LEGEND

<u>rtu-1</u> . Equipme	ENT TAG		MOTORIZED DAMPER	TYP	TYPICAL
		· M ·		TEMP	TEMPERATURE
				SA	SUPPLY AIR
DETAIL TA	AG ("1" INDICATES IDENTIFICATION NUMBER; "M3"			DA DA	
	ES THE SHEET NUMBER DRAWN ON)		FIRE DAMPER WITH ACCESS DOOK	KA EA	
M3 /		FD		EA	EXHAUST AIR
\smile				OA	OUTDOOR AIR
			Smoke Damper with access door	TA	TRANSFER AIR
		SD		FF	EXHAUST FAN
		02			
SUPPLY	DUCT SECTION POSITIVE PRESSURE			CD	
			FIRE/SMOKE DAMPER WITH ACCESS DOOR	RC	RETURN GRILLE
		FSD		EC	EXHAUST CRILLE
RETURN	I OR EXHAUST DUCT NEGATIVE PRESSURE			SWG	SIDEWALL SUPPLY GRILLE
		$ \downarrow \downarrow \downarrow$		1	LOUVER
		<u> </u>	DACKDINALI DAMILEK		
AXD RECIAN		BD		CEI	
SHOWN	(; "B" INDICATES SIDE NOT SHOWN)			GREF	GENTRIFUGAL ROOF MOUNTED
		হা∕ক্রে≶			EXHAUST FAN
A/B FLATO	AL DUCT SIZE ("A" INDICATES SIDE SHOWN; "B"		TEE WITH TURNING VANES AND BALANCING	AHU	INDOOR AIR HANDLING UNIT
INDICA	IES SIDE NOT SHOWN)		DAMPERS IN EACH LEG	СН	CHILLER
				CI	
AØ ROUND	DUCT SIZE	┟╌╖╴┥		CB	OAS BOILEK
		ᡝ᠆᠊᠇ᢪ᠆᠊᠊ᠮ	FLEX DUCT TAKE OFF WITH MVD	CHP	CHILLED WATER PUMP
			RUNOUT SIZE FOUALS DIFFUSER NECK	BP	BOILER PUMP
EXTERN			SIZE UNI ESS OTHERWISE INDICATED	HW/P	HEATING HOT WATER PLIMP
	ALL'I INJULAILU DUCI WONK			<u>'</u> Å	
					THERMOSTAL, "I" INDICATES UNIT CONTROL
		<u>μ</u>		S	DUCT MOUNTED SMOKE DETECTOR
DUCT E	LBOW WITH TURNING VANES	<u> </u>	BRANCH DUCT TAKEOFF WITH MVD	- U -UC	UNDERCUT DOOR ¾"
				- <u></u> ,	
• •				NLC	
		•		N.I.C	
RADIUS	ED DUCT ELBOW	r f f f f f f f f f f f f f f f f f f f	ALITOMATIC AIR VENT	AFF	ABOVE FINISHED FLOOR
н		Ų		💋 FD	FLOOR DRAIN
				UTC TC	TRANSFER GRILLE
		•		SC	
FLEXIBL	E DUCT CONNECTION	\oslash	PRESSURE GAUGE AND 1/4 DALL VALVE	50	
		¥		5W5	SIDEWALL SUPPLY GRILLE
		Т		SWR	SIDEWALL RETURN GRILLE
MANUA	L VOLUME BALANCING DAMPER			DDC	DIRECT DIGITAL CONTROL
L '				CHW	CHILLED WATER
			AIRFLOW MEASURING STATION	CHWS	CHILLED WATER SUPPLY
······································		AFIVI			
······································	ALLY LINED DUCT	SR-1	AIR DEVICE TAG. TOP LINE INDICATES TYPE OF	CHWR	
		100	DEVICE BOTTOM LINE INDICATES AIRELOW IN CEM	HW	HOI WAIER
	CATE VALVE			HWS	Hot water supply
×		(2)\$8.1	AIR DEVICE TAGE TOP LINE INDICATES TYPE OF	HWR	HOT WATER RETURN
		100		NO	NORMALLY OPEN
.Г.		100	(2) INDICATES TYPICAL OF TWO DEVICES		
	DUTTENFLI VALVE		(2) INDIGALS THICAL OF TWO DEVICES		
		Срг		VFM	VENIURI FLOW MEIER
、 只 2		<u>3K-E</u>	LAIJTING AIR DEVICE TAG. TOP LINE INDICATES	Al	ANALOG INPUT
\bowtie	IWO-WAY CONIROL VALVE	100		AO	ANALOG OUTPUT
			AIKFLOW IN CFM	ni	
. P .					
	THREE-WAY CONTROL VALVE	-th		DO	
				TAB	iesting, adjusting and balancing
		1 PS	LOW PRESSURE SUPPLY	TU	TERMINAL UNIT
Υ.	STRAINER WITH BLOW DOWN VALVE AND			NOM	NOMINAL
₽	CAP	нгэ			VARIABLE FRECHENCY DRIVE
lты		XFR	IRANSFER		
	THERMOMETER	FUTURE	EQUIPMENT NOT PROVIDED IN THIS PHASE	E	EXISTING
-T-		FH	ELECTRIC HEATER	FCU	FAN COIL UNIT
Ľ				BCU	BLOWER COIL UNIT
75		IF	IKANSFEK FAN	M\/D	
-	ILIVII LINATUKE FUKTAJ INDIGATED	APD	AIR PRESSURE DROP		
[]		HC	DUCT MOUNTED HEATING COIL	UH	UNITHEATER
	VARIABLE FREQUENCY DRIVE	DIE	RELIEF AIR	(\mathbb{H})	HUMIDITY SENSOR
		KLF		Ľ	
DDC	DIGITAL CONTROLS ENGLOSURE			FD K	FIRE DAMPER AT CEILING DIFFUSER OR CRILI

	LC	DUVER SC	HEDUL	E	
MARK	AIRFLOW CFM (MAX)	LOUVER SIZE (WxH) INCHES	FREE AREA FT ² (MIN)	GREENHECK MODEL	NOTES
LVR-1 CFM	300	18x16	0.6	EHV-901D	1, 2
LVR-2 CFM	910	26x24	1.8	EHV-901D	1, 2
LVR-3 CFM	1470	32x28	2.8	EHV-901D	1, 2
LVR-4 CFM	630	76x18	3.6	EHV-901D	1, 2
LVR-5 CFM	985	36x18	1.7	EHV-901D + AFL-501	1,2,3,4
LVR-6 CFM	1825	32x28	5.2	EHV-901D + AFL-501	1,2,3,4
LVR-7 CFM	5400	72x24	6.3	EHV-901D + AFL-501	1,2,3,4
LVR-8 CFM	1375	44x44	7.6	EHV-901D + AFL-501	1,2,3,4
LVR-9 CFM	4160	60x42	8.3	EHV-901D + AFL-501	1,2,3,4

NOTES:

1. FINISH TO BE SELECTED BY ARCHITECT FROM MANUFACTURER'S STANDARD COLORS.

2. PROVIDE LOUVER WITH FLORIDA PRODUCT APPROVAL, LISTED FOR

COMPLIANCE WITH AMCA 540 AND AMCA 550. 3. PROVIDE LOUVER IN ACCORDANCE WITH FEMA P-361 AND ICC

500. 4. PROVIDE EHV-901D LOUVER IN FRONT OF AFL-501 LOUVER IN COMMON 10 GAUGE SLEEVE.

	AIR PURIFICATION EQUIPMENT SCHEDULE														
ZONE SUPPLY OA PRESS. BASIS OF MODEL QUANTITY ELECTRICAL NOTES															
	CFM	CFM	IN. W.C.	DESIGN			VOLTS/PHASE	WATTS							
AHU-4.1	3970	630	<0.01	GPS	IMOD	1	24	12	1,2,3,7						
AHU-4.2	10540	1825	<0.01	GPS	IMOD	1	24	12	1,2,3,7						
AHU-4.3	5805	985	<0.01	CPS	IMOD	1	24	12	1,2,3,7						

PROVIDE BASIS OF DESIGN OR EQUAL BY CLOBAL PLASMA OR ACTIVE AIR SOLUTIONS. 2. BI-POLAR IONIZATION SYSTEMS REQUIRING PERISHABLE CLASS TUBES ARE NOT ACCEPTABLE.

MANUFACTURER MUST PASS UL-867-2007 OZONE CHAMBER TESTING BY EITHER UL OR ETL. 4. ELECTRICAL INPUT SHALL BE FROM FAN CONTROL TERMINALS.

5. UNIT SHALL BE MOUNTED IN SUPPLY AIR DUCT.

6. UNIT SHALL BE MOUNTED IN FAN INTAKE. 7. UNIT SHALL BE MOUNTED ADJACENT TO COOLING COIL

						F A	AN SC	HEDUL	E		
UNIT	TYPE	CFM	MAX. FAN RPM	ESP (IN. H20)	MAX. MOTOR POWER	SONES/db (MAX.)	BASIS OF DESIGN	MODEL	CONTROL	ELECTRICAL VOLTS/PHASE	NOTES
EF-4.1	INLINE	220	983	0.25	29 W	0.9	GREENHECK	CSP-A390-VC	INTERLOCK WITH AHU-4.1 OA DAMPER	115/1	1,2,3,4,5
EF-4.2	INLINE	240	1021	0.25	34 W	0.8	GREENHECK	CSP-A390-VG	INTERLOCK WITH AHU-4.1 OA DAMPER	115/1	1,2,3,4,5
EF-4.3	INLINE	445	873	0.25	53 W	<0.3	GREENHECK	CSP-A700-VG	INTERLOCK WITH AHU-4.2 OA DAMPER	115/1	1,2,3,4,5
EF-4.4	INLINE	190	936	0.25	23 W	0.7	GREENHECK	CSP-A390-VC	INTERLOCK WITH AHU-4.3 OA DAMPER	115/1	1,2,3,4,5
EF-4.5	CEF	50	808	0.25	6 W	0.7	GREENHECK	SP-A50-90-VG	INTERLOCK WITH AHU-4.3 OA DAMPER	115/1	1,2,3,4,5,6
1. PRO	VIDE DIS	CONNEC	T		4. PR	OVIDE THERM	MAL OVERLOA	D			

CONTROLLER. 3. PROVIDE BACK DRAFT DAMPER

GENERAL NOTES

- 1. ALL DUCT DIMENSIONS ARE NET INSIDE.
- 2. VERIFY COLLAR SIZES ON ALL AIR TERMINALS, EQUIPMENT OUTLETS AND INLETS, TRANSITION DUCTWORK AS NECESSARY. EXTERNALLY INSULATE TRANSITIONS AT EOUIPMENT CONNECTIONS.
- 3. FIELD VERIFY CLEAR SPACE AVAILABLE, ROUTING PATH, AND CONFLICTS WITH STRUCTURE AND THE WORK OF OTHER TRADES PRIOR TO FABRICATING DUCTWORK. PROVIDE OFFSETS IN DUCTWORK AS REQUIRED. WHETHER SPECIFICALLY INDICATED ON DRAWINGS OR NOT. SUBMIT SHOP DRAWINGS ON DUCTWORK LAYOUT PRIOR TO COMMENCING WORK. MAINTAIN CLEARANCE AROUND ALL LIGHT FIXTURES AS REQUIRED TO REMOVE AND SERVICE FIXTURES. COORDINATE WITH ROOF TRUSSES/STRUCTURE. PRESSURE TEST ALL DUCTWORK FOR LEAKS. SEE SPECIFICATIONS.
- 4. CONTRACTOR SHALL INSTALL ALL EQUIPMENT, PIPING, AND DUCTWORK SUCH THAT MANUFACTURERS' RECOMMENDED CLEARANCES ARE MET FOR ALL ACCESS PANELS, MOTORS, FANS, BELTS, FILTERS AND AIR INTAKES. CONDENSATE LINES SHALL BE CLEAR OF FILTER RACK ACCESS.
- 5. PROVIDE DUCT FLEX CONNECTIONS & VIBRATION ISOLATION FOR ALL UNITS NOT INTERNALLY ISOLATED.
- 6. WASTE VENT STACKS, EXHAUST FANS, ETC. SHALL BE A MINIMUM OF 10 FT. FROM OUTSIDE AIR INTAKES.
- 7. ALL SUPPLY, RETURN, EXHAUST AND OUTSIDE AIR INTAKE DUCTWORK SHALL BE GALVANIZED SHEET METAL.
- 8. ALL AHU FILTERS SHALL BE OF A READILY AVAILABLE SIZE, OF DISPOSABLE TYPE, AND BE ACCESSIBLE WITHOUT THE USE OF SCREWS OR OTHER MECHANICAL DEVICES REQUIRING TOOLS.
- 9. PROVIDE ACCESS PANELS IN HARD CEILINGS AS REQUIRED FOR MAINTENANCE AND ADJUSTMENT OF EQUIPMENT LOCATED ABOVE CEILING.
- 10. ALL BIRD AND INSECT SCREENS SHALL BE ANODIZED ALUMINUM.
- 11. BECAUSE OF THE SMALL SCALE OF CONTRACT DOCUMENTS IT IS NOT POSSIBLE TO SHOW ALL OFFSETS, TRANSITIONS, ETC. THE CONTRACT DOCUMENTS ARE ESSENTIALLY DIACRAMATIC. THE CONTRACTOR SHALL PROVIDE SHOP DRAWINGS COORDINATED WITH THE STRUCTURE AND ARCHITECTURAL WORK FOR REVIEW PRIOR TO COMMENCING WORK.
- 12. THIS PROJECT SHALL INCLUDE COMMISSIONING OF THE HVAC, CONTROLS, AND RELATED ELECTRICAL SYSTEMS. THE SERVICES OF THE COMMISSIONING AUTHORITY ARE PROVIDED UNDER SEPARATE CONTRACT. UNDER THIS CONTRACT, THE PRIME CONTRACTOR, SUBCONTRACTORS, AND EQUIPMENT MANUFACTURERS SHALL PROVIDE LABOR AND MATERIAL AS REQUIRED TO ASSIST AND PARTICIPATE IN THE COMMISSIONING PROCESS FOR THE SCOPE OF WORK AS DESCRIBED IN SECTION 230800 OF THE PROJECT SPECIFICATIONS.
- 13. ALL WORK SHALL COMPLY WITH SEVENTH EDITION (2020) FLORIDA BUILDING CODE.
- 14. MOUNT ALL THERMOSTATS 48" ABOVE FINISHED FLOOR.

PIPING GENERAL NOTES

- 1. BUTTERFLY VALVES INDICATED FOR FLOW BALANCING AND SHUT OFF SERVICE SHALL BE PROVIDED WITH INFINITE POSITION THROTTLING HANDLE AND MEMORY STOP AFTER HYDRONIC TEST AND BALANCE HAS BEEN COMPLETED, THE CONTRACTOR SHALL POSITION THE MEMORY STOP AT THE FINAL BALANCE POINT OF EACH VALVE. PROVIDE STAMPED ALUMINUM TAG FOR EACH VALVE INDICATING "BALANCING VALVE - DO NOT REMOVE MEMORY STOP - RETURN TO BALANCE SETTING."
- 2. PROVIDE AIR CHAMBER AND AUTOMATIC AIR VENTS AT ALL HIGH POINTS IN SYSTEM, PIPE TO FLOOR DRAIN WITH COPPER TUBING. SEE "TYPICAL AIR CHAMBER DETAIL."
- 3. BUTTERFLY VALVES FOR SHUT OFF SERVICE SHALL BE PROVIDED WITH STAMPED ALUMINUM TAG INDICATING "SERVICE VALVE."
- 4. ALL CONNECTIONS TO AIR VENTS AND PRESSURE GAGES SHALL BE MADE WITH BRASS PIPING.
- 5. INSTALL PIPE HANCERS NEXT TO AND ON BOTH SIDES OF ALL EQUIPMENT. 6. SEAL ALL PIPE PENETRATIONS OF WALLS AND FLOORS AIR TIGHT REGARDLESS OF WHETHER WALLS OR FLOORS ARE FIRE RATED OR NOT.
- 7. UNDERGROUND CHILLED & HOT WATER PIPING SHALL BE FACTORY FABRICATED PREINSULATED SCHEDULE 40 STEEL CARRIER PIPE WITH POLYURETHANE INSULATION AND HDPE JACKET.

2. PROVIDE SOLID STATE SPEED

5. PROVIDE DIRECT DRIVE FAN 6. PROVIDE ALUMINUM GRILLE

DESIGN CONDITIONS SCHEDULE

	SUMMER *F DB/WB	% RELATIVE HUMIDITY	WINIER *F DB/WB	% RELATIVE HUMIDITY
INDOOR CONDITIONS	75⁰F	20-60%	70°F	20-60%
OUTDOOR CONDITIONS	93°F/78°F		28°F	

1. OUTDOOR CONDITIONS BASED ON ASHRAE 0.4% FOR PENSACOLA, FLORIDA.

2. MEAN COINCIDENT DB/WB CONDITIONS.

DUCTWORK AND INSULATION
GENERAL NOTES

- 1. ALL ROUND FLEXIBLE DUCT SHALL BE FLEXMASTER TYPE 8M OR ENCINEER APPROVED EQUAL. MAXIMUM LENGTH OF ANY FLEXIBLE DUCT RUNOUT SHALL BE 5'-O". WHERE LENGTH REQUIRED EXCEEDS 5'-0", INSTALL EXTERNALLY INSULATED ROUND SNAPLOCK DUCT FOR BALANCE OF DISTANCE TO SPIN-IN TAP AT MAIN DUCT TRUNK.
- 2. SEAL ALL DUCT PENETRATIONS OF WALLS AND FLOORS AIRTIGHT, RECARDLESS OF WHETHER WALLS AND FLOORS ARE FIRE RATED OR NOT.
- 3. UNLESS OTHERWISE INDICATED. ALL SUPPLY AIR DUCTWORK UPSTREAM OF TERMINAL UNITS SHALL BE OVAL OR ROUND, SMACNA STATIC PRESSURE CLASS 3" W.C., SEAL CLASS A, DOUBLE WALL SPIRAL WITH PERFORATED INNER WALL. DUCT SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS.
- 4. ALL SUPPLY AIR DUCTWORK DOWNSTREAM OF TERMINAL UNITS (EXCEPT TAKEOFFS TO SUPPLY AIR DIFFUSERS) SHALL BE LOW PRESSURE RECTANGULAR, SMACNA STATIC PRESSURE CLASS 2" W.C., SEAL CLASS A, EXTERNALLY INSULATED. DUCT SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS.
- 5. ALL RETURN AIR DUCTWORK SHALL BE LOW PRESSURE RECTANGULAR, SMACNA STATIC PRESSURE CLASS 2" W.G., SEAL CLASS A, EXTERNALLY INSULATED. DUCT SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS. PROVIDE ACOUSTICAL DUCT LINER WHERE INDICATED.
- 6. ALL OUTSIDE AIR INTAKE DUCTWORK SHALL BE LOW PRESSURE RECTANCULAR, SMACNA STATIC PRESSURE CLASS 2" W.C., SEAL CLASS A, EXTERNALLY INSULATED. DUCT SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS.
- 7. STANDARD EXHAUST AIR DUCTWORK SHALL BE LOW PRESSURE RECTANGULAR, SMACNA STATIC PRESSURE CLASS 1/2" W.G., SEAL CLASS A, INSULATION NOT REQUIRED.
- 8. AVOID ROUTING DUCTWORK AND TU'S WITHIN 6" OF TOP OF LIGHT FIXTURES WHEREVER POSSIBLE. MAINTAIN CLEARANCE BETWEEN TU'S AND DUCT INSULATION TO TOP OF LICHTS. PROVIDE CLEARANCE ALL AROUND AIR TERMINAL UNITS AS REQUIRED FOR ROUTINE MAINTENANCE.
- 9. PROVIDE SHEET METAL NOSING ZEE AT ALL TRANSITIONS TO AND FROM INTERNALLY LINED DUCT.
- 10. PROVIDE MVD'S AT ALL TAKEOFFS FROM MAIN DUCTS.
- 11. HORIZONTAL CREASE DUCTWORK SHALL BE SLOPED AT MINIMUM OF 1" PER FOOT. CLEANOUTS SHALL BE PROVIDED AT CHANCES IN DIRECTION AND EVERY 20 FOOT.
- 12. GREASE DUCTWORK SHALL BE 18 GAUGE GALVANIZED STEEL WHERE CONCEALED AND 16 CAUGE STAINLESS STEEL WHERE EXPOSED WITH WELDED SEAMS. DUCTWORK SHALL BE WRAPPED WITH 1.5" FIRE PROTECTION DUCT WRAP SYSTEM TESTED PER ASTM E2336 AND MEETING REQUIREMENTS OF AN ALTERNATE SHAFT ENCLOSURE IN ACCORDANCE WITH FLORIDA BUILDING CODE, MECHANICAL.

A	IR DEV	ICE SC	CHEDULE	
	MAX AIRFLOW CFM	AIR DEVICE SIZE	DUCT CONNECTION SIZE	TITUS MODEL
	80	9x9	6Ø	TDC
	245	12x12	8Ø	TDC
	350	12x12	10Ø	TDC
	470	15x15	12Ø	TDC
	535	20x12	18x10	272FL
,TG,RF	<u>₹,ER</u>			
	450	12x12	12x12	350FL
	1705	22x22	22x22	350FL
	2850	46x22	46x22	350FL

ЛЕ 5 :		
MAX	NC=20	

MARK

CD-1 CFM

CD-2 CFM _____ CD-3 CFM CD-4 CFM

SWG-1 CFM

RG,EG,SG

XX-1 CFM

xx-2 CFM

<u>xx-3</u>

NOTES:

PROVIDE 2x2 LAY IN PANEL FOR AIR DEVICES IN LAY IN CEILINCS. PROVIDE BEVELED MOUNTING FRAME FOR CEILING DIFFUSERS IN HARD

CEILINGS. 4. PROVIDE FLAT MOUNTING FRAME FOR GRILLES LOCATED IN HARD CEILINGS. 5. PAINT ALL DUCT VISIBLE THROUGH GRILLES FLAT BLACK.

VENTILATION	VENTILATION SCHEDULE													
SPACE TYPE	VENTILATION CFM/S.F.	VENTILATION CFM/PERSON												
STORAGE	0.06	5												
RESTROOM	0	50/FIXTURE												
LOBBY	0.06	5												
AUDITORIUM	0.06	7.5												
STACE	0.06	5												
DINING ROOM	0.18	7.5												
KITCHEN	0.12	7.5												
CAFETERIA	0.18	7.5												
CLASSROOM	0.12	10												

VENTILATION RATES IN COMPLIANCE WITH THE FLORIDA BUILDING CODE MECHANICAL. VENTILATION HAS BEEN CALCULATED BASED ON THE AVERAGE OCCUPANCY FOR SPACES THAT PEAK OCCUPANCY IS LESS THAN 3 HOURS IN COMPLIANCE WITH FBC BUILDING 453.15.5



		VA	RIA	BLE	AI	S VC)LU	ME	TE	RN	///	IAL UN	IT SO	CHE	DUL	_E - A	HU	-4.1	
MARK	TOTAL	COOL	HEATING				HE	ATING (COIL					SOU	SOUND POWER AT 1.0"			MANUFACTURER	MODEL
TU∽	CFM	CFM MIN.	CFM MAX.	EAT	LAT	MBH	EWT	LWT	GPM	MAX. UNIT APD	MAX. WPD	CONTROL VALVE		REF.	RADIATED	DISCHARGE	SIZE		NUMBER
				(°F)	(°F)	(MIN.)	(°F)	(°F)		(IN.)	(FT.)	RUNOUT SIZE	DROP	CFM	NC	NC	(IN.)		
4.1.1	1040	460	460	51.4	85	16.8	160	140	1.7	0.19	0.29	2-WAY 1/2"	11.5 FT	1040	23	18	12	TITUS	DESV
4.1.2	455	135	135	51.4	85	5.0	160	140	0.5	0.08	0.21	2-WAY 1/2"	11.5 FT	455	25	20	7	TITUS	DESV
4.1.3	65	20	20	51.4	85	0.7	160	140	0.1	0.01	0.01	2-WAY 1/2"	11.5 FT	65	15		5	TITUS	DESV
4.1.4	95	25	25	51.4	85	0.8	160	140	0.1	0.01	0.01	2-WAY 1/2"	11.5 FT	95	20		5	TITUS	DESV
4.1.5	95	25	25	51.4	85	0.8	160	140	0.1	0.01	0.01	2-WAY 1/2"	11.5 FT	95	20		5	TITUS	DESV
4.1.6	95	25	25	51.4	85	0.8	160	140	0.1	0.01	0.01	2-WAY 1/2"	11.5 FT	95	20	-	5	TITUS	DESV
4.1.7	275	180	180	51.4	85	6.5	160	140	0.6	0.11	0.08	2-WAY 1/2"	11.5 FT	275	24	15	6	TITUS	DESV
4.1.8	145	20	20	51.4	85	0.6	160	140	0.1	0.02	0.01	2-WAY 1/2"	11.5 FT	145	18		6	TITUS	DESV
4.1.9	130	95	95	51.4	85	3.4	160	140	0.3	0.02	0.08	2-WAY 1/2"	11.5 FT	130	24		5	TITUS	DESV
4.1.10	165	100	100	51.4	85	3.6	160	140	0.4	0.02	0.12	2-WAY 1/2"	11.5 FT	165	19	10	6	TITUS	DESV
4.1.11	95	25	25	51.4	85	0.8	160	140	0.1	0.01	0.01	2-WAY 1/2"	11.5 FT	95	20	-	5	TITUS	DESV
4.1.12	180	110	125	51.4	85	4.5	160	140	0.5	0.05	0.06	2-WAY 1/2"	11.5 FT	180	20	11	6	TITUS	DESV
4.1.13	425	195	195	51.4	85	7.1	160	140	0.7	0.13	0.13	2-WAY 1/2"	11.5 FT	425	24	19	7	TITUS	DESV
4.1.14	300	155	155	51.4	85	5.7	160	140	0.6	0.12	0.08	2-WAY 1/2"	11.5 FT	300	22	15	6	TITUS	DESV
4.1.15	130	90	90	51.4	85	3.3	160	140	0.3	0.02	0.08	2-WAY 1/2"	11.5 FT	130	24		5	TITUS	DESV
4.1.16	400	210	210	51.4	85	7.5	160	140	0.8	0.12	0.16	2-WAY 1/2"	11.5 FT	400	24	18	7	TITUS	DESV

	VARIABLE AIR VOLUME TERMINAL UNIT SCHEDULE - AHU-4.3																		
MARK	TOTAL	COOL	HEATING		HEATING COIL SOUND POWER AT 1.0									R AT 1.0"	INLET	MANUFACTURER	MODEL		
10-	CFM	CFM MIN.	MAX.	EAT	LAT	MBH	EWT	LWT	GPM	MAX.	MAX.	CONTROL	CONTROL		RADIATED	DISCHARGE	SIZE		NUMBER
				(05)	(05)		(95)	(05)		APD		TYPE &	PRESSURE	REF.					
				(*F)	(*F)	(IVIIIN.)	(*F)	(*F)		(IN.)	(FI.)	RUNOUT SIZE	DROP	CFM	NC	NC	(IN.)		
4.3.1	125	70	70	46.3	85	3.6	160	140	0.4	0.02	0.08	2-WAY 1/2"	11.5 FT	125	-	23	5	TITUS	DESV
4.3.2	255	115	115	46.3	85	6.2	160	140	0.6	0.09	0.06	2-WAY 1/2"	11.5 FT	255	14	24	6	TITUS	DESV
4.3.3	1435	365	365	46.3	85	19.5	160	140	2.0	0.08	0.15	2-WAY 1/2"	11.5 FT	1435	17	20	14	TITUS	DESV
4.3.4	3320	1160	1160	46.3	85	48.4	160	140	4.8	0.49	0.39	2-WAY 3/4"	11.5 FT	3320	22	24	16	TITUS	DESV
4.3.5	155	150	155	46.3	85	8.2	160	140	0.8	0.04	0.08	2-WAY 1/2"	11.5 FT	155	10	18	6	TITUS	DESV
4.3.6	565	250	250	46.3	85	13.3	160	140	1.3	0.12	0.12	2-WAY 1/2"	11.5 FT	565	14	22	9	TITUS	DESV

NOTES:

1. ALL VAV TERMINAL UNITS SHALL BE PRESSURE INDEPENDENT.

2. PROVIDE ALL VAV TERMINAL UNITS WITH ACCESS PANEL

- 4. SOUND DATA FOR DISCHARGE NC BASED ON 10 dB 6. PROVIDE VAV TERMINAL UNITS WITH FACTORY ROOM ABSORPTION, 5' LINED DUCT (12"x12") WITH 1" THICK FIBERGLASS INSULATION, 6' LINED FLEX DUCT (8") TO DIFFUSER, AND MAX 300 CFM PER DIFFUSER. 7.
- 5. SOUND DATA FOR RADIATED NC BASED ON 10 dB ROOM ABSORPTION, 3' DEEP CEILING CAVITY, AND 5/8" THICK, 35 LB/CU. FT. FIBER CEILING TILE.

MULTIPOINT FLOW SENSOR. PROVIDE FACTORY MOUNTED 120V CONTROLS TRANSFORMER TO SUPPLY 24 VOLT POWER TO DAMPER ACTUATOR AND CONTROLS.

8. PROVIDE ALL VAV TERMINAL UNITS WITH DISCONNECT

														(CUS	TON	1 AIF	R HA	ND	LINC	GU	NIT 9	SCHEDUL	.E												
					F/	AN DATA										Cł	HILLED WA	TER COIL	DATA									2	HEATING	COIL DAT	4		FILTER	SECTION		
UNIT	TYPE	FAN		MAX.	MIN.	MIN.	APPROX.	TOTAL	MAXIMUN	I NOM	MAX. FACE	COIL	UNIT TOTAL	UNIT SENSIBLE		AIR	SIDE					WATER	R SIDE			TOTAL	AIR SIDE			W	ATER SIDE			FILTER	THICK-	
DESIG- NATION		TTPE	CONTROL	AIR FLOW (CFM)	AIR FLOW (CFM)	OA DAMPER (CFM)	ESP (IN. W.C.)	SP (IN. W.G.)	MOTOR HP (QTY)	MOTOR RPM	VELOCITY (FPM)	AIR FLOW (CFM)	CAPACITY (MBH)	CAPACITY (MBH)	E (°F) DB	AT (°F) WB	LA (°F) DB	AT (°F) WB	FLOW (CPM)	EWT (°F)	LWT (°F)	MAX. WPD (FT H2O)	CONTROL VALVE (BY DDC CONTRACTOR)	CONTROL VALVE PRESSURE DROP	COIL	CAPACITY (MBH)	EAT (°F)	FLOW (GPM)	EWT L (°F) (VT WP (F) (FT H)	CONTROL VALV 20) DDC CONT	(BY CONTROL VALVE PRESSURE DROP	TYPE	EFF. (%)	NESS NOTE	ΞS
AHU-4.1	HDT	PLENUM	VAV	3970	1855	630	2.0	4.56	4.6 BHP	2239	500	3815	137.5	100.7	75.8	63.3	51.4	50.3	18.3	42	57	1.03	2-WAY	11.5 FT	NONE	N/A	N/A	N/A	N/A M	/A N//	A N/A	N/A	CARTRIDGE	95	12 1,2,3,4	,5,6,7
AHU-4.2	HDT	PLENUM	SZVAV	10540	2985	1825	2.0	4.71	12.1 BHF	1859	500	10195	413.3	271.6	76.1	64.8	51.4	50.5	55.1	42	57	4.99	2-WAY	11.5 FT	REHEAT	113.8	40.5	11.4	160 1	40 2.8	2 2-WAY	11.5 FT	CARTRIDGE	95	12 1,2,3,4	r,5,6,7
AHU-4.3	HDT	PLENUM	VAV	5805	2110	985	1.5	4.34	6.2 BHP	2109	500	5625	201.5	149.1	75.9	63.2	51.4	50.3	26.9	42	57	1.59	2-WAY	11.5 FT	NONE	N/A	N/A	N/A	N/A M	/A N//	A N/A	N/A	CARTRIDGE	95	12 1,2,3,4	,5,6,7
	SCHE	Edule Leci	END:									SCHEDULE NOTES:									3	. AVERA	CE ATMOS	SPHERIC D	UST SPOT	FFICIENCY	BASED									

HDT - HORIZONTAL DRAW THRU

SDU - STACKED DEHUMIDIFICATION UNIT FC - FORWARD CURVED

PF - PLENUM FAN BC - BACKWARD CURVED

SZVAV - VARIABLE AIR VOLUME, SINGLE ZONE VAV - VARIABLE AIR VOLUME, MULTIPLE ZONES CV - CONSTANT VOLUME

- SWITCH.

- TO ALLOW SERVICING OF AIR VALVE WITHOUT DISCONNECTING DUCT WORK.
- 3. PROVIDE ALL VAV TERMINAL UNITS WITH FIBER FREE INSULATION.

			DUCTI	ESS SPI	IT SYST	EM UNIT S	SCHE	DULE			
UNIT DSHP/WM	BASIS OF DESIGN	MODEL DSHP/WM	TYPE	NOMINAL COOL CAPACITY (BTUH)	NOMINAL HEAT CAPACITY (BTUH)	REFIG PIPE DIAMETER LIQUID/SUCTION (IN)	AIRFLOW (CFM)	VOLTS/PHASE	MCA	МОСР	NOTES
4.1/4.1.1	MITSUBISHI	PUZ-A18-NKA7/PKA-A18LA	WALL MOUNT	18000	19000	0.5/0.25	455	208/1	11	28	1,2,3,4,5,6,7,8,9,10
4.2/4.2.1	MITSUBISHI	PUZ-A18-NKA7/PKA-A18LA	WALL MOUNT	18000	19000	0.5/0.25	455	208/1	11	28	1,2,3,4,5,6,7,8,9,10
4.3/4.3.1	MITSUBISHI	PUZ-A18-NKA7/PKA-A18LA	WALL MOUNT	18000	19000	0.5/0.25	455	208/1	11	28	1,2,3,4,5,6,7,8,9,10

COIL EAT OF 80/67°F (DB/WB), OUTDOOR OF 95°F (DB) 5. PROVIDE FACTORY ENGINEERED SHOP DRAWINGS WITH 2. NOMINAL HEATING CAPACITIES ARE BASED ON INDOOR

COIL EAT OF 70°F (DB), OUTDOOR OF 43°(WB) 3. EFFICIENCY VALUES FOR EER, IEER, AND COP ARE BASED ON AHRI 1230 TEST METHOD FOR MIXTURE OF DUCTED 7. PROVIDE CONDENSATE PUMP - 0.1 GPM AT 12FT OF AND NON-DUCTED INDOOR UNITS.

1. NOMINAL COOLING CAPACITIES ARE BASED ON INDOOR 4. HEATING AND COOLING SHALL INCLUDE NO DIVERSITY.

REFRIGERANT PIPE SIZES.

6. EXPOSED (INDOOR OR OUTDOOR) REF PIPING SHALL BE HARD DRAWN COPPER.

HEAD. BLUE DIAMOND MICROBLUE OR EQUAL.

CHILLER SCH	IEDULE	
MARK	CH-1	CH-2
COMPRESSOR TYPE	SCREW	SCREW
CONDENSOR TYPE	AIR COOLED	AIR COOLED
MINIMUM CAPACITY (TONS)	70	70
MAXIMUM POWER (TOTAL UNIT KW)	75.95	75.95
FULL LOAD EFFICIENCY (EER)	10.85	10.85
PART LOAD EFFICIENCY (IPLV)	16.63	16.63
VOLTAGE/PHASE	208/3	208/3
MCA/MOP (AMPS)	308/350	308/350
ENTERING WATER TEMP. (°F)	57	57
LEAVING WATER TEMP. (°F)	42	42
CHILLED WATER FLOW (GPM)	151.8	151.8
EVAPORATOR WPD FT. (MAX)	10.0	10.0
EVAPORATOR FOULING FACTOR (HR-SQ FT-F/BTU)	0.000100	0.000100
CONDENSER ENTERING AIR TEMP. (°F)	95.0	95.0
NUMBER OF REFRIGERANT CIRCUITS	2	2
MINIMUM PART LOAD CAPACITY (WITH ARI RELIEF)	25%	25%
REFRIGERANT	R-454B	R-454B

NOTES: 1. PROVIDE 3/4" FLEXIBLE UNICELLULAR INSULATION PACKAGE FOR EVAPORATOR, WATER BOXES, AND MOTOR HOUSING. FACTORY FOAM INSULATION ON SUCTION LINE, LIQUID LEVEL SENSOR, AND OIL RETURN ASSEMBLY.

2. PROVIDE FACTORY SOUND REDUCTION PACKAGE AND INSULATION. 3. PROVIDE FACTORY WIRED AND MOUNTED DISCONNECT AND WYE-DELTA

STARTER. 4. PROVIDE CHILLER WITH MAXIMUM A-WEIGHTED SOUND PRESSURE AT

30' OF 64 dBA MAXIMUM. SOUND RATINGS IN ACCORDANCE WITH ARI STANDARD 370.

5. PROVIDE ELECTRONIC CONTROLS FOR VARIABLE PRIMARY FLOW.

1. ESP DOES NOT INCLUDE PRESSURE DROP THROUGH AHU CASING OR COILS.2. TOTAL SP INCLUDES PRESSURE DROP THROUGH CASING

AND COILS.

5. 30% PRE FILTERS AND SPECIFIED FINAL FILTERS. 6. VARIABLE FREQUENCY DRIVE WITH BUILT IN DISCONNECT FOR FAN MOTOR PROVIDED BY DDC CONTRACTOR

7. 208V/3 PHASE

8. PROVIDE DRAIN PAN LEVEL SENSOR TO SHUT DOWN UNIT IN THE EVENT OF CONDENSATE DRAIN FAILURE. 9. INDOOR UNIT TO BE POWERED BY OUTDOOR UNIT.

10. PROVIDE WITH FACTORY INSTALLED REFRICERANT MONITORING SYSTEM AND EPA APPROVED REFRIGERANT.

PUMP SCHEDULE DESIGNATION CHP-1 CHP-2 HWP-1 HWP-2 USE CHILLED WATER CHILLED WATER HOT WATER HOT WATER PATTERSON PATTERSON PATTERSON PATTERSON MANUFACTURER - MODEL E2DA9A-CC E2DA9A-CC E1.5BA9A-CC E1.5BA9BA-CC TYPE CLOSED COUPLED CLOSED COUPLED CLOSED COUPLED CLOSED COUPLED SUCTION SIZE (IN.) 2.5 2.5 2 2 DISCHARGE SIZE (IN.) 2 2 1.5 1.5 PUMP TYPE END SUCTION END SUCTION END SUCTION END SUCTION CAPACITY (CPM) 151.8 151.8 60.5 60.5 TOTAL HEAD (FT. H20) 68.2 68.2 69.9 69.9 RPM 1800 1800 1800 1800 MINIMUM EFFICIENCY (%) 70.1 70.1 50.**6** 50.6 MOTOR HP (MAX) 5 5 3 208/3 VOLTAGE/PHASE 208/3 208/3 208/3

NOTES: 1. ALL PUMPS SHALL BE BRONZE FITTED.

2. ALL PUMPS SHALL HAVE ENERGY EFFICIENT MOTORS. 3. SUCTION AND DISCHARGE SIZES ARE THE MINIMUM ACCEPTABLE.

BOILER SC	HEDULE
MARK	GB-1
MANUFACTURER	FULTON
MODEL NUMBER	EDR-750
TYPE / FLUID	WATER
CAS INPUT (MBH)	750
NET OUTPUT (MBH)	728.3
WORKING PRESSURE (PSI)	160
FUEL	NATURAL GAS
PRESSURE DROP (FT. H20)	1.15
ELECTRICAL CIRCUIT (V/Ø)	120/1
WATER SUPPLY TEMP (°F)	160
WATER RETURN TEMP (°F)	140
WATER FLOW (GPM)	60.5

NOTES:

1. PROVIDE 5:1 TURN DOWN 2. MINIMUM EFFICIENCY AT DESIGN CONDITIONS = 88%

3. PROVIDE BOILER PLANT MANAGER WITH BACNET INTERFACE TO CAMPUS DDC SYSTEM.

4. PROVIDE TYPE 'B' CAS VENT AND GALVANIZED INTAKE DUCT. 5. PROVIDE CONDENSATE DRAIN PH NEUTRALIZING KIT.

4. BASIS OF DESIGN: TRANE CUSTOM AIR HANDLING UNIT





PROJECT NAME / LOCATION:	SUBMITTAL	DATE	REVISION	S		SEAL
MOWAT MIDDLE SCHOOL	GMP DOCUMENTS	01/06/2025	NO. DATE	E DESCRIPTION	452 Clini 850.522 Clini Florida 6 Null TAN	
CAFETERIA AND ADMINISTRATION ADDITION					T IN Con Street, 33447 Pro- Certificate Watford, P TS	
					F E Maria ject N of Aut E Flor	
PANAMA CITY, FLORIDA					O E F F anna, FI- horizati ida Lice	
SHEET TITLE:					C C C C C C C C C C C C C C C C C C C	
HVAC NEW WORK PLAN-BUILDING 4					2 1 1 1 1 1 1 1 1	

S			



	SHEET NOTE
	MAKE CONNECTION TO EXISTING SITE EARLY PACKAGE.
2 3	PROVIDE MOTORIZED CONTROL VALV PROVIDE MOTORIZED CONTROL VALV
4	FOR EACH POINT WHERE HYDRONIC I WALL OF THE HARDENED AREA, THE P BE PROTECTED. PROVIDE PRODUCTS F PENETRATION HOUSING, LLC. OR APP MEETING ICC-500 AND FEMA 361 STA DETAIL 9/M3.1. PROVIDE CYCLONE WA PENETRATION WITH THE CYCLONE WA THE ADMINISTRATION SIDE OF THE WA EXIT SEALS. INSTALL PER MANUFACTUR INSTRUCTIONS. PROVIDE BREAKAWAY ADMINISTRATION SIDE OF PENETRATION
5	PROVIDE 3" CHILLED WATER BYPASS.
6	Route condensate full size of un Floor drain in room 4-427.
7	ROUTE CONDENSATE FULL SIZE OF UN HUB DRAIN IN ROOM 4-453. REFER T DRAWINGS FOR EXACT LOCATION.
8	Route condensate full size of un Hub drain in Room 4-450. Refer t Drawings for exact location.

- YR, SCREWED ENDS, Y-PATTERN, LINE SIZE, WITH TWO FACTORY P/T PORTS. RANCE 2-32 PSID.
- 3) INSTALL COIL COMPONENTS IN THE PHYSICAL RELATIONSHIP INDICATED WITH RESPECT TO THE COIL, AND TO EACH OTHER.
- 4) INSTALL 2-WAY CONTROL VALVE WITH ACTUATOR IN VERTICAL POSITION.
- 5) INSTALL P/T PORTS IN REDUCING TEE. HALF COUPLINGS ARE NOT ALLOWABLE.
- ARRANGE PIPING SUCH THAT THE ENTIRE COIL CONNECTION ASSEMBLY CAN BE 6) REMOVED BY DISCONNECTING AT POINTS MARKED WITH AN ASTERISK (*) FOR COIL SERVICING. PIPING SHALL NOT INTERFERE WITH ACCESS TO ANY COMPONENT OF THE AIR HANDLING UNIT THAT REQUIRES SERVICE.

TYPICAL AHU COOLING COIL CONNECTION SCHEMATIC $\overline{2}$ SCALE: NONE M4.1 PIPE SIZE 2" AND SMALLER

 $\langle 3 \rangle$ SUPPLY RUNOUT

5 1/4" AUTOMATIC AIR VENT IN COIL HEADER, FLOW DESIGN MODEL AA025.

 $\langle 6 \rangle$ BALL SERVICE VALVE, SCREWED

 (7)
 AUTOMATIC FLOW CONTROL VALVE,
 SCREWED

8 2-WAY CONTROL VALVE, BRONZE SCREWED BODY, MIXING PATTERN, LINEAR FLOW PLUC.

 $\langle 9 \rangle$ SERVICE UNION

10 PRESSURE/TEMPERATURE PORT WITH EXTENDED NECK

BRONZE STRAINER, SCREWED. (12) STRAINER BLOWDOWN/HOSE END DRAIN VALVE WITH BRASS CAP AND CHAIN

FLOW DESIGN MODEL HE. 3/8" COPPER DRAIN W/BALL VALVE

(14) STAINLESS STEEL WELL FOR DDC TEMPERATURE TRANSMITTER IN TEE, COORDINATE WITH DDC CONTRACTOR.

(15) 1/2" AUTOMATIC AIR VENT, SEE MOUNTING DETAIL THIS SHEET.

(16) THERMOMETER

1 INSULATION 2

2 PIPE COVERING PROTECTION SADDLE

 $\langle \mathfrak{Z} \rangle$ hanger rod fasten to structure per specification $\langle 4 \rangle$ CLEVIS TYPE HANGER

OVERHEAD PIPE SUPPORT 3

SCALE: NONE M4.1

EVENTER AND METER	(14)	FLEXIBLE CONNECTOR
20 PSI	(15)	Concrete Housekeeping Pad 6" Larger Than Equipment Footprint and 4" Thick
30 PSI	(16)	THERMOMETER
	(17)	STAINLESS STEEL WELL FOR EMCS SENSOR
	(18)	PRESSURE GAUGE
OINTS, PIPE TO FLOOR	(19)	INSULATED CHWS, CHWR PIPING LOCATED ABOVE GRADE
HILLER SLAB.		WITH 4 WATT/LINEAR FOOT, 120 VOLT HEATER TAPE.
el strainer, pipe drain	(20)	PIPE SLEEVE AND CAULKING
	21	VAPOR PROOF FLOW SWITCH (NEMA 4X)
	22	CONNECT TO DOMESTIC COLD WATER SUPPLY
L FOR SHOT FEEDER	23	PROVIDE CONCRETE INERTIA BLOCK FOR FLOOR-MOUNTED EQUIPMENT (BF2) ON 4" CONCRETE PAD.
sion tank. Use taco Ance volume and a	24	PROVIDE TURBINE FLOW METER
	(25)	CHWS TO BUILDINGS 2 AND 3.
'PE CK10 SILENT SPRING CATIONS.	(26)	CHWR FROM BUILDINGS 2 AND 3.
e at full size of chw	(27)	MOTORIZED CONTROL VALVE

HEATING HOT WATER PLANT PIPING DIAGRAM NOTES

	REDUCED PRESSURE BACKFLOW PREVENTER AND METER	(16)	THERMOMETER
2	PRESSURE REDUCING VALVE SET AT 20 PSI	(17)	STAINLESS STEEL WELL FOR EMCS SENSOR
3	3/4" PRESSURE RELIEF VALVE SET AT 30 PSI	(18)	PRESSURE GAUGE
4	HWR FROM BLDG.	(19)	TYPE BF2 VIBRATION ISOLATION PER SPECIFICATIONS
5	HWS TO BLDG.	6	
6	AUTOMATIC AIR VENT AT ALL HIGH POINTS IN SYSTEM, PIPE TO FLOOR DRAIN WITH 1/4" COPPER TUBING.	21)	CONNECT TO DOMESTIC COLD WATER SUPPLY
$\langle 7 \rangle$	ASME RELIEF VALVE SET AT 30 PSI. PIPE DISCHARGE TO FLOOR DRAIN.	(22)	ANGLE IRON SUPPORT STAND - PAINT PER ARCHITECTURAL
(8)	AIR SEPARATOR WITH STAINLESS STEEL STRAINER, PIPE DRAIN TO		SPECIFICATIONS
_	FLOOR DRAIN	(23)	BOILER CONTROL PANEL.
৩	SUCTION DIFFUSER	24	6"Ø STAINLESS STEEL TYPE 'B' GAS FLUE VENT AND VENT CAP. REFER TO FLOOR PLANS FOR EXACT ROUTING.
(10)	5 GAL. CHEMICAL SHOT FEEDER. FILL FOR SHOT FEEDER SHALL BE A MAX. OF 36" AFF.	(25)	8"Ø PVC COMBUSTION AIR INTAKE ROUTED AS SHOWN ON FLOOR
(1)	REPLACEABLE BLADDER TYPE EXPANSION TANK WITH MINIMUM 140		
	GAL, ACCEFTAINCE VOLUME AND A TOTAL VOLUME OF 140 GAL.	20	CONDENSATE DRAIN TRAP BOILER ACCESSORY.
(12)	BUTTERFLY ISOLATION VALVE AND TYPE CK10 SILENT SPRING CHECK VALVE PER PROJECT SPECIFICATIONS.	(27)	PROVIDE TURBINE FLOW METER.
(13)	BOILER CONTROL TEMPERATURE SENSOR	28	PIPE SLEEVE AND CAULKING.
(14)	TYPE PF1 FLEXIBLE CONNECTOR PER PROJECT SPECIFICATIONS.	29	HWS TO BUILDINGS 2 AND 3.
(15)	6" CONCRETE HOUSEKEEPING PAD. REFER TO SPECIFICATIONS.	(30)	HWR FROM BUILDINGS 2 AND 3.
	4" HWS	S ————	

VERTICAL INSTALLATION

- 1. Opening Clearance The opening in the wall or floor shall be larger than the damper/sleeve assembly to permit installation or expansion. For two angle installations the opening shall be a minimum of 1/8" per foot (3 per 305) larger than the overall size of THE damper/sleeve assembly. The maximum opening size shall not exceed 1/8" per foot (3 per 305) plus 2" (51), nor shall the opening be less than 1/4" (6) larger than the damper/sleeve assembly. For one angle installations, the opening shall be a minimum of 1/4" (6) to a maximum of 1" (25) larger than the overall size of the damper/sleeve assembly. The opening may be as much as 2" (51) larger than the damper/sleeve assembly if a 16ga (1.6) mounting angles is utilized.
- 2. FASTENERS AND MULTIPLE SECTION ASSEMBLY Use No. 10 (M5) bolts or screws, 3/16" (5) rivets, tack welds or spot welds as depicted in figures 3 and 4 and spaced as follows when joining individual dampers to make multiple section damper assemblies or when fastening damper 6. Duct/Sleeve Connections TO THE SLEEVE:
- Vertical Mount (In wall) Galvanized steel dampers 12" (305) spacing Stainless steel dampers 6" (152) spacing Horizontal Mount (In floor) All dampers 6" (152) spacing
- Multiple section horizontal mount dampers require a 14 gage thick x 41/2" (2 x 114) wide steel reinforcing plate sandwiched between the damper frames with 1/2" (13) long welds staggered intermittently and spaced on maximum 6" (152) centers. The reinforcing plate must be the same material as the dampers. The length must be equal to the
- damper width of two or more adjoining damper sections. Reinforcing plates are NOT REQUIRED FOR assemblies consisting of two dampers attached end-to-end or three dampers ATTACHED SIDE-TO-SIDE AS DEPICTED IN FIGURE 5.
- **3. DAMPER SLEEVE** Sleeve thickness must be equal to or thicker than the duct connected to it. Sleeve gage requirements are listed in the SMACNA Fire, Smoke and Radiation
- DAMPER INSTALLATION GUIDE FOR HVAC SYSTEMS AND IN NFPA90A. If A breakaway style duct/sleeve connection is not used, the sleeve shall be a minimum of 16 gage (1.6) for dampers up to 36" (914) wide by 24" (610) high and 14 gage (1.9) for dampers exceeding 36" (914) wide by 24" (610) High. Damper sleeve shall not extend more than 6" (152) beyond the fire wall or partition unless damper is equipped with a factory installed access door. Sleeve may extend up to 16" (406) beyond the fire wall or partition on sides equipped with a factory installed access door. Sleeve shall terminate at both sides of wall within dimensions shown.
- 4. DAMPER ORIENTATION Use "Air Flow" and "Mount with Arrow Up" labels on Dynamic DIBD and DIBDX models for proper damper orientation. For Static IBD models use only "MOUNT WITH ARROW UP" label on damper for proper damper orientation.
- 5. MOUNTING ANGLES Mounting angles shall be a minimum of 11/2" x 11/2" x 20 gage steel (38 x 38 x 1.0). For openings in metal stud, wood stud walls or concrete/masonry WALLS AND FLOORS OF SIZES 90" X 49" OR 49" X 90" (2286 X 1245 OR 1245 X 2286) and less mounting angles are only required on one side of the wall or top side of the floor and must be attached to both the sleeve and the wall or 7 floor. Mounting angles may be installed directly to the metal stud under the wall board on metal stud wall installations only. Larger openings require mounting angles on both sides of the partition and must be attached only to the sleeve. Mounting angles must overlap the partition a minimum of 1" (25). Do not weld or fasten angles together at corners of dampers. Ruskin fire dampers may be installed using Ruskin FAST angle for one angle installation or Ruskin PFMA for two angle installations.

TO BE USED.

PRODUCTS TO BE USED TO THE PERMITTING AUTHORITY FOR THE ACTUAL SYSTEMS

NOTE: ALL SYSTEMS DETAILED ON MECHANICAL PENETRATIONS SHEETS ARE BASED ON THE MANUFACTURERS SPECIFIED AS BASIS OF DESIGN AND APPLY TO MECHANICAL, FIRE PROTECTION, AND PLUMBING. THE CONTRACTOR SHALL SUBMIT A PENETRATIONS PACKAGE DETAILING EACH PENETRATION AND

performed safely and do not cause system damage.

using 3/8" (10) steel bolts and nuts, and metal cleats, as tested by SMACNA, are approved break-away connections when installed as shown ON THE FLANGED SYSTEM BREAKAWAY CONNECTIONS SUPPLEMENT. d. Non-Break-away Duct/Sleeve Connections If other duct sleeve connections are used, the sleeve shall be a minimum of

. Installation and Maintenance

Flanged connection systems manufactured by Ductmate, Nexus or Ward are approved break-away connections when installed as shown on the Flanged System Breakaway CONNECTIONS SUPPLEMENT. TDC AND TDF Roll-formed flanged connections

16 GAGE (1.6) FOR DAMPERS UP TO 36" (914) wide x 24" (610) High and

14 GAGE (2.0) for dampers exceeding 36" (914) wide x 24" (610) High.

To ensure optimum operation and performance, the damper must be installed so

it is square and free from racking. Each fire damper should be maintained and

tested on a regular basis and in accordance with the latest editions of NFPA

90A and local codes. Care should be exercised to ensure that such tests are

- Note: When optional sealing of these joints is desired, the following sealants may be applied in accordance with the sealant manufacturer's instructions: HARdcast, Inc. – Iron Grip 601 Precision – PA2084T Eco Duct Seal 44-52 Design Polymerics – DP 1010 Flanged Break-away Style Duct Sleeve Connections.
- Duct diameters over 22" (559) and including 36" (914) Maximum 5 SCREWS. • DUCT diameters over 36" (914) and up to and including 191" (4851) total perimeter – Maximum 8 screws. For flat oval ducts, the diameter is considered the largest (major) dimension of the duct.
- slips up to 20" (508) long on the sides may also be used. b. Round and Oval Break-away Connections Round and flat oval break-away connections must use either A 4" (102) wide drawband or #10 sheet metal screws spaced equally around the circumference of the duct as follows: • Duct diameters 22" (559) and smaller – Maximum 3 screws.
- (Angle Reinforced), standing, standing S (bar Reinforced), standing S (angle reinforced, or drive slip joint. A maximum of two #10 sheet metal screws on each side and THE DOTTOM, located in the center of the slip pocket and penetrating both sides of the slip pocket may be used. Connections using these slip joints on the top and bottom with flat drive
- A MINIMUM OF 11/2" (38). For two angle installations the fasteners shall be spaced at 8" (203) o.c. A. BREAK-AWAY DUCT/SLEEVE CONNECTIONS RECTANGULAR DUCTS MUST USE ONE OR MORE OF THE CONNECTIONS: plain "S" slip, HEMMED "S" slip, double "S" slip, inside slip joint, standing S, standing S

(19). Screw fasteners used in masonry walls or floors must engage the wall

- MASONRY/WALL OR FLOOR: #10 self-tapping concrete screws. Wood/Steel Stud Wall: #10 screws b. Mounting Angle Fastener Spacing For one angle installations the sleeve fasteners shall be spaced at 6" (152) o.c. and the wall or floor fasteners shall be spaced at 12" (305) o.c. with A MINIMUM OF 2 FASTENERS ON EACH SIDE, TOP AND BOTTOM. SCREW FASTENERS USED in metal stud must engage the metal stud a minimum of 1/2" (13). Screw fasteners used in wood stud must engage the wood stud a minimum of 3/4"
- A. MOUNTING ANGLE FASTENERS Sleeve: #10 bolts or screws, 3/16" (5) steel rivets or 1/2" (13) long welds.

CONSULT CURRENT UNDERWRITERS LABORATORIES, INC. "FIRE RESISTANCE DIRECTORY" FOR DETAILS UL SYSTEM WL1003

- 1. WALL ASSEMBLY—THE 1 OR 2 HR FIRE-RATED CYPSUM WALLBOARD/STUD WALL ASSEMBLY SHALL BE CONSTRUCTED OF THE MATERIALS AND IN THE MANNER DESCRIBED IN THE INDIVIDUAL U300 OR U400 SERIES WALL OR PARTITION DESIGN IN THE UL FIRE RESISTANCE DIRECTORY AND SHALL INCLUDE THE FOLLOWING CONSTRUCTION FEATURES:
- A. STUDS—WALL FRAMING MAY CONSIST OF EITHER WOOD STUDS OR STEEL CHANNEL STUDS. WOOD STUDS TO CONSIST OF NOM 2 BY 4 IN. LUMBER SPACED 16 IN. OC WITH NOM 2 BY 4 IN. LUMBER END PLATES AND CROSS BRACES. STEEL STUDS TO BE MIN 3-1/2 IN. WIDE BY 1-3/8 IN. DEEP CHANNELS SPACED MAX 24 IN. OC.
- B. WALLBOARD, GYPSUM*-NOM 5/8 IN. THICK, 4 FT. WIDE WITH SQUARE OR TAPERED EDGES. THE GYPSUM WALLBOARD TYPE, THICKNESS, NUMBER OF LAYERS, FASTENER TYPE AND SHEET ORIENTATION SHALL BE AS SPECIFIED IN THE INDIVIDUAL U300 OR U400 SERIES DESIGN IN THE UL FIRE RESISTANCE DIRECTORY. MAX DIAM OF OPENING IS 15 IN.
- THE HOURLY F RATING OF THE FIRESTOP SYSTEM IS EQUAL TO THE HOURLY FIRE RATING OF THE WALL ASSEMBLY IN WHICH IT IS INSTALLED
- 2. THROUGH-PENETRANT—ONE METALLIC PIPE, CONDUIT OR TUBING TO BE INSTALLED EITHER CONCENTRICALLY OR ECCENTRICALLY WITHIN THE FIRESTOP SYSTEM. THE SPACE BETWEEN PIPES, CONDUITS OR TUBING AND THE STEEL SLEEVE (ITEM 3A) SHALL BE MIN OF 0 IN. (POINT CONTACT) TO MAX 2-3/8 IN. PIPE, CONDUIT OR TUBING TO BE RIGIDLY SUPPORTED ON BOTH SIDES OF WALL ASSEMBLY. THE FOLLOWING TYPES AND SIZES OF METALLIC PIPES, CONDUITS OR TUBING MAY BE USED
- A. STEEL PIPE—NOM 12 IN. DIAM (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL PIPE. B. IRON PIPE—NOM 12 IN. DIAM (OR SMALLER) SERVICE WEIGHT (OR HEAVIER) CAST IRON SOIL PIPE, NOM 12 IN.
- DIAM (OR SMALLER) OR CLASS 50 (OR HEAVIER) DUCTILE IRON PRESSURE PIPE. C. CONDUIT-NOM 6 IN. DIAM (OR SMALLER) STEEL CONDUIT OR NOM 4 IN. DIAM (OR SMALLER) STEEL ELECTRICAL
- METALLIC TUBING. D. COPPER TUBING-NOM 6 IN. DIAM (OR SMALLER) TYPE L (OR HEAVIER) COPPER TUBING.

- E. COPPER PIPE—NOM 6 IN. DIAM (OR SMALLER) RECULAR (OR HEAVIER) COPPER PIPE. 3. FIRESTOP SYSTEM—INSTALLED SYMMETRICALLY ON BOTH SIDES OF WALL ASSEMBLY. THE DETAILS OF THE FIRESTOP SYSTEM
- SHALL BE AS FOLLOWS. A. STEEL SLEEVE—CYLINDRICAL SLEEVE FABRICATED FROM MIN 0.019 IN. THICK (NO. 28 CAUCE) CALV SHEET STEEL AND HAVING A MIN 2 IN. LAP ALONG THE LONGITUDINAL SEAM. LENCTH OF STEEL SLEEVE TO BE EQUAL TO THICKNESS OF WALL PLUS 1 TO 4 IN. SUCH THAT, WHEN INSTALLED, THE ENDS OF THE SLEEVE WILL PROJECT APPROXIMATELY 1/2 TO 2 IN. BEYOND THE SURFACE OF THE WALL ON BOTH SIDES OF THE WALL ASSEMBLY. SLEEVE INSTALLED BY COILING THE SHEET STEEL TO A DIAM SMALLER THAN THE THROUGH OPENING, INSERTING THE
- COIL THROUGH THE OPENINGS AND RELEASING THE COIL TO LET IT UNCOIL AGAINST THE CIRCULAR CUTOUTS IN THE GYPSUM WALLBOARD LAYERS. B. PACKING MATERIAL—MIN 1 IN. THICKNESS OF MINERAL
- WOOL BATT INSULATION FIRMLY PACKED INTO STEEL SLEEVE ON BOTH SIDES OF THE WALL ASSEMBLY AS PERMANENT FORMS. PACKING MATERIAL TO BE RECESSED MIN 1/2 IN. FROM END OF STEEL SLEEVE (FLUSH WITH OR RECESSED INTO GYPSUM WALLBOARD SURFACE) ON BOTH SIDES OF WALL ASSEMBLY
- B1. PACKING MATERIAL—(NOT SHOWN)—AS AN ALTERNATE TO ITEM B, NOM 1 IN. THICK POLYETHYLENE BACKER ROD MAY BE USED. THE BACKER ROD IS TO BE RECESSED WITHIN THE STEEL SLEEVE A MIN OF 1 IN. FROM EACH SURFACE OF WALL C. FILL, VOID OR CAVITY MATERIALS*—CAULK—WHEN MINERAL
- WOOL BATT INSULATION IS USED, APPLIED TO FILL THE STEEL SLEEVE TO A MIN DEPTH OF 1/2 IN. ON BOTH SIDES OF WALL ASSEMBLY, WHEN BACKER ROD IS USED, A MIN THICKNESS OF 1 IN. OF CP-25WB+ CAULK IS REQUIRED FLUSH WITH SURFACE OF WALL. A NOM 1/4 IN. DIAM CONTINUOUS BEAD OF CAULK SHALL BE APPLIED AROUND THE CIRCUMFERENCE OF THE STEEL SLEEVE AT ITS ECRESS FROM THE CYPSUM WALLBOARD LAYERS ON BOTH SIDES OF THE WALL ASSEMBLY. MINNESOTA MINING & MFG. CO.-CP 25WB+ *BEARING THE UL CLASSIFICATION MARKING

- 1. FLOOR OR WALL ASSEMBLY-MIN 2-1/2 IN. THICK REINFORCED LIGHTWEIGHT OR NORMAL WEIGHT (100-150) PCF CONCRETE. WALL MAY ALSO BE CONSTRUCTED OF ANY UL CLASSIFIED CONCRETE BLOCKS*. MAX DIAM OF OPENING IS 18 IN. SEE CONCRETE BLOCKS (CAZT) CATEGORY IN THE FIRE
- RESISTANCE DIRECTORY FOR NAMES OF MANUFACTURERS 1A. STEEL SLEEVE—NOM 10 IN. (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL SLEEVE CAST OR CROUTED INTO FLOOR OR WALL ASSEMBLY. SLEEVE MAY EXTEND A MAX OF 2 IN. ABOVE TOP OF FLOOR OR BEYOND EITHER SURFACE OF WALL. T RATING IS 0 HR WHEN SLEEVE IS USED.
- 2. THROUGH PENETRANT—NOM 4 IN. DIAM (OR SMALLER) TYPE L (OR HEAVIER) COPPER PIPE, NOM 12 IN. DIAM (OR SMALLER) SERVICE WEIGHT (OR HEAVIER) CAST IRON SOIL PIPE, NOM 12 IN. DIAM (OR SMALLER) CLASS 50 (OR HEAVIER) DUCTILE IRON PRESSURE PIPE OR NOM 12 IN. DIAM (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL PIPE CENTERED IN THE OPENING AND RIGIDLY SUPPORTED ON BOTH SIDES OF THE FLOOR OR WALL ASSEMBLY.
- 3. PIPE COVERING*—NOM 1/2 TO 2 IN. THICK HOLLOW CYLINDRICAL HEAVY DENSITY (MIN. 3.5 PCF) GLASS FIBER UNITS JACKETED ON THE OUTSIDE WITH AN ALL SERVICE JACKET, LONGITUDINAL JOINTS SEALED WITH METAL FASTENERS OR FACTORY-APPLIED SELF-SEALING LAP TAPE. TRANSVERSE JOINTS SECURED WITH METAL FASTENERS OR WITH BUTT STRIP TAPE SUPPLIED WITH THE PRODUCT. SEE PIPE AND EQUIPMENT COVERING—MATERIALS*(BRGU) CATEGORY IN BUILDING MATERIALS DIRECTORY FOR NAMES OF MANUFACTURERS. ANY PIPE COVERING MATERIAL MEETING THE ABOVE SPECIFICATIONS AND BEARING THE UL CLASSIFICATION MARKING WITH A FLAME SPREAD INDEX OF 25 OR LESS AND A SMOKE DEVELOPED INDEX OF 50 OR LESS MAY BE USED.
- 4. FIRESTOP SYSTEM—THE DETAILS OF THE FIRESTOP SYSTEM SHALL BE AS FOLLOWS: A. PACKING MATERIAL—MIN 1 IN. THICKNESS OF FIRMLY PACKED MINERAL WOOL BATT INSULATION USED AS A PERMANENT FORM. PACKING MATERIAL
- TO BE RECESSED FROM TOP SURFACE OF FLOOR OR SLEEVE OR FROM BOTH SURFACES OF WALL AS REQUIRED TO ACCOMMODATE THE REQUIRED THICKNESS OF CAULK FILL MATERIAL (ITEM B). B. FILL, VOID OR CAVITY MATERIAL*—CAULK—APPLIED TO FILL THE ANNULAR
- SPACE FLUSH WITH THE TOP SURFACE OF THE FLOOR OR SLEEVE OR FLUSH WITH BOTH SURFACES OF WALL. WHEN NOM PIPE COVERING THICKNESS IS 2 IN., MIN THICKNESS OF CAULK FILL MATERIAL IS 2 IN. WHEN NOM PIPE COVERING THICKNESS IS 1-1/2 IN. OR LESS, MIN THICKNESS OF CAULK FILL MATERIAL IS 1 IN. THE HOURLY F AND T RATINCS OF THE FIRESTOP SYSTEM ARE DEPENDENT UPON THE THICKNESS OF THE FLOOR OR WALL, THE SIZE OF PIPE, THE THICKNESS OF PIPE COVERING MATERIAL AND THE SIZE OF THE
- ANNULAR SPACE (BETWEEN THE PIPE COVERING MATERIAL AND THE EDGE OF THE CIRCULAR THROUGH OPENING), AS SHOWN IN THE FOLLOWING TABLE: MIN FLOOR OR MAX PIPE NOM PIPE ANNULAR WALL THKNS DIAM COVERING THKNS SPACE F RATING T
- RATING HR IN. IN. HR 1 OR 1-1/2 1/2 TO 2-3/8 2 2-1/2 4 1/4 TO 3-5/8 2 1-1/2 4-1/2 4 1/2 TO 1-1/2 2 1/2 2-1/2 12 1 1/2 TO 2-3/8 3 1 4-1/2 12 12 1/2 1/2 TO 2-3/8 2-1/2 MINNESOTA MINING & MFC. CO.—CP 25WB+.

*BEARING THE UL CLASSIFICATION MARKING

CONSULT CURRENT UNDERWRITERS LABORATORIES "FIRE RESISTANCE DIRECTORY" FOR DETAILS

CONSULT CURRENT UNDERWRITERS LABORATORIES "FIRE RESISTANCE DIRECTORY" FOR DETAILS UL SYSTEM WL5011

- 1. WALL ASSEMBLY—THE 1 OR 2 HR FIRE-RATED CYPSUM WALLBOARD/STUD WALLASSEMBLY SHALL BE CONSTRUCTED OF THE MATERIALS AND IN THE MANNER DESCRIBED IN THE INDIVIDUAL U300 OR U400 SERIES WALL AND PARTITION DESIGN IN THE UL FIRE RESISTANCE DIRECTORY AND SHALL INCLUDE THE FOLLOWING CONSTRUCTION FEATURES:
- A. STUDS—WALL FRAMING MAY CONSIST OF EITHER WOOD STUDS OR STEEL CHANNEL STUDS. WOOD STUDS TO CONSIST OF NOM 2 BY 4 IN. LUMBER SPACED 16 IN. OC WITH NOM 2 BY 4 IN. LUMBER END PLATES AND CROSS BRACES. STEEL STUDS TO BE MIN 3-5/8 IN. WIDE BY 1-3/8 DEEP CHANNELS SPACED MAX 24 IN. OC. B. WALLBOARD, GYPSUM*-NOM 5/8 IN. THICK, 4 FT WIDE WITH SQUARE
- OR TAPERED EDGES. THE GYPSUM WALLBOARD TYPE, THICKNESS, NUMBER OF LAYERS, FASTENER TYPE AND SHEET ORIENTATION SHALL BE AS SPECIFIED IN THE INDIVIDUAL U300 OR U400 SERIES DESIGN IN THE UL FIRE RESISTANCE DIRECTORY. MAX DIAM OF OPENING IS 14-1/2 IN. FOR WOOD STUD WALLS AND 17 IN. FOR STEEL STUD WALLS. THE HOURLY F RATING OF THE FIRESTOP SYSTEM IS 1 HR WHEN INSTALLED IN A 1 HR FIRE RATED WALL AND 2 HR WHEN INSTALLED IN A 2 HR FIRE
- RATED WALL. 2. THROUGH PENETRANTS—ONE METALLIC PIPE, CONDUIT OR TUBING TO BE CENTERED WITHIN THE FIRESTOP SYSTEM. PIPE, CONDUIT OR TUBING TO BE RIGIDLY SUPPORTED ON BOTH SIDES OF WALL ASSEMBLY. THE FOLLOWING TYPES AND SIZES OF METALLIC PIPES, CONDUITS OR TUBING MAY BE USED:
- A. STEEL PIPE—NOM 12 IN. DIAM (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL PIPE. WHEN STEEL PIPE IS USED, T RATING IS 1 HR. B. CONDUIT—NOM 3 IN. DIAM (OR SMALLER) STEEL ELECTRICAL METALLIC TUBING OR STEEL CONDUIT. WHEN STEEL CONDUIT IS USED, T RATING IS
- C. COPPER TUBING—NOM 6 IN. DIAM (OR SMALLER) TYPE L (OR HEAVIER) COPPER TUBING. WHEN COPPER TUBING IS USED, T RATING IS 1/2 AND
- 1 HR WHEN INSTALLED IN 1 AND 2 HR RATED WALLS, RESPECTIVELY. D. COPPER PIPE—NOM 6 IN. DIAM (OR SMALLER) RECULAR (OR HEAVIER) COPPER PIPE. WHEN COPPER PIPE IS USED, T RATING IS 1/2 AND 1 HR WHEN INSTALLED IN 1 AND 2 HR RATED WALLS, RESPECTIVELY. . PIPE COVERING*-NOM 1 OR 1-1/2 IN. THICK HOLLOW CYLINDRICAL
- HEAVY DENSITY (MIN 3.5 PCF) CLASS FIBER UNITS JACKETED ON THE OUTSIDE WITH AN ALL SERVICE JACKET. LONGITUDINAL JOINTS SEALED WITH METAL FASTENERS OR FACTORYAPPLIED SELF-SEALING LAP TAPE. TRANSVERSE JOINTS SEALED WITH METAL FASTENER STRIP TAPE SUPPLIED

WITH THE PRODUCT.

- SEE PIPE AND EQUIPMENT COVERINGS—MATERIALS—(BRCU) CATECORY IN BUILDING MATERIALS DIRECTORY FOR NAMES OF MANUFACTURERS. ANY PIPE COVERING MATERIAL MEETING THE ABOVE SPECIFICATIONS AND BEARING THE UL CLASSIFICATION MARKING WITH A FLAME SPREAD INDEX OF 25 OR LESS AND A SMOKE DEVELOPED INDEX OF 50 OR LESS MAY BE USED.
- STEEL SLEEVE—CYLINDRICAL SLEEVE FABRICATED FROM MIN 0.019 IN. THICK (NO. 28 GAUGE) GALV SHEET STEEL AND HAVING A MIN 2 IN. LAP ALONG THE LONGITUDINAL SEAM. LENGTH OF STEEL SLEEVE TO BE EOUAL TO THICKNESS OF WALL PLUS 1 IN. SUCH THAT, WHEN INSTALLED, THE ENDS OF THE SLEEVE WILL PROJECT APPROX 1/2 IN. BEYOND THE SURFACE OF THE WALL ON BOTH SIDES OF THE WALL ASSEMBLY. THE DIAM OF THE OPENINCS CUT IN THE GYPSUM WALLBOARD LAYERS ON EACH SIDE OF THE WALL ASSEMBLY (CONCENTRIC WITH PIPE) TO BE 2 TO 2-1/2 IN. LARCER THAN OUTSIDE DIAM OF PIPE INSULATION SUCH THAT, WHEN THE STEEL SLEEVE IS INSTALLED, A 1 TO 1-1/4 IN. ANNULAR SPACE WILL BE PRESENT BETWEEN THE STEEL SLEEVE AND THE PIPE INSULATION AROUND THE ENTIRE CIRCUMFERENCE OF THE PIPE. SLEEVE INSTALLED BY COILING THE SHEET STEEL TO A DIAM SMALLER THAN THE THROUGH OPENING, INSERTING THE COIL THROUGH THE OPENINGS AND RELEASING THE COIL TO LET IT UNCOIL AGAINST THE CIRCULAR CUTOUTS IN THE CYPSUM WALLBOARD LAYERS.
- 5. PACKING MATERIAL—POLYETHYLENE BACKER ROD OR MIN 1 IN. THICKNESS OF MINERAL WOOL BATT INSULATION FIRMLY PACKED INTO STEEL SLEEVE ON BOTH SIDES OF THE WALL ASSEMBLY AS PERMANENT FORMS. PACKING MATERIAL TO BE RECESSED MIN 1 IN, FROM END OF STEEL SLEEVE (RECESSED MIN 1/2 IN, INTO CYPSUM WALLBOARD SURFACE) ON BOTH SIDES OF WALL ASSEMBLY.
- 6. FILL, VOID OR CAVITY MATERIALS*—CAULK—MIN 1 IN. THICKNESS OF FILL MATERIAL APPLIED WITHIN ANNULUS ON BOTH SIDES OF WALL ASSEMBLY. THICKNESS FOR FILL MATERIAL FOR NOM 3 IN. DIAM (OR SMALLER) STEEL PIPES OR CONDUITS MAY BE REDUCED TO A MIN 1/2 IN. A NOM 1/4 IN. DIAM CONTINUOUS BEAD OF CAULK SHALL BE APPLIED AROUND THE CIRCUMFERENCE OF THE STEEL SLEEVE AT ITS EGRESS FROM THE GYPSUM WALLBOARD LAYERS ON BOTH SIDES OF THE WALL ASSEMBLY
- MINNESOTA MINING & MFG. CO.-CP 25WB+ *BEARING THE UL CLASSIFICATION MARKING

UL SYSTEM CAJ5001

TYPICAL FIRE RATED WALL/FLOOR PENETRATION FIBERGLASS INSULATED METALLIC PIPE

CONSULT CURRENT UNDERWRITERS LABORATORIES "FIRE RESISTANCE DIRECTORY" FOR DETAILS UL SYSTEM CAJ5060

NOTE: ALL SYSTEMS DETAILED ON MECHANICAL PENETRATIONS SHEETS ARE BASED ON THE MANUFACTURERS SPECIFIED AS BASIS OF DESIGN AND APPLY TO MECHANICAL, FIRE PROTECTION, AND PLUMBING. THE CONTRACTOR SHALL SUBMIT A PENETRATIONS PACKAGE DETAILING EACH PENETRATION AND PRODUCTS TO BE USED TO THE PERMITTING AUTHORITY FOR THE ACTUAL SYSTEMS TO BE USED.

UL SYSTEM WL2003

- 1. WALL ASSEMBLY—THE 1 OR 2 HR FIRE-RATED GYPSUM WALLBOARD/STUD WALL ASSEMBLY SHALL BE CONSTRUCTED OF THE MATERIALS AND IN THE MANNER DESCRIBED IN THE INDIVIDUAL U300 OR U400 SERIES WALL OR PARTITION DESIGN IN THE UL FIRE RESISTANCE DIRECTORY AND SHALL INCLUDE THE FOLLOWING CONSTRUCTION FEATURES:
- A. **STUDS**—WALL FRAMING MAY CONSIST OF EITHER WOOD STUDS OR STEEL CHANNEL STUDS. WOOD STUDS TO CONSIST OF NOM 2 BY 4 IN. LUMBER SPACED 16 IN. OC WITH NOM 2 BY 4 IN. LUMBER END PLATES AND CROSS BRACES. STEEL STUDS TO BE MIN 3-5/8 IN. WIDE BY 1-3/8 IN. DEEP CHANNELS SPACED MAX 24 IN. OC.
- B. WALLBOARD, GYPSUM*—5/8 IN. THICK, 4 FT WIDE WITH SQUARE OR TAPERED EDGES. THE GYPSUM WALLBOARD TYPE, THICKNESS, NUMBER OF LAYERS, FASTENER TYPE AND SHEET ORIENTATION SHALL BE AS SPECIFIED IN THE INDIVIDUAL U300 OR U400 SERIES DESIGN IN THE UL FIRE RESISTANCE DIRECTORY. MAX DIAM OF OPENING IS 3-1/8 IN.
- 2. THROUGH PENETRANTS—ONE NONMETALLIC PIPE OR CONDUIT TO BE CENTERED INTHE THROUGH OPENING. THE ANNULAR SPACE BETWEEN PIPE OR CONDUIT AND PERIPHERY OF OPENING SHALL BE MIN 1/4 IN. AND MAX 3/8 IN. PIPE OR CONDUIT TO BE RICIDLY SUPPORTED ON BOTH SIDES OF THE FLOOR-CEILING ASSEMBLY THE FOLLOWING TYPES AND SIZES OF NONMETALLIC PIPES OR CONDUITS MAY BE USED:
- A. POLYVINYL CHLORIDE (PVC) PIPE—NOM 2 IN. DIAM (OR SMALLER) SCHEDULE 40 SOLID CORE PVC PIPE FOR USE IN CLOSED (PROCESS OR SUPPLY) OR VENTED (DRAIN, WASTE OR VENT) PIPING SYSTEM.
- B. RIGID NONMETALLIC CONDUIT++-NOM 4 IN. DIAM (OR SMALLER)(SCHEDULE 40 OR 80) PVC CONDUIT INSTALLED IN ACCORDANCE WITH ARTICLE 347 OF THE NATIONAL ELECTRIC
- CODE (NFPA NO. 70). C. CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE—NOM 2 IN. DIAM (OR SMALLER) SDR17 CPVC PIPE FOR USE IN CLOSED (PROCESS OR SUPPLY) OR VENTED (DRAIN, WASTE OR VENT)
- PIPING SYSTEMS. D. CELLULAR CORE POLYVINYL CHLORIDE (CCPVC) PIPE-NOM 2 IN. DIAM (OR SMALLER) SCHEDULE 40 CELLULAR CORE PVC PIPE FOR USE IN CLOSED (PROCESS OR SUPPLY) OR VENTED

- (DRAIN, WASTE OR VENT) PIPING SYSTEM. E. ACRYLONITRILE BUTADIENE STYRENE (ABS) PIPE—NOM 2 IN. DIAM (OR SMALLER) SCHEDULE 40 SOLID CORE ABS PIPE FOR USE IN CLOSED (PROCESS OR SUPPLY) OR VENTED (DRAIN,
- WASTE OR VENT) PIPING SYSTEMS. F. CELLULAR CORE ACRYLONITRILE BUTADIENE STYRENE (CCABS) PIPE—NOM 2 IN. DIAM (OR SMALLER) SCHEDULE 40 CELLULAR CORE ABS PIPE FOR USE IN CLOSED (PROCESS OR SUPPLY) OR VENTED (DRAIN, WASTE OR VENT) PIPING SYSTEMS.
- FIRESTOP SYSTEM—INSTALLED SYMMETRICALLY ON BOTH SIDES OF WALL ASSEMBLY. THE HOURLY F AND T RATINGS FOR THE FIRESTOP SYSTEM ARE EQUAL TO THE HOURLY FIRE RATING OF THE WALL ASSEMBLY IN WHICH IT IS INSTALLED. THE DETAILS OF THE FIRESTOP SYSTEM SHALL BE AS FOLLOWS.
- A. FILL, VOID OR CAVITY MATERIALS*—WRAP STRIP—NOM 1/4 IN. THICK INTUMESCENT ELASTOMERIC MATERIAL FACED ON ONE SIDE WITH ALUMINUM FOIL, SUPPLIED IN 2 IN. WIDE STRIPS. NOM 2 IN. WIDE STRIP TIGHTLY WRAPPED AROUND NONMETALLIC PIPE (FOIL SIDE OUT) WITH SEAM BUTTED. WRAP STRIP LAYER SECURELY BOUND WITH STEEL WIRE OR ALUMINUM FOIL TAPE AND SLID INTO ANNULAR SPACE APPROX 1-1/4 IN. SUCH THAT APPROX 3/4 IN. OF THE WRAP STRIP PROTRUDES FROM THE WALL SURFACE.
- MINNESOTA MINING & MFG, CO.—FS-195+ B. FILL, VOID OR CAVITY MATERIALS*—CAULK OR PUTTY—MIN 5/8 IN. THICKNESS OF CAULK OR PUTTY APPLIED INTO ANNULAR SPACE BETWEEN WRAP STRIP AND PERIPHERY OF OPENING. A NOM 1/4 IN. DIAM BEAD OF CAULK OR PUTTY TO BE APPLIED TO THE WRAP STRIP/WALL INTERFACE AND TO THE EXPOSED EDGE OF THE WRAP STRIP LAYERS APPROX 3/4 IN. FROM THE WALL SURFACE. MINNESOTA MINING & MFG CO.-CP 25WB+ CAULK OR MPS-2+ PUTTY. (NOTE: L RATINCS APPLY ONLY WHEN TYPE CP-25 WB+ CAULK IS USED.)
- C. FOIL TAPE—(NOT SHOWN)—NOM 4 IN, WIDE, 3 MIL THICK ALUMINUM TAPE WRAPPED AROUND PIPE PRIOR TO THE INSTALLATION OF THE WRAP STRIP (ITEM 3A). MIN OF ONE WRAP, FLUSH WITH BOTH SIDES OF WALL AND PROCEEDING OUTWARD. TAPE IS NOT REQUIRED FOR PIPES SHOWN IN ITEMS 2A, 2B AND 2C. ***BEARING THE UL CLASSIFICATION MARKING**

- FLOOR OR WALL ASSEMBLY—MIN 2-1/2 IN. THICK LICHTWEICHT OR NORMAL WEICHT (100-150 PCF) CONCRETE WALL MAY ALSO BE CONSTRUCTED OF ANY UL CLASSIFIED CONCRETE BLOCKS*. F RATINCS AND T RATINCS ARE DEPENDENT ON THE MIN THICKNESS OF FLOOR OR WALL, AS WELL AS THE MAX SIZE OF THE PIPE AND THE NOM THICKNESS OF THE CELLULAR CLASS INSULATION, AS NOTED IN ITEM 3. MAX DIAM OF THROUGH OPENING IS 28-1/2 IN.
- SEE CONCRETE BLOCKS (CAZT) CATEGORY IN THE FIRE RESISTANCE DIRECTORY FOR NAMES OF MANUFACTURERS
- 1A. STEEL SLEEVE—MAX 15 IN. ID (OR SMALLER), MIN 0.25 IN. WALL THICKNESS (OR HEAVIER) STEEL SLEEVE CAST OR GROUTED INTO FLOOR OR WALL ASSEMBLY. SLEEVE MAY EXTEND A MAX OF 2 IN. ABOVE TOP OF FLOOR OR
- BEYOND EITHER SURFACE OF WALL. T RATING IS O HR WHEN SLEEVE IS USED. . THROUGH PENETRANTS—ONE METALLIC PIPE OR TUBING TO BE POSITIONED WITHIN THE FIRESTOP SYSTEM. PIPE OR TUBINC TO BE RIGIDLY SUPPORTED ON BOTH SIDES OF FLOOR OR WALL ASSEMBLY. THE FOLLOWING TYPES AND SIZES OF METALLIC PIPES OR TUBINC MAY BE USED:
- A. STEEL PIPE-NOM 20 IN. DIAM (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL PIPE.
- B. COPPER TUBING-NOM 6 IN. DIAM (OR SMALLER) TYPE L (OR HEAVIER) COPPER TUBING. C. COPPER PIPE—NOM 6 IN. DIAM (OR SMALLER) REGULAR (OR HEAVIER) COPPER PIPE.
- PIPE COVERING MATERIALS*—CELLULAR GLASS INSULATION—NOM 1-1/2 TO 3 IN. THICK CELLULAR GLASS UNITS SIZED TO THE OUTSIDE DIAM OF THE STEEL PIPE AND SUPPLIED IN NOM 24 IN. LONG HALF SECTIONS OR NOM 18 IN. LONG SEGMENTS. PIPE INSULATION INSTALLED ON PIPE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. F RATINGS AND T RATINGS ARE DEPENDENT ON THE ITEMS NOTED IN THE FOLLOWING TABLE MIN FLOOR OR MAX PIPE NOM CLASS F RATING T RATING

ALL THKNS	SIN. DIAM IN.	INSUL THKNS I	N. HI	२
2-1/2	6	1-1/2 AND 3	2	3/4
4-1/2	6	1-1/2	3	1
4-1/2	6	3	3	1-1/2
4-1/2	20	1-1/2	2	1/2
4-1/2	20	3	2	1
	PITTSBURGH CO	RNING CORP	OAMCLAS	

- 4. PACKING MATERIAL—MIN 1 IN. THICKNESS OF TIGHTLY-PACKED MINERAL WOOL BATT INSULATION MATERIAL USED AS A PERMANENT FORM. PACKING MATERIAL TO BE RECESSED MIN 1 IN. FROM TOP SURFACE OF FLOOR OR FROM BOTH SURFACES OF WALL TO ACCOMMODATE THE CAULK FILL MATERIAL (ITEM 5). 5. FILL, VOID OR CAVITY MATERIALS*—CAULK—INSTALLED TO FILL ANNULAR SPACE TO A MIN DEPTH OF 1 IN., FLUSH WITH TOP SURFACE OF FLOOR OR BOTH SURFACES OF WALL. A MIN 1/2 IN. DIAM BEAD OF CAULK SHALL BE APPLIED TO THE PIPE INSULATION/CONCRETE INTERFACE AT THE POINT CONTACT LOCATION ON THE TOP SURFACE OF THE FLOOR AND ON BOTH SIDES OF WALLS.
- MINNESOTA MINING & MFC. CO.—CP 25WB+ METAL JACKET—MIN 12 IN. LONG JACKET FORMED OF MIN 0.010 IN. THICK STEEL OR ALUMINUM SHEET CUT TO WRAP TICHTLY AROUND THE PIPE INSULATION WITH A MIN 2 IN. LAP AND SECURED USING BANDS AND SEALS OF SIMILAR MATERIAL. BANDS TO BE LOCATED WITHIN 2 IN. OF EACH END OF THE JACKET AND SPACED MAX 10 IN. OC. JACKET TO BE INSTALLED WITH EDGE ABUTTING SURFACE OF CAULK FILL MATERIAL (ITEM 5) ON TOP SURFACE OF FLOOR OR BOTH SURFACES OF WALL. METAL JACKET TO BE USED IN ADDITION TO ANY OTHER JACKETING MATERIAL WHICH MAY BE REQUIRED OR DESIRED ON THE PIPE INSULATION. ***BEARING THE UL CLASSIFICATION MARKING**

CELLULAR CLASS INSULATED METALLIC PIPE

SEQUENCE OF OPERATION CHILLED WATER PLANT

THE CHILLED WATER SYSTEM SHALL BE STARTED AUTOMATICALLY WHENEVER ANY OF THE FOLLOWING CONDITIONS OCCUR:

A) THE OUTSIDE TEMPERATURE IS 60 DECREES F (ADJUSTABLE) OR ABOVE DURING THE OCCUPIED PERIOD.

B) ANY SPACE TEMPERATURE IS ABOVE SET POINT.

C) ANY SPACE REQUIRES HUMIDITY CONTROL.

PUMP CONTROL: UPON CHW SYSTEM STARTUP, THE DDC SYSTEM SHALL START CHP-1 OR CHP-2. THE DDC SHALL ALTERNATE CHP'S DAILY BASED ON RUNTIME. WHENEVER THE CHW SYSTEM IS IN OPERATION THE DDC SHALL MODULATE PUMP SPEED WITH THE VFD TO MAINTAIN CONSTANT DIFFERENTIAL PRESSURE INSIDE THE BUILDING. SETPOINT SHALL BE DETERMINED BY TEST AND BALANCE CONTRACTOR AS THE LOWEST DIFFERENTIAL PRESSURE REQUIRED TO OBTAIN DESIGN FLOW AT ALL UNITS. THE DDC SHALL LIMIT CHANGES IN FLOW AFTER CHILLER STARTUP TO 10% PER MINUTE. IF A PUMP FAILS TO OPERATE WHEN ENABLED, THE DDC SYSTEM SHALL START THE ALTERNATE PUMP AND POST AN ALARM. THE DDC SHALL MONITOR TOTAL FLOW. THE DDC SHALL MONITOR DIFFERENTIAL PRESSURE OF EACH PUMP AND SHUT DOWN THE PUMP WHEN DIFFERENTIAL PRESSURE EXCEEDS 95% OF SHUTOFF HEAD AND POST AN ALARM.

PUMP SPEED RESET: THE DDC SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT DOWN WHEN NO CHILLED WATER VALVES ARE OPEN 100%. THE DDC SHALL REDUCE THE SETPOINT IN STEPS EQUAL TO 10% OF THE ORIGINAL VALUE Determined by test and balance down to a minimum 50% of the ORIGINAL VALUE DETERMINED BY TEST AND BALANCE DOWN TO A MINIMUM OF 50% OF THE ORIGINAL VALUE (ADJUSTABLE). THE DDC SHALL MAKE CHANGES (INCREASES OR DECREASES) IN SETPOINT IN FIVE MINUTE INTERVALS. THE DDC SHALL REVERSE SETPOINT ADJUSTMENT WHEN MORE THAN 10% OF THE CHW VALUES ARE 100% OPEN FOR MORE THAN 5 MINUTES (ADJUSTABLE).

CHILLER CONTROL SUMMARY: THE DDC SYSTEM SHALL ENABLE THE CHILLERS BASED ON BUILDING LOAD AND EACH CHILLER SHALL OPERATE THROUGH ITS INTERNAL CONTROLS TO MAINTAIN CHILLED WATER SUPPLY TEMPERATURE AT SETPOINT OF 42°F. UPON ENABLE OF A CHILLER, THE CONDENSER WATER SYSTEM SHALL BE ENABLED BY THE DDC. THE DDC SHALL START THE CHILLER WITH THE LEAST RUNTIME AS THE LEAD UNIT EACH DAY. UPON A CALL FOR COOLING THE DDC SHALL OPEN THE CHV AND CWV FOR THE LEAD CHILLER AND START THE CHP. UPON PROOF OF FLOW, THE CHILLER SHALL OPERATE TO MAINTAIN LEAVING WATER AT SETPOINT. THE DDC SHALL MONITOR CHW FLOW THROUGH EACH CHILLER. THE DDC SHALL MAINTAIN A MINIMUM FLOWRATE OF 80 GPM IN THE CHILLER WHEN IT IS ENABLED AND OPERATING. THE DDC SYSTEM SHALL MONITOR ALARM STATUS OF EACH CHILLER AND POST AN ALARM IN THE EVENT A CHILLER IS ENABLED AND NOT OPERATING. THE DDC SHALL MONITOR ALL POINTS AVAILABLE THROUGH THE MANUFACTURER'S FACTORY MOUNTED CHILLER MICROPROCESSOR CONTROL THROUGH BACNET PROTOCOL.

CHILLER CONTROL:

<u>CENERAL</u> - THE DDC PROGRAM SHALL BE FULLY EDITABLE AND SET-UP VIA POINT AND CLICK ON A STANDARD WINDOWS SCREEN. IT SHALL NOT REQUIRE SPECIAL SOFTWARE TOOLS OR A BAS TECHNICIAN TO OPERATE AND MODIFY CHILLER SEQUENCING CONTROL.

- THE DDC SHALL PERFORM THE FOLLOWING CONTROL STRATEGIES:
- 1. CHILLER PLANT SYSTEM SCHEDULING
- 2. CHILLER SEQUENCING
- 2. CHILLER MINIMUM FLOW BY-PASS VALVE CONTROL 3. COLOR GRAPHIC BASED CHILLER PLANT STATUS SCREENS
- 4. COLOR GRAPHIC BASED CHILLER STATUS SCREENS
- 5. SYSTEM AND CHILLER DIAGNOSTIC MESSAGES 6. SYSTEM AND CHILLER REPORTS

CHILLER SEQUENCING FOR VARIABLE PRIMARY FLOW CHILLED WATER SYSTEMS:

- 1. THE SYSTEM SETPOINT SHALL BE 42 DEGREES F AND EDITABLE BY THE OPERATOR.
- 2. WHEN THE "CHW ADD ERROR" VALUE EXCEEDS 1.5 F (OPERATOR ADJUSTABLE) CONTINUOUSLY FOR 15 MINUTES (OPERATOR ADJUSTABLE) THE CHILLER SEQUENCING SOFTWARE SHALL INITIATE THE START OF THE NEXT CHILLER IN THE SEQUENCE.

"CHW ADD ERROR = CHW SUPPLY TEMP - CHW SETPOINT TEMP"

PRIOR TO THE START OF ANOTHER CHILLER THE CHILLER SEQUENCING SOFTWARE SHALL UNLOAD ALL OPERATING CHILLERS. (THIS IS DONE TO PREVENT FLOW DISTURBANCES CAUSED BY THE STARTING OF ANOTHER PUMP FROM AFFECTING CHILLER OPERATION. FOLLOWING CONFIRMATION OF THE ADDITIONAL CHILLER OPERATION ALL CHILLERS SHALL BE ALLOWED TO RELOAD.)

LAG CHILLERS SHALL START IN A SIMILAR MANNER TO THE LEAD CHILLER START SEQUENCE.

3. THE DDC SHALL CONSIDER STOPPING A CHILLER WH LOAD ON OPERATING CHILLERS DROPS TO A LEVEL ENOUGH SO THAT A CHILLER CAN BE TURNED OFF A REMAINING CHILLER CAN CARRY THE LOAD.

THE LOAD ON THE OPERATING CHILLER(S) SHALL BE BASED ON THE MONITORED [ACTUAL CURRENT DRAW [ACTUAL POWER DRAW (% KW)].

WHEN ALL OPERATING CHILLERS LOADS ARE LESS TH SYSTEM CALCULATED "SUBTRACT CHILLER LOAD" (SC (OPERATOR EDITABLE) FOR 15 MINUTES (OPERATOR THE SYSTEM SHALL SUBTRACT A CHILLER.

THE CHILLER SEQUENCING SOFTWARE SHALL CALCU "SUBTRACT CHILLER LOAD" (SCL) SUCH THAT WHEN T CHILLER IS SUBTRACTED THE REMAINING OPERATING SHALL BE LOADED TO THE SPECIFIED "LOAD ON REM CHILLERS" (LRC). THE EQUATION FOR CALCULATING SUBTRACT CHILLER LOAD IS:

SCL = (LRC X (NOC - 1) / NOC

SCL - SUBTRACT CHILLER LOAD LRC - LOAD ON REMAINING CHILLERS NOC - NUMBER OF OPERATING CHILLERS

4. THE DDC SHALL NOT CLOSE A CHILLER ISOLATION VA SHUTDOWN THE SYSTEM PUMP UNTIL ALL CHILLER CO ARE PROVEN OFF.

CHILLED WATER PLANT ENERGY MANAGEMENT: THE DDC CALCULATE AND DISPLAY A REAL-TIME KW/TON FOR THE CHILLED WATER PLANT INCLUDING CHILLERS, PUMPS, CO TOWER FANS, AND CONDENSER WATER PUMPS. THE DDO UTILIZE THIS DATA TO STACE CHILLERS TOGETHER OR SEP/ DURING PART LOAD CONDITIONS TO MAXIMIZE ENERGY I

CHILLER FAILURE: UPON SENSING A CHILLER FAILURE THI SEQUENCING SOFTWARE SHALL LOCKOUT THAT CHILLER, VALVE, AND IMMEDIATELY INITIATE THE START OF THE NEX THE ROTATION SEQUENCE.

CHILLER MINIMUM FLOW BY-PASS VALVE CONTROL:

THE "CHILLER MINIMUM FLOW BY-PASS VALVE" SHALL BE OPEN VALVE. THE "CHILLER MINIMUM FLOW BY-PASS VAI BE MODULATED TO THE FULLY OPEN POSITION WHEN THE SHUTDOWN. THIS SHALL BE DONE TO PREVENT WATER H WHEN A PUMP IS STARTED AND TO ALLOW FOR MINIMUM THE EVENT THE CHILLER CALLS FOR PUMP OPERATION.

FOLLOWING THE CONFIRMED START OF THE LEAD CHILLE WHENEVER SYSTEM IS ENABLED CHILLER SEQUENCING SY MODULATE THE "CHILLER MINIMUM FLOW BY-PASS VALVE THE CHILLED WATER FLOW THROUGH ANY OPERATING C SHALL NOT DROP BELOW THE MANUFACTURERS RECOMM MINIMUM FLOW.

THE CHILLER MINIMUM AND MAXIMUM FLOW SHALL BE D BY DIRECT MEASUREMENT USING A HIGH ACCURACY VEN METER ON EACH CHILLER. THE FLOW METER SETPOINT SI DETERMINED BASED ON THE MANUFACTURERS RECOMME MINIMUM AND MAXIMUM CHILLER FLOW RATE.

CHILLER SYSTEM OPERATOR INTERFACE - DDC APPLICATIO OPERATIONAL STATUS SCREEN TO INCLUDE:

- A. CHILLER SYSTEM STATUS (OFF/SOFT START/NORM
- LOCKOUT/SHUTDOWN IN PROCRESS) B. CHILLER PLANT SUPPLY WATER SETPOINT
- C. CHILLED WATER SYSTEM SUPPLY WATER TEMPER D. CHILLED WATER SYSTEM RETURN WATER TEMPER
- E. INDIVIDUAL CHILLER FAILURE RESET F. ALL CHILLER FAILURE RESET
- G. SYSTEM PUMP FAILURE RESET
- H. MANUAL ADDITION OF CHILLER I. MANUAL SUBTRACTION OF CHILLER
- J. MANUAL ROTATION OF CHILLER SEQUENCE

EMERGENCY CONDITIONS:

CH-2 SHALL BE INTERLOCKED WITH TRANSFER SWITCH. TRANSFER SWITCH IS ACTIVATED, CH-1 SHALL BE LOCKED SHUTOFF SWITCH SHALL BE LOCATED IN ROOM 04-440 T

LOUNCE. PROVIDE SIGN ABOVE SWITCH STATING "IN EVE WEATHER EMERGENCY, SWITCH SHALL BE ACTIVATED." ACTIVATION OF SWITCH, DDC SHALL CLOSE CHV-3, CHV-AND CHV-6 AND POST AN ALARM.

1. THE CONTRACTOR SHALL PROVIDE A COMPLETE NEW DDC SYSTEM TO PERFORM THE INDICATED SEQUENCES, ALL OTHER FUNCTIONS REQUIRED BY THE CONTRACT DOCUMENTS, AND ALL OTHER FUNCTIONS REQUIRED FOR A COMPLETE AND FUNCTIONAL SYSTEM. SYSTEM SHALL TIE INTO EXISTING SCHNEIDER ELECTRIC FRONT EL
2. ALL SEQUENCES ARE SUBJECT TO SAFETIES. DDC CONTRACTOR SHALL PROVIDE ALL NECESSARY AND CUSTOMARY SAFETIES. ALL DDC SENSORS LOCATED IN NORMAL UNOCCUPIED AREAS (HALLWAYS, CORRIDORS, RESTROOMS, ETC) SHALL BE CELLING MOUNTED.
 ALL WIRING SHALL BE IN CONDUIT. ALL CONDUIT SHALL BE IN ACCORDANCE WITH ELECTRICAL SPECIFICATIONS. REQUIREMENTS FOR 120 VAC CIRCUITS.
4. ALL CONTROL TUBING SHALL BE RUN IN CONDUIT. ALL CONDUIT SHALL BE IN ACCORDANCE WITH ELECTRICAL SPECIFICATIONS, REQUIREMENTS FOR 120 VAC CIRC
5. ALL WELLS SHALL BE 316 STAINLESS STEEL AND SHALL BE INSTALLED IN NEW THREDOLETS. IN CHILLED WATER PIPING PROVIDE NEW WELLS WITH EXTENDED NECK TO INSULATION THICKNESS.
6. THE DDC CONTRACTOR IS CO-RESPONSIBLE, ALONG WITH THE TAB CONTRACTOR FOR COORDINATING THE PROPER INSTALLATION OF WELLS, PRESSURE TAPS, AND I IN ALL LOCATIONS INDICATED AND OTHERWISE AS REQUIRED FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.
 THE DDC CONTRACTOR AND THE TAB CONTRACTOR SHALL UTILIZE P/T'S TO CALIBRATE INSTRUMENTS TO CERTIFIED PRESSURE GAGES, PRESSURE METERS AND THERMOMETERS.
8. CONDUIT SHALL BE RUN PERPENDICULAR AND PARALLEL TO BUILDING LINES IN A FIRST CLASS WORKMANSHIP LIKE MANNER.
9. PROVIDE TWO PORTABLE LAPTOP COMPUTERS WITH ALL NECESSARY SERVICE SOFTWARE INSTALLED.
10. PROVIDE OPERATING SCHEDULE FOR EACH AHU. PROVIDE SEPARATE OPERATING SCHEDULE FOR OUTSIDE AIR FOR EACH AHU.
11. PROVIDE SUB-METER FOR EACH MECHANICAL EQUIPMENT, LICHTING, AND THE MAIN BUILDING ELECTRICAL PANELS. REFER TO ELECTRICAL SINGLE LINE RISER DIAG AND FLOOR PLANS FOR QUANTITIES AND LOCATIONS.
12. PROVIDE DUCT ACCESS DOOR AT EACH AIRFLOW MEASURING STATION TO ALLOW SERVICE AND INSPECTION OF DUCT MOUNTED UNIT.
13. PROVIDE PUSH BUTTON LOCATED INSIDE SRO OFFICE AND THE MAIN ADMINISTRATION (FINAL LOCATION TO BE DETERMINED BY OWNER) TO SHUT DOWN ALL AHU'S CLOSE OUTSIDE AIR DAMPERS UPON ACTIVATION. THE BUTTON SHALL BE LOCATED INSIDE AN ENCLOSURE WITH A AUDIBLE ALARM UPON OPENING THE ENCLOSURI SHUT DOWN THE EQUIPMENT, THE ENCLOSURE MUST BE OPENED AND THE BUTTON ACTIVATED. THE BUTTON SHALL REMAIN ACTIVATED UNTIL PHYSICALLY RELEASED THE ACTIVATED POSITION. UPON RELEASE, THE DDC SHALL DELAY STARTUP OF THE EQUIPMENT FOR 30 MINUTES (ADJUSTABLE).
14. THIS PROJECT SHALL INCLUDE COMMISSIONING OF THE HVAC, CONTROLS, AND RELATED ELECTRICAL SYSTEMS. THE SERVICES OF THE COMMISSIONING AUTHORITY PROVIDED UNDER SEPARATE CONTRACT. UNDER THIS CONTRACT, THE PRIME CONTRACTOR, SUBCONTRACTORS, AND EQUIPMENT MANUFACTURERS SHALL PROVIDE AND MATERIAL AS REQUIRED TO ASSIST AND PARTICIPATE IN THE COMMISSIONING PROCESS FOR THE SCOPE OF WORK AS DESCRIBED IN SECTION 230800 OF THE F SPECIFICATIONS.
CAMPUS DDC TEMPERATURE MONITORING NOTES
1 PROVIDE ONE (1) TEMPERATURE SENSOR INSIDE EACH EREEZER, COOLER, DATA ROOM, AND DRY STORAGE
2. MONITOR TEMPERATURE IN EACH UNIT. IDENTIFY GRAPHICALLY ON THE OVERALL CAMPUS PLAN.
3. ALARM UPON SENSOR FAILURE OR "OUT OF RANGE" FOR EACH UNIT. "OUT OF RANGE" SHALL BE DEFINED AS FOLLOWS:
FREEZER: 0 DEGREES F OR HICHER (ADJUSTABLE)
COOLER: 40 DECREES F OR HIGHER (ADJUSTABLE) DRY STORAGE: 72 DECREES F OR HIGHER (ADJUSTABLE)
4 WHEN THE ALARM IS SET THE DDC SHALL EMAIL AND TEXT NUMBERS ASSIGNED BY THE SCHOOL DISTRICT
 THE DDC SHALL MAINTAIN A TREND FOR 30 DAYS OF DATA COLLECTED AT 15 MINUTE INTERVALS.
BACNEI WIOINITOKED STSTEWIS
DIVISION 22 AND 26 SYSTEMS
THE DDC SHALL MONITOR SYSTEM CONTROLLERS PROVIDED BY OTHERS THROUGH A FACTORY BACNET INTERFACE. THE DDC SHALL READ AND IDENTIFY ALL POINTS TRANSMITTED BY THE FACTORY CONTROLLER. THE DDC SHALL INCLUDE A SYSTEM GRAPHIC FOR EACH CONTROLLED DEVICE WITH BACNET ADJUSTABLE SET POINTS IDENT AND ADJUSTABLE FROM THE CRAPHIC. THE FOLLOWING SYSTEMS ARE TO BE INCLUDED.
CAS WATER HEATERS
BUILDING LIGHTING CONTROLS
COORDINATE WITH THE EQUIPMENT AND CONTROLLERS PROVIDED BY OTHERS.
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DIRECT DIGITAL CONTROLS GENERAL NOTES

- CHILLED WATER SYSTEM KEY NOTES
- DIFFERENTIAL PRESSURE SWITCH.
- 2 TEMPERATURE TRANSMITTER WITH STAINLESS STEEL RTD IMMERSION
- (3) CHILLER CONTROLS.

SENSOR.

(4) OUTSIDE AIR TEMPERATURE SENSOR, LOCATE ON OUTSIDE WALL UNDER SUN SHIELD.

LECTRIC FRONT END.

OCATED IN NORMALLY

OR 120 VAC CIRCUITS.

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LINE RISER DIAGRAM

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ALL POINTS SET POINTS IDENTIFIED

SEQUENCE OF OPERATION HEATING HOT WATER PLANT

STARTING AND STOPPING OF EQUIPMENT SHALL BE ACCOMPLISHED THRU A "HAND-OFF-AUTO" SWITCH LOCATED ON FACE OF THE BOILER BOILER PLANT MANAGER. THE BOILER PANEL SHALL COMMUNICATE ALL POINT VALUES MONITORED WITH THE CAMPUS DDC SYSTEM THROUGH ITS BACNET INTERFACE. AN ALARM SHALL BE POSTED TO THE DDC SYSTEM ANYTIME THE BOILER PLANT MANAGER HOA SWITCH IS INDEXED TO THE "HAND" OR "OFF" POSITIONS. WITH THE HOA SWITCH IN THE "AUTO" POSITION, THE HOT WATER SYSTEM SHALL BE STARTED AUTOMATICALLY BY UPON CALL FROM THE DDC SYSTEM AND ALL CONTROLS ACTIVATED SUBJECT TO SAFETIES AND OVERLOADS. THE HOT WATER SYSTEM SHALL BE STARTED ON A CALL FOR HEATING FROM ANY TEMPERATURE CONTROLLER, SENSOR OR FREEZE PROTECTION SAFETY.

HEATING PLANT STAGING:

THE BOILER FACTORY CONTROL PANEL SHALL TO SEQUENCE AND STAGE CB-1 AND GB-2 TO MAINTAIN HWS TEMPERATURE AT SETPOINT OF 160°F (SUBJECT TO RESET SCHEDULE).

PUMP CONTROL: UPON HW SYSTEM STARTUP, THE DDC SYSTEM SHALL START HWP-1 AND/OR HWP-2 AS REQUIRED. THE DDC SHALL ALTERNATE HWP'S DAILY BASED ON RUNTIME. WHENEVER THE HW SYSTEM IS IN OPERATION THE DDC SHALL MODULATE PUMP SPEED WITH THE VFD TO MAINTAIN CONSTANT DIFFERENTIAL PRESSURE INSIDE THE BUILDINC. SETPOINT SHALL BE DETERMINED BY TEST AND BALANCE CONTRACTOR AS THE LOWEST DIFFERENTIAL PRESSURE REQUIRED TO OBTAIN DESIGN FLOW AT ALL UNITS. IF A PUMP FAILS TO OPERATE WHEN ENABLED, THE DDC SYSTEM SHALL START THE ALTERNATE PUMP AND POST AN ALARM. THE DDC SHALL MONITOR TOTAL FLOW. IF THE HWS TEMPERATURE FALLS BELOW 85°F FOR MORE THAN 5 MINUTES, THE DDC SHALL POST AN ALARM, SHUT DOWN THE CB'S, AND STOP THE HWP'S. THE DDC SHALL MONITOR DIFFERENTIAL PRESSURE OF EACH PUMP AND SHUT DOWN THE PUMP WHEN DIFFERENTIAL PRESSURE EXCEEDS 95% OF SHUTOFF HEAD AND POST AN ALARM.

<u>PUMP SPEED RESET</u>: THE DDC SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT DOWN WHEN NO HOT WATER VALVES ARE OPEN 100%. THE DDC SHALL REDUCE THE SETPOINT IN STEPS EQUAL TO 10% OF THE ORIGINAL VALUE DETERMINED BY TEST AND BALANCE DOWN TO A MINIMUM 50% OF THE ORIGINAL VALUE DETERMINED BY TEST AND BALANCE DOWN TO A MINIMUM OF 50% OF THE ORIGINAL VALUE (ADJUSTABLE). THE DDC SHALL MAKE CHANCES (INCREASES OR DECREASES) IN SETPOINT IN FIVE MINUTE INTERVALS. THE DDC SHALL REVERSE SETPOINT ADJUSTMENT WHEN MORE THAN 10% OF THE HW VALUES ARE 100% OPEN FOR MORE THAN 5 MINUTES (ADJUSTABLE).

BOILER CONTROL: THE BOILER SHALL, THROUCH ITS INTERNAL CONTROLS, MAINTAIN THE HWS TEMPERATURE AT A BACNET INTERFACE ADJUSTABLE SET POINT OF 160°F. THE DDC SHALL POST AN ALARM UPON FAILURE OF ANY HWP. THE BOILER CONTROL PANEL SHALL DISABLE BOILER IF FLOW IS NOT PROVEN THROUGH THE BOILER.

EMERGENCY CONDITIONS:

SHUTOFF SWITCH SHALL BE LOCATED IN ROOM 04-440 TEACHER LOUNGE. PROVIDE SIGN ABOVE SWITCH STATING "IN EVENT OF WEATHER EMERGENCY, SWITCH SHALL BE ACTIVATED." UPON ACTIVATION OF SWITCH, DDC SHALL CLOSE HWV-1, HWV-2, HWV-3, AND HWV-4 AND POST AN ALARM.

ŀ	HOT WATER PLANT POIN														T	S			S	T											
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DESCRIPTION				ESSURE				ATURE			ËR			SD.													0				Ш
BOILER	CRAPHIC	TEMPERATURE	PERCENT	DIFFERENTIAL PRI	FLOWRATE	SPEED	PERCENT OPEN	AMBIENT TEMPER			PNEU. IRANSDUC	STATUS ON/OFF	FILTER STATUS	STATUS OPEN/CLS	START/STOP	OPEN/CLOSE	SPEED	ENABLE/DISABLE	HICH/LOW	HICH ANALOC	LOW ANALOG	SENSOR FAIL	FLOW FAIL	PROOF	COMM. FAIL	DIAGNOSTIC	TIME SCHEDULING	RUN TIME	TIMED OVERRIDE	ALTERNATE	BACNET INTERFAC
PLANT WATER SUPPLY		x		x	x															х	х	х									
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HWV-4																x				х	х	x									

HOT WATER RE	SET SCHEDULE
HOT WATER SUPPLY TEMP	OUTSIDE AIR TEMP
115'F	60 ° F
160 ' F	30°F

<u>NOTE</u>: BETWEEN 60°F AND 30°F, THE HOT WATER SUPPLY TEMPERATURE SHALL VARY LINEARLY BETWEEN 115°F AND 160°F

HWR FROM BUILDING 4 Admin Side

HWS TO BUILDING 4 ADMIN SIDE

HOT WATER SYSTEM

KEY NOTES

1 DIFFERENTIAL PRESSURE SWITCH.

TEMPERATURE TRANSMITTER WITH STAINLESS STEEL RTD IMMERSION SENSOR.

3 FACTORY BOILER PLANT MANAGER

SEQUENCE OF OPERATION VARIABLE VOLUME AHU

STARTING AND STOPPING OF EQUIPMENT SHALL BE ACCOMPLISHED THROUGH A "HAND-OFF-AUTO" SWITCH LOCATED ON FACE OF DDC CONTROL PANEL. AN ALARM SHALL BE POSTED TO THE DDC SYSTEM ANYTIME THE HOA SWITCH IS INDEXED TO THE "HAND" OR "OFF" POSITIONS. WITH THE HOA SWITCH IN THE "AUTO" POSITION, THE UNIT SHALL BE STARTED AUTOMATICALLY BY THE DDC SYSTEM AND ALL CONTROLS ACTIVATED SUBJECT TO FIRE ALARM RELAY. SAFETIES AND OVERLOADS.

OCCUPIED MODE: OPEN OUTSIDE AIR DAMPER AND START EXHAUST FANS INDICATED WHENEVER THE BUILDING IS IN OCCUPIED MODE.

COOLING COIL FREEZE PROTECTION: THE DDC SYSTEM SHALL CLOSE THE OUTSIDE AIR DAMPER ANYTIME THE COOLING COIL ENTERING AIR TEMPERATURE FALLS BELOW 40°F LONGER THAN 5 MINUTES. THE LOW LIMIT FREEZE STAT SHALL STOP THE AHU FAN MOTOR ANYTIME THE COOLING COIL ENTERING AIR TEMPERATURE FALLS BELOW 35°F

DISCHARGE TEMPERATURE CONTROL: THE DDC SYSTEM SHALL MODULATE THE CHILLED WATER VALVE AS REQUIRED TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AT SET POINT (REFER TO AHU SCHEDULE). WHEN MINIMUM SPEED IS REACHED AND THERE IS A CALL FOR HEATING FROM ANY ZONE, THE DDC SHALL RESET SUPPLY AIR TEMPERATURE UP IN 2°F INCREMENTS EVERY FIVE MINUTES TO A MAXIMUM OF 65°F. THE DDC SHALL REVERSE SUPPLY AIR RESET UPON RETURN A CALL FOR COOLING OR WHEN RETURN AIR RH RISES ABOVE 60%. THE DDC SHALL HAVE A SEPARATE SET POINT FOR UNOCCUPIED HUMIDITY CONTROL, ADJUSTABLE FROM THE GRAPHIC.

FAN SPEED CONTROL WITH STATIC PRESSURE RESET: MAX TU DAMPER POSITION

THE DDC SYSTEM SHALL CONTROL THE FAN SPEED THROUGH THE VARIABLE FREQUENCY DRIVE (VFD) TO MAINTAIN SUPPLY DUCT STATIC PRESSURE AT SETPOINT. THE FAN SPEED SHALL BE REDUCED DOWN TO A MINIMUM SPEED SETPOINT (TO BE SET IN THE VFD) DETERMINED TO PROVIDE SUFFICIENT PRESSURE TO DELIVER THE MINIMUM AIRFLOW OF ALL VAV TERMINAL UNITS OR THE SCHEDULED MINIMUM OUTSIDE AIRFLOW SETPOINT (WHICHEVER SPEED IS GREATER). UPON SYSTEM START-UP THE STATIC PRESSURE SETPOINT SHALL BE SET TO THE MIDDLE OF THE STATIC PRESSURE RESET RANGE AND SHALL BE RESET EVERY 15 MINUTES (ADJUSTABLE) BASED ON THE FOLLOWING LOGIC

MAX TU DAMPER POSITION METHOD: SETPOINT SHALL BE RESET BETWEEN THE MIN AND THE MAX SETPOINTS (DETERMINED DURING CX) BASED ON ALL OF THE ASSOCIATED VAV TERMINAL UNIT AIR DAMPER POSITIONS. IF THERE ARE NO VAV TERMINAL UNITS WITH DAMPERS OPEN GREATER THAN 80% (ADJUSTABLE) THEN THE SETPOINT SHALL BE DECREASED BY THE STATIC PRESSURE RESET INCREMENT (0.10"W.C., ADJUSTABLE). IF THERE ARE ANY VAV TERMINAL UNITS WITH ITS DAMPER OPEN GREATER THAN 90% THEN THE SETPOINT SHALL BE INCREASED BY THE STATIC PRESSURE RESET INCREMENT. NOTE THAT TU WHICH SERVE ONLY 'SUPPORT' SPACES SHALL NOT BE INCLUDED IN THIS LOGIC.

OUTSIDE AIR CONTROL: THE DDC SYSTEM, WITH OA DUCT MOUNTED FLOW MEASURING STATION, SHALL MODULATE RA DAMPER AS REQUIRED TO MAINTAIN OUTSIDE AIR QUANTITY AT SET POINT REGARDLESS OF THE TOTAL AIR FLOW OF THE AIR HANDLING UNIT AT ANYTIME. READOUT OF OUTSIDE AIR QUANTITY SHALL BE IN CFM. OUTSIDE AIR DAMPER SHALL BE OPENED TO ITS BALANCED POSITION DURING OCCUPIED CYCLES. UPON FAILURE THE OA DAMPER SHALL BE NORMALLY CLOSED. WHENEVER THE AHU OPERATES DURING UNOCCUPIED MODE, THE OA DAMPER SHALL REMAIN CLOSED.

UNOCCUPIED MODE: THE OA DAMPER SHALL SHUT AND THE FAN SHALL CYCLE UPON A CALL FOR COOLING OR HEATNG FROM ANY SPACE.

INTERLOCKED EXHAUST FANS: INTERLOCKED EXHAUST FANS SHALL OPERATE ONLY DURING OCCUPIED TIMES.

MONITORED ZONES: PROVIDE ROOM TEMPERATURE SENSOR IN DATA CLOSETS, DRY STORAGE, FREEZER AND COOLER. THE DDC SHALL MONITOR SPACE TEMPERATURES IN ALL AREAS. DDC SHALL PROVIDE A TEXT AND EMAIL ALERT WHEN FREEZER OR COOLER TEMP DROPS BELOW A USER DEFINED AND ADJUSTABLE ALARM SET POINT.

SEQUENCE OF OPERATION SINGLE DUCT TERMINAL UNIT

EACH TERMINAL UNIT SHALL BE PROVIDED WITH A UNIT CONTROL MODULE (UCM). THE UCM SHALL BE FIELD OR FACTORY MOUNTED. THE ELECTRICAL CONTRACTOR SHALL PROVIDE 120V POWER TO EACH TERMINAL UNIT.

UNIT AIRFLOW SHALL BE MONITORED BY AN INTEGRAL, MULTIPLE POINT, AVERAGING FLOW SENSING DEVICE AND A TRANSDUCER TO MAINTAIN AIRFLOW WITHIN 5% OF RATED CFM DOWN TO A MINIMUM CFM AS SCHEDULED, INDEPENDENT OF CHANGES IN SYSTEM STATIC PRESSURE.

COOLING MODE: THE UCM SHALL MONITOR THE ZONE TEMPERATURE AGAINST ITS SET POINT (74°F ADJUSTABLE) AND MODULATE THE DAMPER TO MEET THE ZONE SETPOINT. IF THE TU CALLS FOR FULL COOLING AND CANNOT REACH MAXIMUM AIRFLOW FOR FIVE MINUTES, THE DDC SHALL RESET THE AHU STATIC PRESSURE UP 0.15".

HEATING MODE: THE DAMPER SHALL MODULATE TO THE HEATING AIRFLOW (SEE TU SCHEDULES) AND THE HOT WATER VALVE SHALL MODULATE AS REQUIRED TO MAINTAIN SPACE TEMPERATURE (COOLING SET POINT MINUS 3°F).

THE ZONE TEMPERATURE SENSOR WITH SET POINT ADJUSTMENT SHALL BE PROVIDED WITH NIGHT SETBACK OVERRIDE AND A COMMUNICATIONS JACK. UPPER AND LOWER ZONE TEMPERATURE SET POINTS SHALL BE SET BY THE DDC.

OCCUPIED/UNOCCUPIED MODE: CONTROLS CONTRACTOR SHALL CONSULT WITH OWNER FOR SPACE TEMPERATURE SETPOINTS.

OVERRIDE MODE: THE OVERRIDE TIMER SHALL PLACE THE TU AND AHU IN OCCUPIED MODE FOR ONE HOUR (ADJUSTABLE).

ION SENSOR: TU-4.1.16, AND 4.3.6 SHALL BE EQUIPPED WITH A SUPPLY AIR MOUNTED ION SENSOR WITH ADJUSTABLE SETPOINT AND DIGITAL OUTPUT. THE DDC SHALL POST AN ALARM WHEN THE ION COUNT FALLS BELOW THE SETPOINT. INITIAL SETPOINT MINIMUM SHALL BE 5000 IONS/CC/SEC. DUCT SETPOINT SHALL BE CONFIRMED BY SPACE ION MEASUREMENTS AT A MINIMUM OF 2000 IONS/CC/SEC IN THE SPACE SERVED.

SEQUENCE OF OPERATION SINGLE ZONE VARIABLE VOLUME AHU

STARTING AND STOPPING OF EQUIPMENT SHALL BE ACCOMPLISHED THROUGH A "HAND-OFF-AUTO" SWITCH LOCATED ON FACE OF DDC CONTROL PANEL. AN ALARM SHALL BE POSTED TO THE DDC SYSTEM ANYTIME THE HOA SWITCH IS INDEXED TO THE "HAND" OR "OFF" POSITIONS. WITH THE HOA SWITCH IN THE "AUTO" POSITION, THE UNIT SHALL BE STARTED AUTOMATICALLY BY THE DDC SYSTEM AND ALL CONTROLS ACTIVATED SUBJECT TO FIRE ALARM RELAY, SAFETIES AND OVERLOADS.

OCCUPIED MODE

OPEN THE OUTSIDE AIR DAMPERS AND START EXHAUST FANS INDICATED ON FAN SCHEDULE WHENEVER THE BUILDING IS IN OCCUPIED MODE.

PREHEAT CONTROL: ANYTIME THE MIXED AIR TEMPERATURE FALLS BELOW 40°F WITH NO CALL FOR COOLING, THE DDC SHALL REST THE MINIMUM AIRFLOW TO MAINTAIN 50°F MIXED AIR TEMPERATURE.

COOLING COIL FREEZE PROTECTION: THE DDC SYSTEM SHALL CLOSE THE OUTSIDE AIR DAMPER ANYTIME THE MIXED AIR TEMPERATURE FALLS BELOW 40°F LONGER THAN 5 MINUTES. THE LOW LIMIT FREEZE STAT SHALL STOP THE AHU FAN MOTOR ANYTIME THE COOLING COIL ENTERING AIR TEMPERATURE FALLS BELOW 35°F.

DISCHARGE TEMPERATURE CONTROL: THE DDC SYSTEM SHALL MODULATE THE CHILLED WATER VALVE AS REQUIRED TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AT SET POINT (REFER TO AHU SCHEDULES) UNTIL MINIMUM SPEED IS REACHED. WHEN MINIMUM SPEED IS REACHED AND THERE IS A CALL FOR HEATING, THE DDC SHALL RESET SUPPLY AIR TEMPERATURE UP IN 2°F INCREMENTS EVERY FIVE MINUTES TO A MAXIMUM OF 65°F(ADJUSTABLE). THE DDC SHALL REVERSE SUPPLY AIR RESET UPON A CALL FOR COOLING OR WHEN ROOM AIR DEWPOINT RISES ABOVE 57°F.

FAN SPEED CONTROL: SUBJECT TO HIGH LIMIT DUCT STATIC PRESSURE SENSOR, AHU AIRFLOW SHALL BE LIMITED TO SCHEDULED MAXIMUM AND MINIMUM VALUES. THE ADJUSTABLE VARIABLE FREQUENCY DRIVE SHALL MODULATE FAN SPEED AS REQUIRED TO MAINTAIN ROOM TEMPERATURE AT SETPOINT (74°F ADJUSTABLE). UPON REACHING MINIMUM SPEED, THE DDC SHALL MODULATE THE HWV AS REQUIRED TO MAINTAIN ROOM TEMP AT SETPOINT. AHU FAN SHALL RUN CONTINUOUSLY DURING OCCUPIED MODE.

OUTSIDE AIR CONTROL: THE DDC SYSTEM, WITH OA DUCT MOUNTED FLOW MEASURING STATION, SHALL MODULATE RA AND OA DAMPERS AS REQUIRED TO MAINTAIN OUTSIDE AIR QUANTITY AT SET POINT REGARDLESS OF THE TOTAL AIR FLOW OF THE AIR HANDLING UNIT AT ANYTIME. READOUT OF OUTSIDE AIR QUANTITY SHALL BE IN CFM. OUTSIDE AIR DAMPER SHALL BE OPENED TO MAINTAIN OA AT THE MINIMUM SCHEDULED DURING OCCUPIED CYCLES. UPON A RISE IN RETURN AIR CO2 CONCENTRATION EXCEEDING THE OA CO2 CONCENTRATION MORE THAN 750PPM, THE DDC SHALL RESET THE OA SETPOINT TO THE MAXIMUM OA VALUES SCHEDULED UNTIL THE DIFFERENCE IN CO2 CONCENTRATIONS FALLS BELOW 650PPM FOR A MINIMUM OF 1 HOUR.

UNOCCUPIED MODE:

THE DDC SHALL CYCLE THE FAN AND COOLING OR HEATING COIL AS NECESSARY TO MAINTAIN SETPOINT OF 85°F (ADJUSTABLE). OA DAMPER SHALL BE CLOSED DURING UNOCCUPIED TIME.

OVERRIDE: OVERRIDE SHALL PLACE THE UNIT IN OCCUPIED MODE FOR A PERIOD OF 1 HR.

INTERLOCKED EXHAUST FANS: INTERLOCKED FANS SHALL OPERATE ONLY DURING OCCUPIED TIMES.

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FAN CONTROL							x			X	:)	x		х	x							x								
MIXED AIR		х																		х	x	x								
CWC DISCHARGE AIR		х																		х	х	x								
UNIT DISCHARGE AIR		х																		х	х	x								
ROOM SENSER	X	х		x	x			x												Х	х	X								
PREHEAT VALVE						x																								
COOLING VALVE						x																								
HEATING VALVE						x																								
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OUTSIDE AIR			x		x															х	x	x								
RETURN AIR																				Х	х	x								
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