
 - b. Latches: Non-corrosive alloy construction, with operating levers for positive cam action, operable from either inside or outside. Doors that do not open against unit operating pressure shall allow the door to ajar and then require approximately 0.785 radian (45 degrees) further movement of the handle for complete opening.

Latch shall be capable of restraining explosive opening of door with a force not less than 1991 Pa (8 inch WG).

- c. Gaskets: Neoprene, continuous around door, positioned for direct compression with no sliding action between the door and gasket.

Secure with high quality mastic to eliminate possibility of gasket slipping or coming loose.

- 7. Provide sealed sleeves, metal or plastic escutcheons or grommets for penetrations through casing for power and temperature control wiring and pneumatic tubing. Coordinate with electrical and temperature control subcontractors for number and location of penetrations. Coordinate lights, switches, and duplex receptacles and disconnect switch location and mounting. All penetrations and equipment mounting may be provided in the factory or in the field. All field penetrations shall be performed neatly by drilling or saw cutting. No cutting by torches will be allowed. Neatly seal all openings airtight.

D. Floor:

- 1. Unit floor shall be level without offset space or gap and designed to support a minimum of 488 kg/square meter (100 lbs per square foot) distributed load without permanent deformation or crushing of internal insulation. Provide adequate structural base members beneath floor in service access sections to support typical service foot traffic and to prevent damage to unit floor or internal insulation. Unit floors in casing sections, which may contain water or condensate, shall be watertight with drain pan.
- 2. Where indicated, furnish and install floor drains, flush with the floor, with nonferrous grate cover and stub through floor for external connection.

- E. Condensate Drain Pan: Drain pan shall be designed to extend entire length of cooling coils including headers and return bends. Depth of drain pan shall be at least 43 mm (1.7 inches) and shall handle all condensate without overflowing. Drain pan shall be double-wall, double sloping type, and fabricated from stainless (304) with at least 50 mm (2 inch) thick insulation sandwiched between the inner and outer surfaces. Drain pan shall be continuous metal or welded watertight. No mastic sealing of joints exposed to water will be permitted. Drain pan shall be placed on top of casing floor or integrated into casing floor assembly. Drain pan shall be pitched in all directions to drain line.

- 1. An intermediate, stainless-steel (304) condensate drip pan with copper downspouts shall be provided on stacked cooling coils. Use of intermediate condensate drain channel on upper casing of lower coil

is permissible provided it is readily cleanable. Design of intermediate condensate drain shall prevent upper coil condensate from flowing across face of lower coil.

2. Drain pan shall be piped to the exterior of the unit. Drain pan shall be readily cleanable.
3. Installation, including frame, shall be designed and sealed to prevent blow-by.

F. Plenum Fans -Multiple Fans in an Array:

1. General: Fans shall be Class II (minimum) construction with single inlet, aluminum wheel and stamped air-foil aluminum bladed. The fan wheel shall be mounted on the directly-driven motor shaft in AMCA Arrangement 4. Fans shall be dynamically balanced and internally isolated to minimize the vibrations. Provide a steel inlet cone for each wheel to match with the fan inlet. Locate fan in the air stream to assure proper flow. The fan performance shall be rated in accordance with AMCA 210 or ASHRAE 51.
2. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).
3. The plenum fans shall be driven by variable speed drives with at least one back-up drive as shown in the design documents. Use of a drive with bypass is not permitted.
4. Multiple fans shall be installed in a pre-engineered structural frame to facilitate fan stacking. All fans shall modulate in unison, above or below the synchronous speed within the limits specified by the manufacturer, by a common control sequence. Staging of the fans is not permitted. Redundancy requirement shall be met by all operating fans in an array and without the provision of an idle standby fan.
5. Fan Accessories

- a. Fan Isolation: Provide a manual blank off plate to isolate the fan not in operation due to failure.
 - b. Fan Airflow Measurement: Provide an airflow measuring device integral to the fan to measure air volume within +/- 5 percent accuracy. The probing device shall not be placed in the airflow path to stay clear of turbulence and avoid loss of performance.
- G. Fan Motor, Drive, and Mounting Assembly (Plenum Fans):
 Fan Motor and Drive: Motors shall be premium energy efficient type, as mandated by the Energy Policy Act of 2005, with efficiencies as shown in the Specifications Section 23 05 12 (General Motor Requirements For HVAC and Steam Equipment), on drawings and suitable for use in variable frequency drive applications. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, for additional motor and drive specifications. Refer to Specification Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS
- H. Mixing Boxes: Mixing box shall consist of casing and outdoor air and return air dampers in opposed blade arrangement with damper linkage for automatic operation. Coordinate damper operator with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Dampers shall be of ultra-low leak design with metal compressible bronze jamb seals and extruded vinyl edge seals on all blades. Blades shall rotate on stainless steel sleeve bearings or bronze bushings. Leakage rate shall not exceed 1.6 cubic meters/min/square meter (5 CFM per square foot) at 250 Pa (1 inch WG) and 2.8 cubic meters/min/square meter (9 CFM per square foot) at 995 Pa (4 inch WG) Electronic operators shall be furnished and mounted in an accessible and easily serviceable location by the air handling unit manufacturer at the factory. Damper operators shall be of same manufacturer as controls furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.M. Blenders: Construction of the blender section shall be of welded aluminum 2 mm (0.081 inch) thick framing and turbulators. The mixer shall have no moving parts and shall contain a primary set of directional changing vanes, a secondary set of turbulator vanes, and a cone design for mixing of air streams. Certify blender performance to achieve no more than a 5°F variation across the cross section of the AHU measured 12 inches downstream of the blender over a face velocity range of 1-4 m/s (200-800 FPM).
- I. Filter Section: Refer to Section 23 40 00, HVAC AIR CLEANING DEVICES, for filter requirements.
 - 1. Filters including one complete set for temporary use at site shall be provided independent of the AHU. The AHU manufacturer shall install filter housings and racks in filter section compatible with filters

furnished. The AHU manufacturer shall be responsible for furnishing temporary filters (pre-filters and after-filters, as shown on drawings) required for AHU testing.

2. Factory-fabricated filter section shall be of the same construction and finish as the AHU casing including filter racks and hinged double wall access doors. Filter housings shall be constructed in accordance with side service housing requirements in Section 23 40 00, HVAC AIR CLEANING DEVICES.

J. Coils: Coils shall be mounted on hot dipped galvanized steel supports to assure proper anchoring of coil and future maintenance. Coils shall be face or side removable for future replacement thru the access doors or removable panels. Each coil shall be removable without disturbing adjacent coil. Cooling coils shall be designed and installed to insure no condensate carry over. Provide factory installed extended supply, return, drain, and vent piping connections. Copper fins are also required for all duct-mounted and terminal reheat coils.

1. Integral Face and Bypass Steam Coils: Provide integral face and bypass dampers in vertical or horizontal orientation. Electric damper operators shall be furnished and mounted by the AHU manufacturer at the factory. Damper operators shall be of same manufacturer as controls furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

K. Humidifier: When included in design, coordinate the humidification requirements with section 23 22 13 Steam and Condensate Heating Piping. Provide air-handling unit-mounted humidification section with stainless steel drain pan of adequate length to allow complete absorption of water vapor. Provide stainless steel dispersion panel or distributors as indicated, with stainless steel supports and hardware.

L. Electrical and Lighting: Wiring and equipment specifications shall conform to Division 26, ELECTRICAL.

1. Vapor-proof lights using cast aluminum base style with glass globe and cast aluminum guard shall be installed in access sections for fan, mixing box, humidifier and any section over 300 mm (12 inch) wide. A switch shall control the lights in each compartment with pilot light mounted outside the respective compartment access door. Wiring between switches and lights shall be factory installed. All wiring shall run in neatly installed electrical conduits and terminate in a junction box for field connection to the building system. Provide single point 115 volt - one phase connection at junction box.
2. Install compatible 100 watt bulb in each light fixture.

3. Provide a convenience duplex receptacle next to the light switch.
4. Disconnect switch and power wiring: Provide factory or field mounted disconnect switch. Coordinate with Division 26, ELECTRICAL.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air handling unit in conformance with ARI 435.
- B. Assemble air handling unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas with paint in accordance with Military Spec. DOD-P-21035. Repair painted units by touch up of all scratches with finish paint material. Vacuum the interior of air handling units clean prior to operation.
- C. Leakage and test requirements for air handling units shall be the same as specified for ductwork in Specification Section 23 31 00, HVAC DUCTS AND CASINGS except leakage shall not exceed Leakage Class (C_L) 12 listed in SMACNA HVAC Air Duct Leakage Test Manual when tested at 1.5 times the design static pressure. Repair casing air leaks that can be heard or felt during normal operation and to meet test requirements.
- D. Perform field mechanical (vibration) balancing in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- E. Seal and/or fill all openings between the casing and AHU components and utility connections to prevent air leakage or bypass.

3.2 STARTUP SERVICES

- A. The air handling unit shall not be operated for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings are lubricated and fan has been test run under observation.
- B. After the air handling unit is installed and tested, provide startup and operating instructions to VA personnel.
- C. An authorized factory representative should start up, test and certify the final installation and application specific calibration of control components. Items to be verified include fan performance over entire operating range, noise and vibration testing, verification of proper alignment, overall inspection of the installation, Owner/Operator training, etc.

3.3 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

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