

MULTIZONE TO VARIABLE VOLUME CONTROL RETROFIT CONVENTIONAL (WITH AND WITHOUT RETURN FAN) TEMPLATE DRAWINGS

GENERAL NOTES

1. THESE DRAWINGS ARE FOR A CONTROL SYSTEM RETROFIT TO CONVERT A MULTIZONE HVAC SYSTEM TO VARIABLE VOLUME
2. PROVIDE A COMPLETE, PROPERLY FUNCTIONING INSTALLATION IN CONFORMANCE WITH ALL APPLICABLE CODES, STANDARDS AND ORDINANCES, INCLUDING BUT NOT LIMITED TO: UFC 3-410-02 HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS, UFC 3-510-01 ELECTRICAL ENGINEERING, NFPA 70 NATIONAL ELECTRICAL CODE, AND THE LOCALLY ADOPTED BUILDING CODE AMENDMENTS.
3. UNLESS SPECIFIED OTHERWISE, PROVIDE ALL SUPERVISION, LABOR, MATERIALS, TRANSPORTATION, EQUIPMENT, HAULING AND SERVICES NECESSARY FOR COMPLETELY FINISHED AND OPERATIONAL MECHANICAL, ELECTRICAL, AND CONTROL SYSTEMS. PROVIDE ALL MINOR INCIDENTAL ITEMS SUCH AS OFFSETS, FITTINGS, ETC. REQUIRED AS PART OF THE WORK EVEN THOUGH NOT SPECIFICALLY SHOWN ON CONTRACT DOCUMENTS. THE CONTRACTOR SHALL PROVIDE AND INSTALL THE NUMBER OF ITEMS OF EQUIPMENT AS INDICATED ON THE DRAWINGS AND AS REQUIRED FOR COMPLETE SYSTEMS.
4. THESE DRAWINGS ARE DIAGRAMMATICAL IN NATURE AND SHOW THE GENERAL ARRANGEMENT OF PIPING, DUCTWORK, MECHANICAL, ELECTRICAL, AND CONTROLS EQUIPMENT AND APPURTENANCES, AND SHALL BE FOLLOWED AS CLOSELY AS ACTUAL BUILDING CONSTRUCTION AND THE WORK OF THEIR TRADES WILL PERMIT. BECAUSE OF THE SMALL SCALE OF THESE DRAWINGS, IT IS NOT POSSIBLE TO INDICATE ALL OFFSETS, FITTINGS, AND ACCESSORIES WHICH MAY BE REQUIRED. INVESTIGATE THE STRUCTURAL AND FINISH CONDITIONS AFFECTING THE WORK AND PROVIDE SUCH FITTINGS AND ACCESSORIES AS MAY BE REQUIRED TO MEET SUCH CONDITIONS. VERIFY DIMENSIONS GOVERNING MECHANICAL, ELECTRICAL, AND CONTROLS WORK. DO NOT SCALE THE DRAWINGS FOR DIMENSIONS. TAKE DIMENSIONS, MEASUREMENTS, LOCATIONS, LEVELS, ETC. FROM THE ACTUAL FIELD CONDITIONS. NO EXTRA COMPENSATION SHALL BE CLAIMED OR ALLOWED ON ACCOUNT OF DIFFERENCES BETWEEN THE ACTUAL DIMENSIONS AND THOSE INDICATED ON THE DRAWINGS.
5. PERFORM ALL WORK IN A WORKMANLIKE MANNER. INSTALLATION SHALL CONCLUDE WITH A COMPLETE WORKING SYSTEM IN ALL RESPECTS. AVOID INTERFERENCE WITH ALL OTHER BUILDING SYSTEMS. IF CONFLICTS ARISE, REQUEST RESOLUTION FROM THE CONTRACTING OFFICER.
6. CONTRACTOR SHALL OBTAIN NECESSARY BUILDING PERMITS AND ARRANGE ALL REQUIRED INSPECTIONS WITH THE APPROPRIATE REGULATORY AGENCY. CONTRACTOR SHALL MAINTAIN RESPONSIBILITY FOR COMPLIANCE WITH ALL CODES OR STANDARDS WHICH AFFECT WORK. ALERT CONTRACTING OFFICER OF ALL ITEMS NOT DEPICTED ON DRAWINGS IN A CODE-COMPLYING MANNER. DO NOT PROCEED WITH FURTHER WORK UNTIL WRITTEN RESPONSE IS RECEIVED FROM CONTRACTING OFFICER.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ASPECTS OF JOB SITE SAFETY, VIOLATIONS WILL BE DOCUMENTED AND CORRECTIVE ACTION TAKEN.
8. CONTRACTOR IS RESPONSIBLE FOR PATCHING AND REPAIRING ALL PENETRATIONS IN OR DAMAGE TO WALLS OR CEILING THAT ARE A RESULT OF WORK.
9. CONTRACTOR SHALL OFFER GOV'T THE OPTION TO RETAIN POSSESSION OF ANY DEMOLISHED MATERIALS OR EQUIPMENT. CONTRACTOR SHALL REMOVE ALL DEMOLISHED MECHANICAL MATERIALS NOT RETAINED BY GOV'T FROM PROJECT SITE.
10. INSTALL ALL NEW EQUIPMENT AND DEVICES IN COMPLETE COMPLIANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS. ARRANGE ALL EQUIPMENT AND DEVICES TO PERMIT EASY REMOVAL OF PARTS WHICH MIGHT REQUIRE PERIODIC REPLACEMENT OR MAINTENANCE IN ACCORDANCE WITH THE MANUFACTURER'S REQUIRED SERVICE CLEARANCES EXCEPT WHERE NOTED OTHERWISE.

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MULTIZONE TO VARIABLE VOLUME
CONTROL RETROFIT
CONVENTIONAL

TITLE SHEET AND INDEX OF DRAWINGS

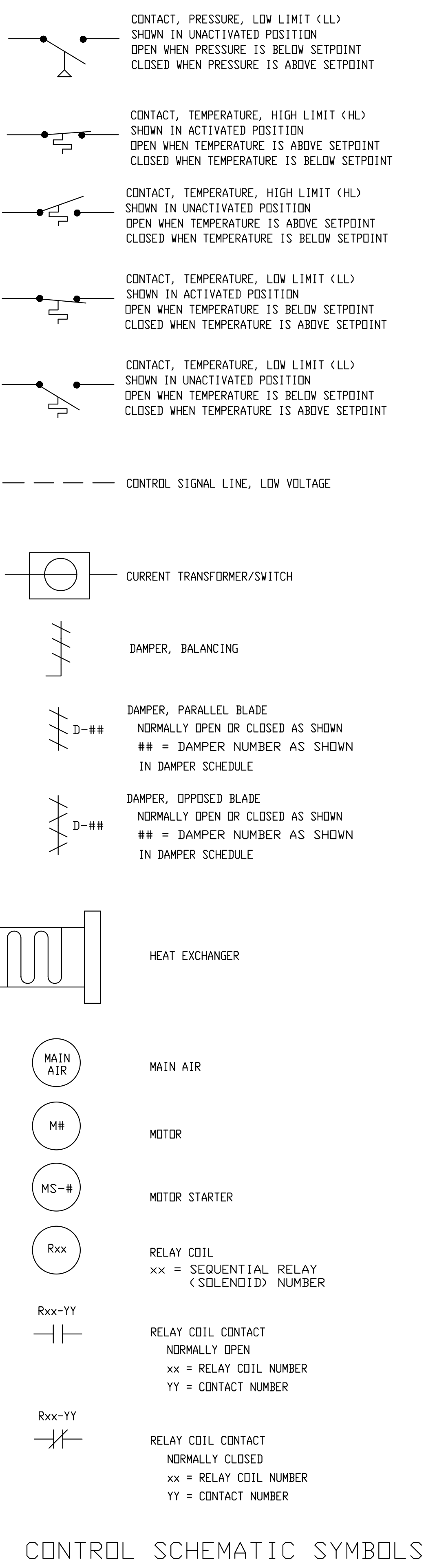
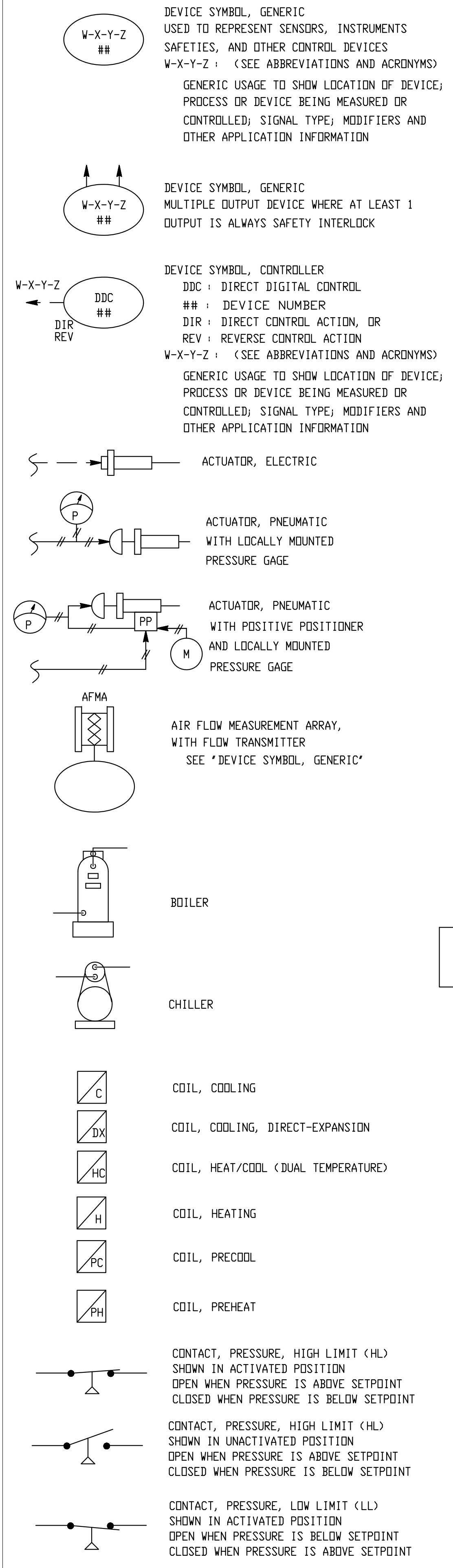
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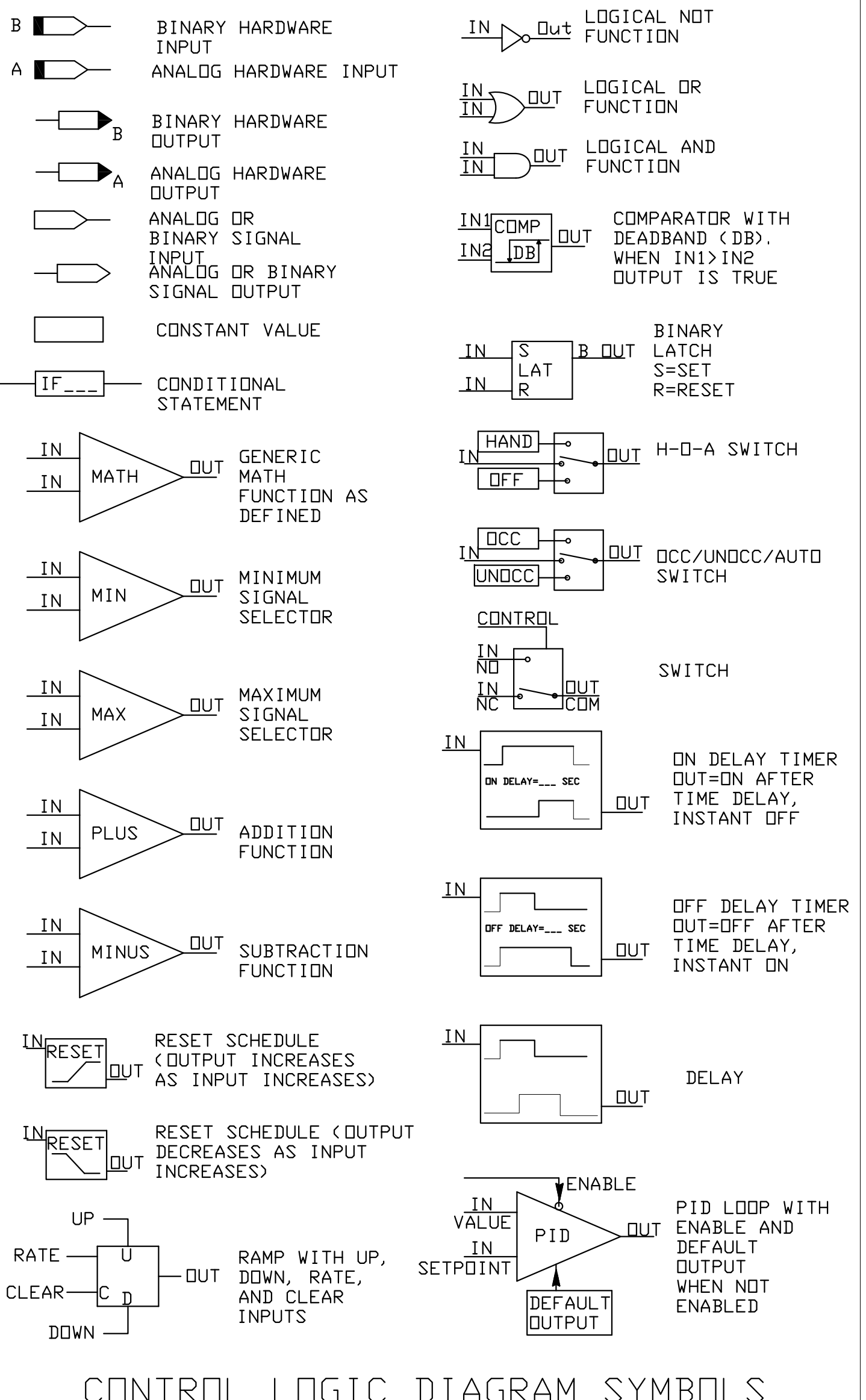
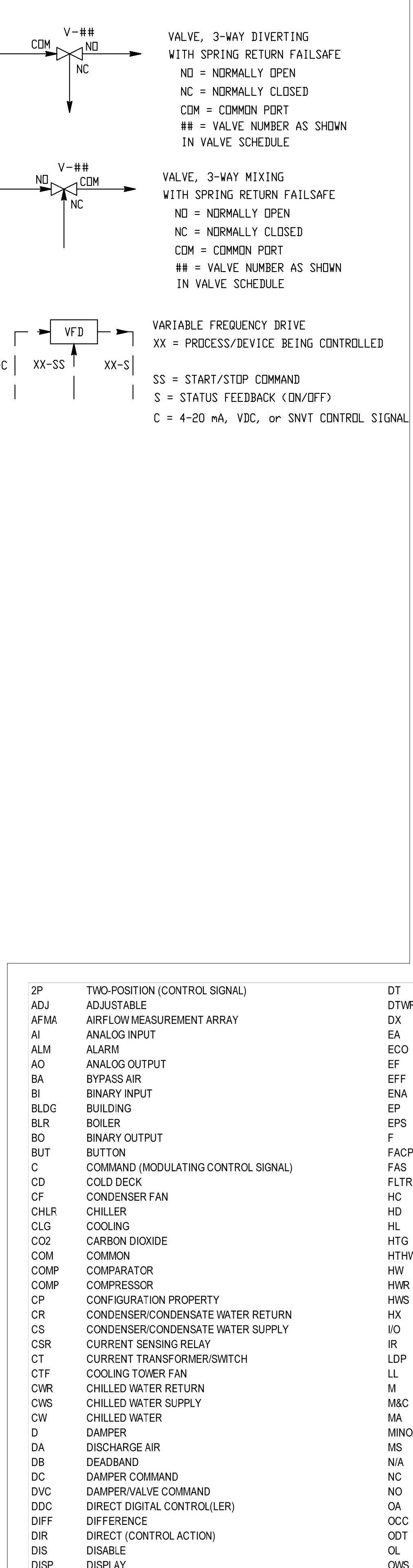
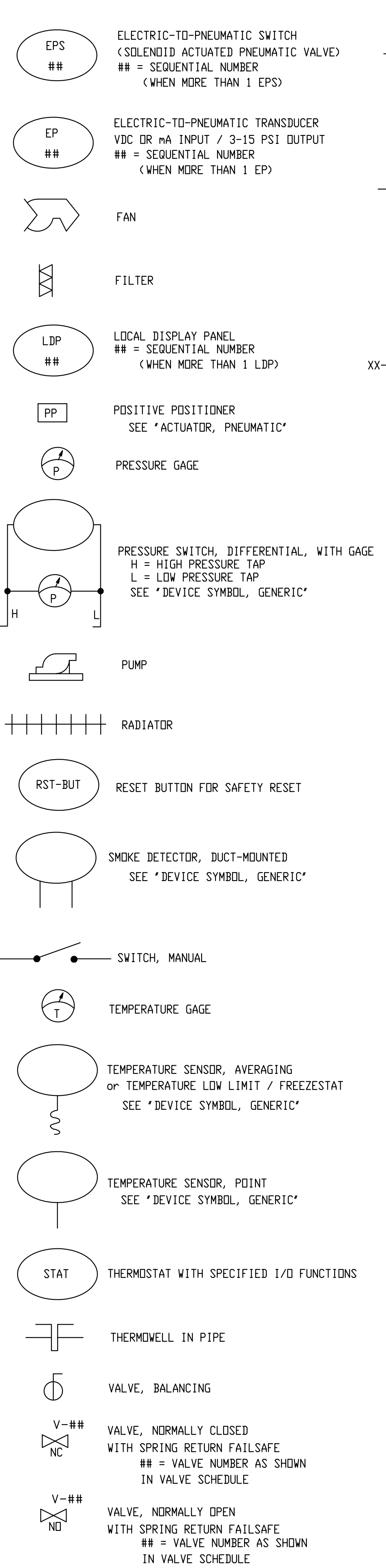
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CONTROL SCHEMATIC SYMBOLS



CONTROL LOGIC DIAGRAM SYMBOLS

2P	TWO-POSITION (CONTROL SIGNAL)	DT	DUAL TEMP	P	PRESSURE
ADJ	ADJUSTABLE	DTWR	DUAL TEMP WATER RETURN	PCW	PRIMARY CHILLER WATER
AFMA	AIRFLOW MEASUREMENT ARRAY	DX	DIRECT EXPANSION (UNIT)	PCWR	PRIMARY CHILLER WATER RETURN
AI	ANALOG INPUT	EA	EXHAUST AIR	PCWS	PRIMARY CHILLER WATER SUPPLY
ALM	ALARM	ECO	ECONOMIZER	PH	PREHEAT
AO	ANALOG OUTPUT	EF	EXHAUST FAN	PID	PROPORTIONAL INTEGRAL DERIVATIVE (CONTROL)
BA	BYPASS AIR	EFF	EFFECTIVE (SETPOINT)	PMP	PUMP
BI	BINARY INPUT	ENA	ENABLE	PP	POSITIVE POSITIONER
BLDG	BUILDING	EP	ELECTRIC TO PNEUMATIC TRANSDUCER	R	RELAY
BLR	BOILER	EPS	ELECTRIC TO PNEUMATIC SWITCH	RA	RETURN AIR
BO	BINARY OUTPUT	F	FLOW	REV	REVERSE (CONTROL ACTION)
BUT	BUTTON	FACP	FIRE ALARM CONTROL PANEL	RF	RETURN FAN
C	COMMAND (MODULATING CONTROL SIGNAL)	FAS	FIRE ALARM SYSTEM	RH	RELATIVE HUMIDITY
CD	COLD DECK	FLTR	FILTER	RLA	RELIEF AIR
CF	CONDENSER FAN	HC	HEAT-COOL	RM	ROOM
CHLR	CHILLER	HD	HOT DECK	RQST	REQUEST
CLG	COOLING	HL	HIGH LIMIT	RST	RESET
CO2	CARBON DIOXIDE	HTG	HEATING	RT	RATE
COM	COMMON	HTHW	HIGH TEMPERATURE HOT WATER	RTN	RETURN
COMP	COMPRESSOR	HW	HOT WATER	S	STATUS
COMP	COMPRESSOR	HWR	HOT WATER RETURN	SA	SUPPLY AIR
CP	CONFIGURATION PROPERTY	HWS	HOT WATER SUPPLY	SEC	SECONDARY
CR	CONDENSER/CONDENSATE WATER RETURN	HX	HEAT EXCHANGER	SF	SUPPLY FAN
CS	CONDENSER/CONDENSATE WATER SUPPLY	IO	INPUT/OUTPUT	SMK	SMOKE
CSR	CURRENT SENSING RELAY	IR	INFRARED	SNVT	STANDARD NETWORK VARIABLE TYPE
CT	CURRENT TRANSFORMER/SWITCH	LDP	LOCAL DISPLAY PANEL	SP	SETPOINT
CTF	COOLING TOWER FAN	LL	LOW LIMIT	SS	START/STOP COMMAND
CWR	CHILLED WATER RETURN	M	MOTOR or MAIN	STAT	THERMOSTAT (SPACE SENSOR MODULE)
CWS	CHILLED WATER SUPPLY	M&C	MONITORING & CONTROL (SOFTWARE)	STM	STEAM
CW	CHILLED WATER	MA	MIXED AIR	SYS	SYSTEM
D	DAMPER	MINOA	MINIMUM OUTSIDE AIR	SCHD	SCHEDULER
DA	DISCHARGE AIR	MS	MOTOR STARTER	T	TEMPERATURE
DB	DEADBAND	N/A	NOT APPLICABLE	TAP	TAP, PRESSURE
DC	DAMPER COMMAND	NC	NORMALLY CLOSED	UNOCC	UNOCCUPIED
DVC	DAMPER/VALVE COMMAND	NO	NORMALLY OPEN	V	VALVE
DDC	DIRECT DIGITAL CONTROL(LER)	OA	OUTSIDE AIR	VV	VARIABLE VOLUME
DIFF	DIFFERENCE	OCC	OCCUPIED OR OCCUPANCY	VFD	VARIABLE FREQUENCY DRIVE
DIR	DIRECT (CONTROL ACTION)	ODT	ON DELAY TIMER	WB	WET BULB (TEMPERATURE)
DIS	DISABLE	OL	OVERLOAD	XFMR	TRANSFORMER
DISP	DISPLAY	OWS	OPERATOR WORKSTATION	ZN	ZONE

ABBREVIATIONS AND ACRONYMS

US Army Corps of Engineers

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MULTI-ZONE TO VARIABLE VOLUME CONTROLS RETROFIT CONVENTIONAL

SYMBOL LEGEND AND ABBREVIATIONS

SHEET IDENTIFICATION M-101 SHEET 2 OF 12

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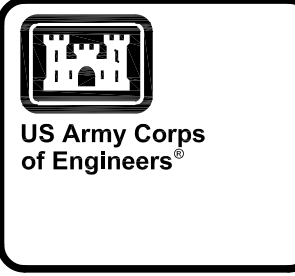
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NOTE: INSERT FLOOR PLANS SHOWING HVAC DUCTWORK, IF DESIRED, OR AS A SEPARATE DRAWING.
 IF TAB IS INCLUDED IN THE PROJECT, PROVIDE ZONE AIRFLOW DRAWINGS SHOWING AIR DISTRIBUTION
 OTHER SUGGESTED DRAWINGS INCLUDE MECHANICAL ROOM LAYOUT AND ANY OTHER AS-BUILT OF THE SYSTEM

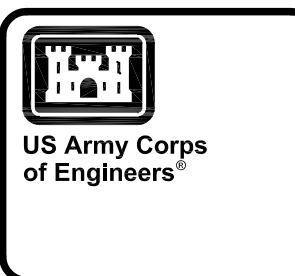


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MULTIZONE TO VARIABLE VOLUME
 CONTROLS RETROFIT
 CONVENTIONAL
 FLOOR PLANS

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M-102
 SHEET 3 OF 12



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MULTI-ZONE TO VARIABLE VOLUME
 CONTROLS RETROFIT
 CONVENTIONAL WITH RETURN FAN
 CONTROL SCHEMATIC

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 SHEET 4 OF 12

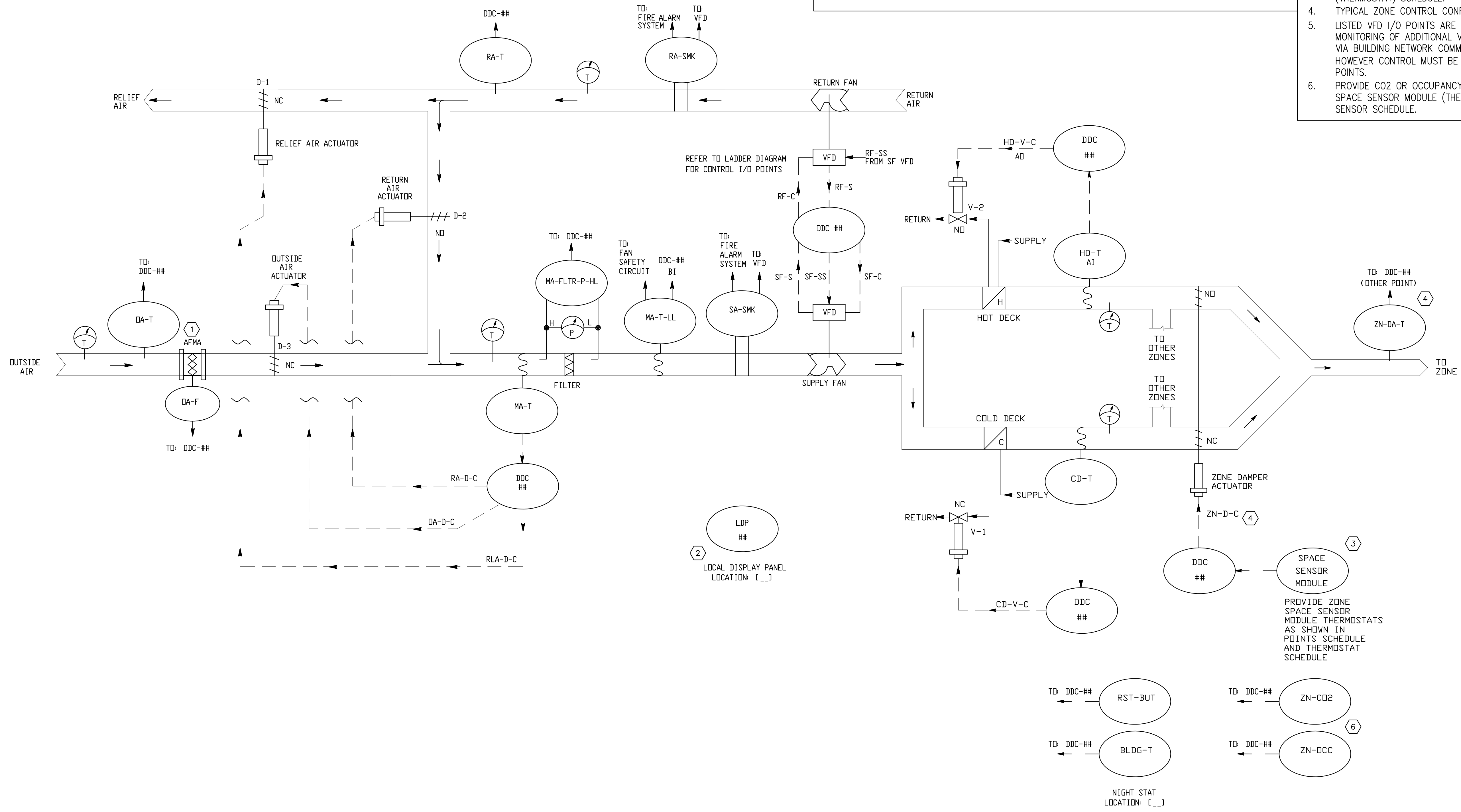
MULTIZONE TO VARIABLE VOLUME CONTROL SCHEMATIC

GENERAL NOTES:

- NOTE 1: CONTRACTOR MAY REUSE EXISTING DEVICES AND HARDWARE WHERE THEY MEET THE PROJECT SPECIFICATIONS AND REQUIREMENTS OTHERWISE NEW DEVICES AND HARDWARE SHALL BE PROVIDED.
- NOTE 2: CONTRACTOR SHALL AFFIX PERMANENT TAGS/LABELS TO ALL DEVICES AS SPECIFIED
- NOTE 3: CONTRACTOR SHALL LABEL ALL DDC I/O SIGNAL LINES: 4-20 mA, VDC, OR NETWORK VARIABLE
- NOTE 4: CONTRACTOR SHALL SHOW A UNIQUE IDENTIFIER FOR EACH DEVICE. WERE MULTIPLE IDENTICAL DEVICES ARE SHOWN (FOR EXAMPLE; DDC CONTROLLER, OA SENSOR, OR EP TRANSDUCER) EACH SHALL BE SEQUENTIALLY NUMBERED. WHERE SEPARATE DDC CONTROLLER BUBBLES ARE USED TO REPRESENT/SHOW A COMMON (OR SINGLE) CONTROLLER EACH BUBBLE SHALL USE THE SAME IDENTIFIER AND NUMBER. DEVICE AND SIGNAL IDENTIFIERS SHALL BE CONSISTENT BETWEEN DRAWINGS.

KEYED NOTES:

1. PROVIDE AIRFLOW MEASUREMENT ARRAY AS SPECIFIED.
2. PROVIDE LOCAL DISPLAY PANEL AND MOUNT IN THE MECHANICAL ROOM CLOSEST TO THE EQUIPMENT PROVIDING INFORMATION DISPLAYED BY THE LDP AND INSTALLED ON, ADJACENT TO, OR INSIDE THE DDC ENCLOSURE/CABINET. DISPLAY POINTS AS SPECIFIED IN THE POINTS SCHEDULE.
3. PROVIDE SPACE SENSOR MODULE THERMOSTAT WITH FUNCTIONALITY SHOWN IN THE SPACE SENSOR MODULE (THERMOSTAT) SCHEDULE.
4. TYPICAL ZONE CONTROL CONFIGURATION.
5. LISTED VFD I/O POINTS ARE TO BE HARDWIRED. MONITORING OF ADDITIONAL VFD POINTS IS ACCEPTABLE VIA BUILDING NETWORK COMMUNICATION CARD IN VFD HOWEVER CONTROL MUST BE VIA HARDWIRED I/O POINTS.
6. PROVIDE CO2 OR OCCUPANCY SENSORS BASED ON SPACE SENSOR MODULE (THERMOSTAT) AND ZONE SENSOR SCHEDULE.

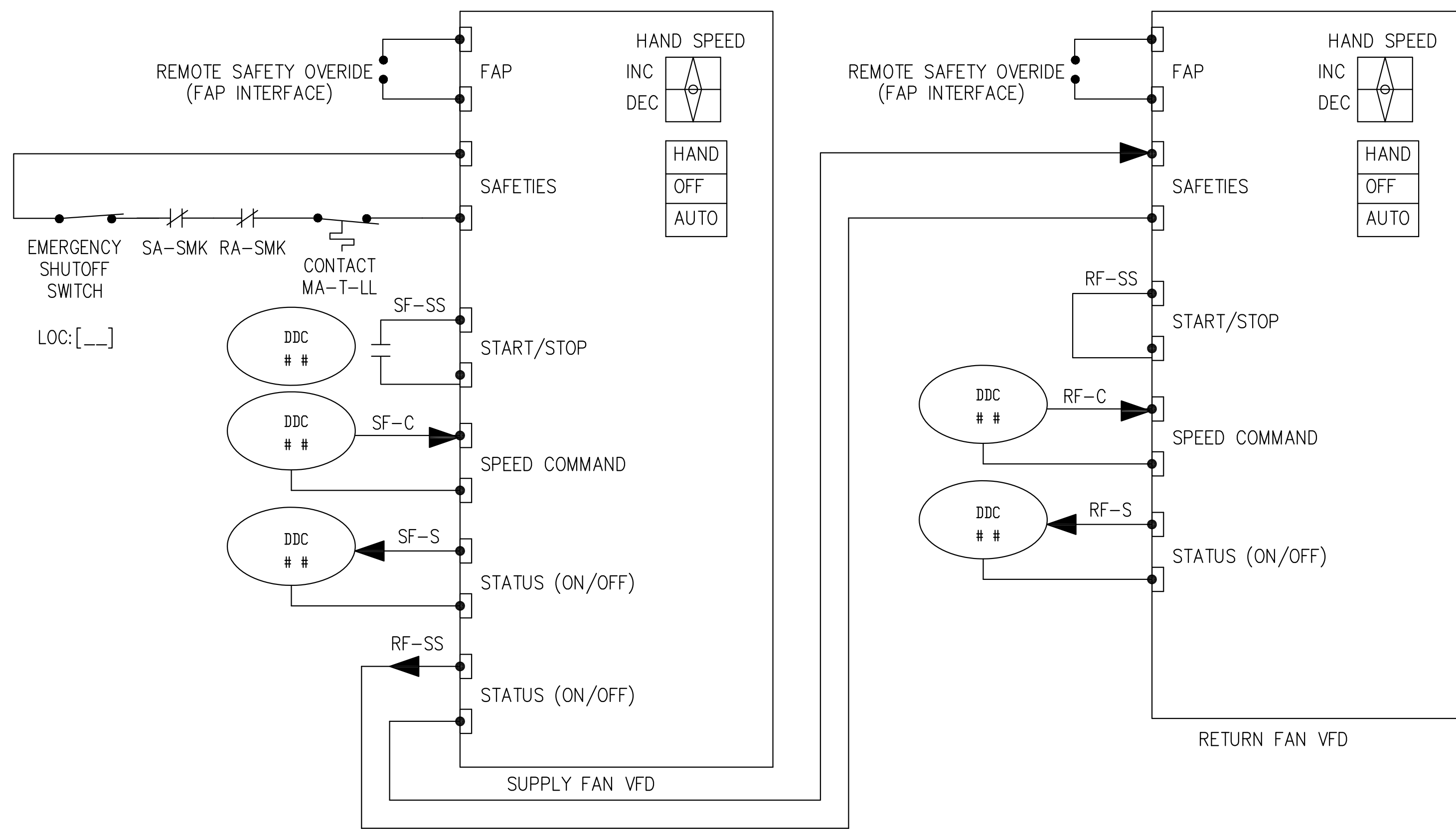


GENERAL NOTES:

NOTE 1: THIS IS A FUNCTIONAL REPRESENTATION. CONTRACTOR WIRING MAY DIFFER.

NOTE 2: A SUPPLY FAN VFD WITH A SINGLE STATUS (ON/OFF) OUTPUT MAY USE AN INTERPOSING RELAY FOR THE SF-S AND RF-SIGNALS.

NOTE 3: RETURN FAN START/STOP INPUT IS JUMPERED "ON" SO THAT THE RETURN FAN OPERATION IS DEPENDENT ON THE SUPPLY FAN "ON/OFF" STATUS, FAP INTERFACE, AND SAFETIES.



LADDER DIAGRAM

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MULTI-ZONE TO VARIABLE VOLUME CONTROLS RETROFIT CONVENTIONAL WITH RETURN FAN
LADDER DIAGRAM

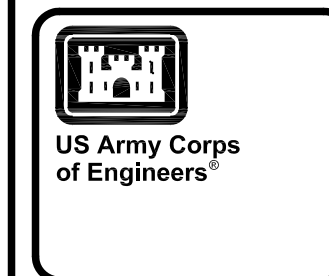
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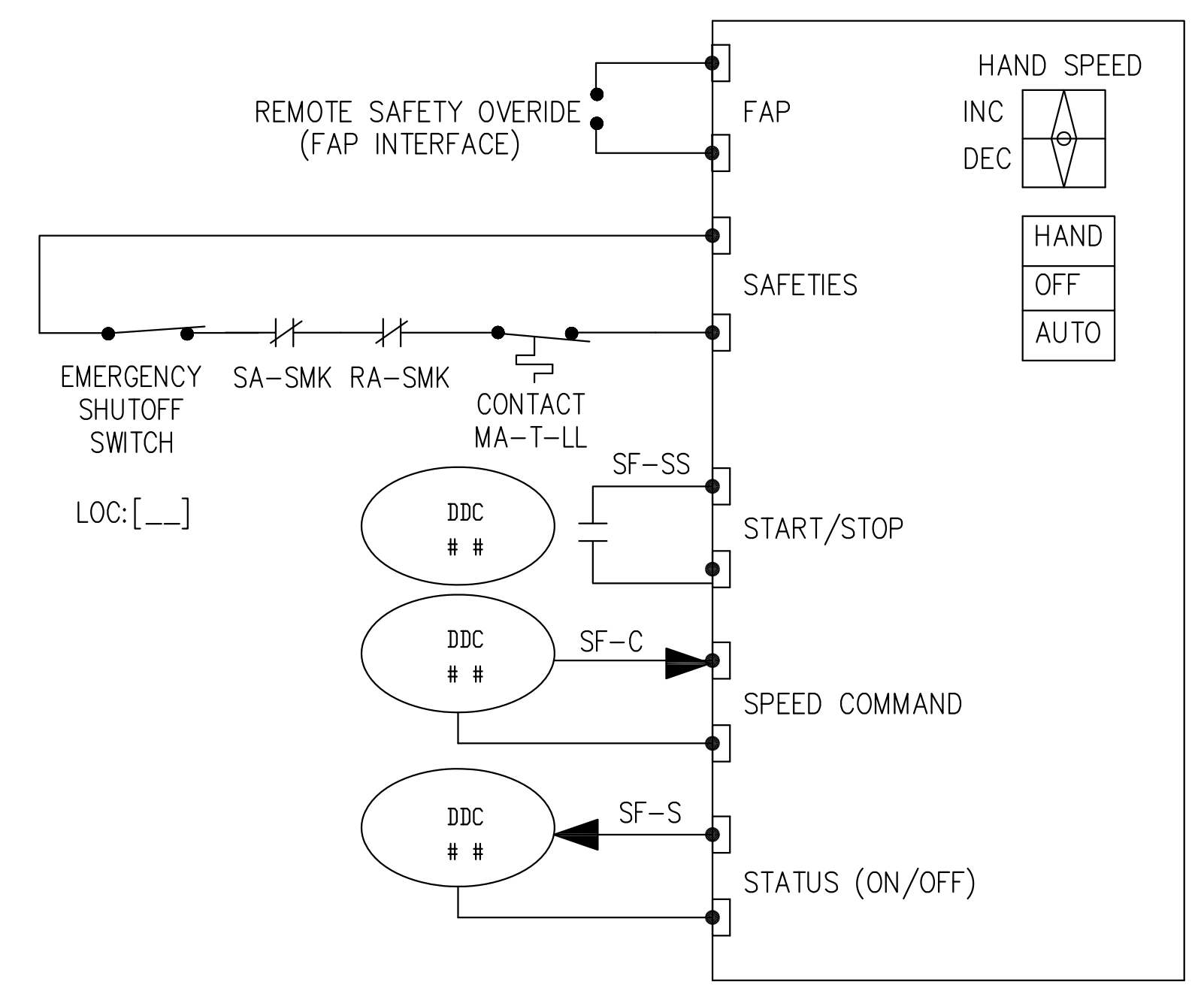
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GENERAL NOTES:

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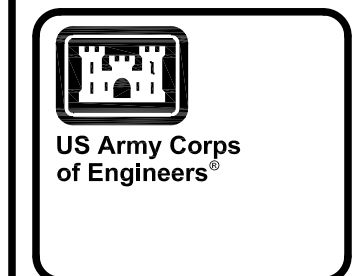


LADDER DIAGRAM

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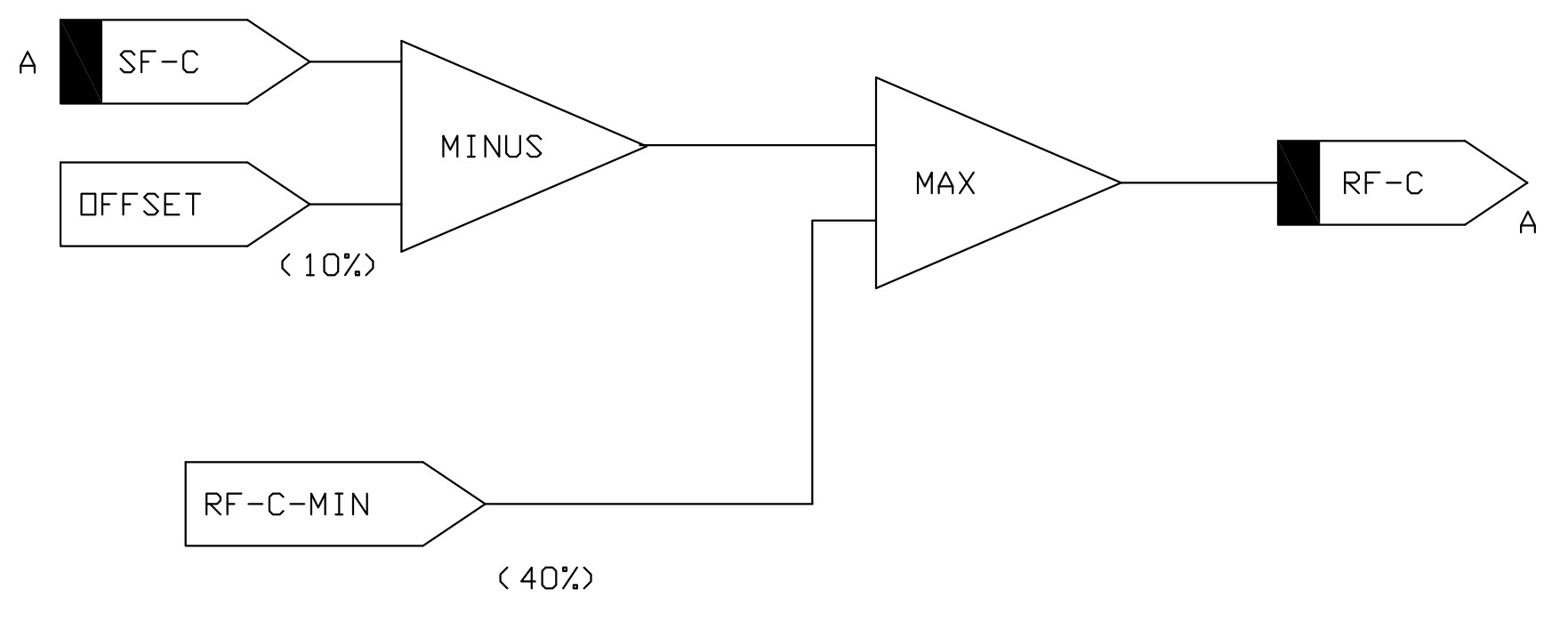
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MULTI-ZONE TO VARIABLE VOLUME
CONTROLS RETROFIT
CONVENTIONAL WITHOUT RETURN FAN
LADDER DIAGRAM

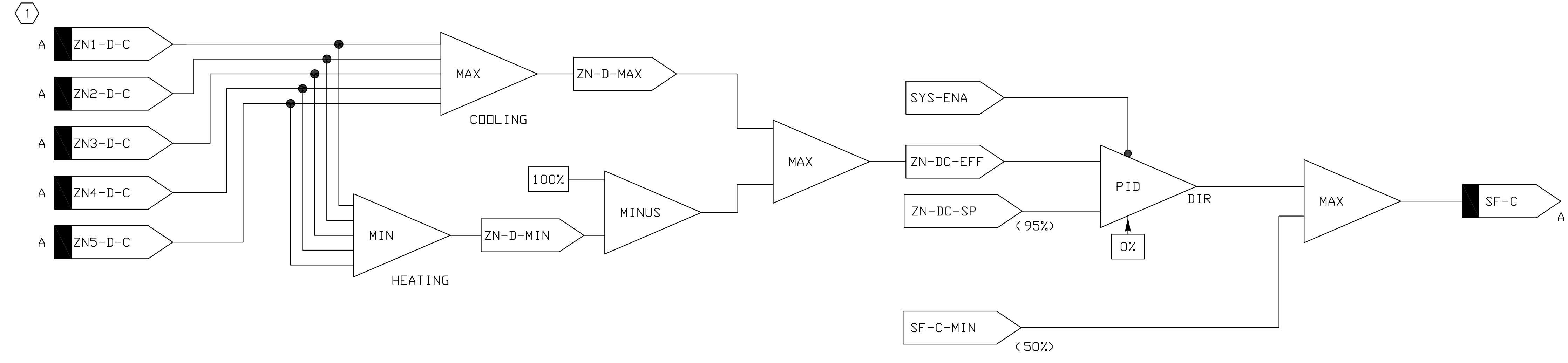


KEYED NOTES:

1. THE 'ZONE HEATING/COOLING LOAD DETERMINATION' CONTROL LOGIC DIAGRAM IS A FUNCTIONAL REPRESENTATION SHOWING FIVE ZONES. THE PROJECT-SPECIFIC REQUIREMENT IS THAT EVERY ZONE'S DAMPER AND VALVE COMMAND WILL SERVE AS AN INPUT TO THE FAN CAPACITY CONTROL LOOP.

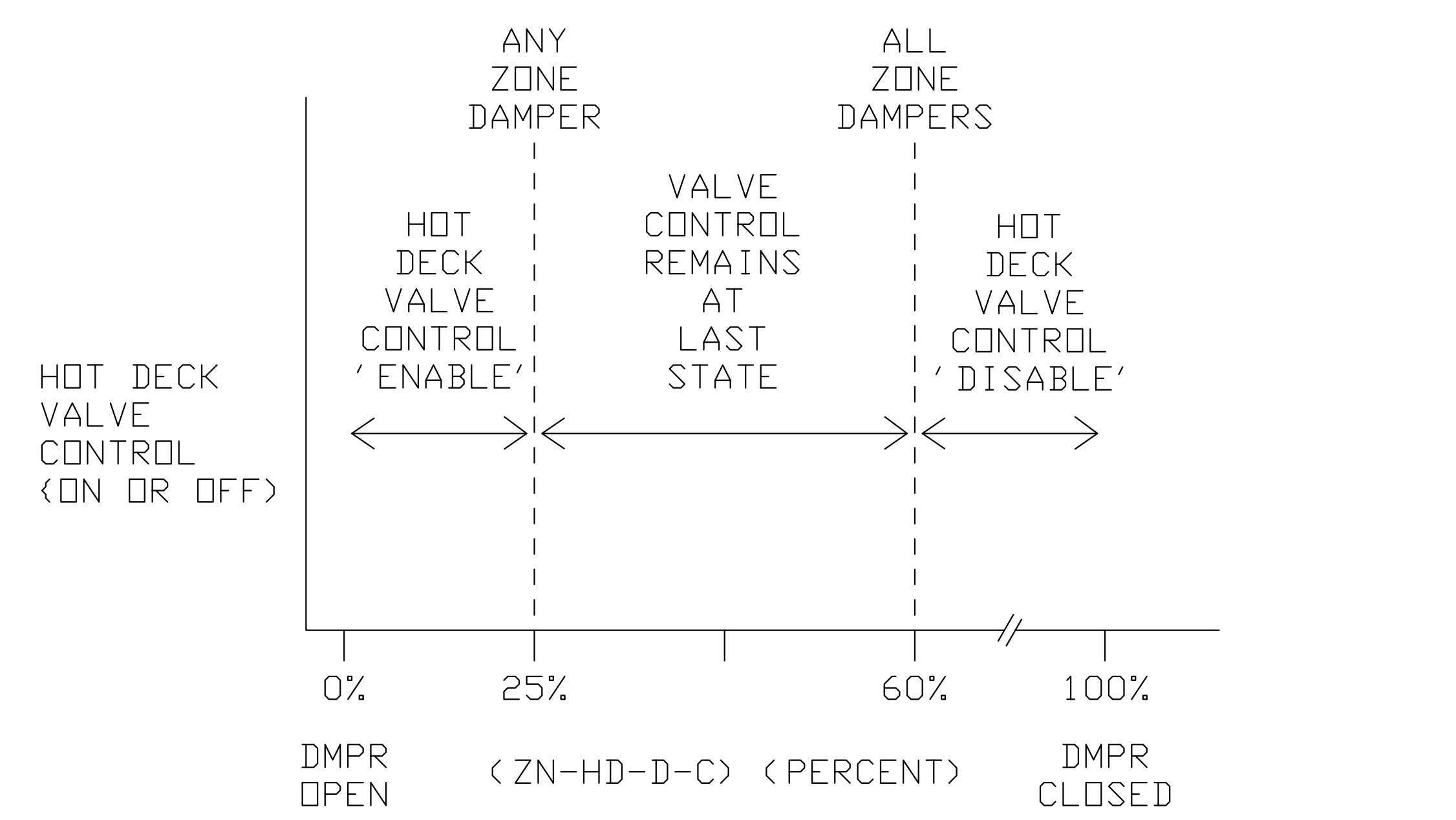


RETURN FAN CAPACITY CONTROL LOOP

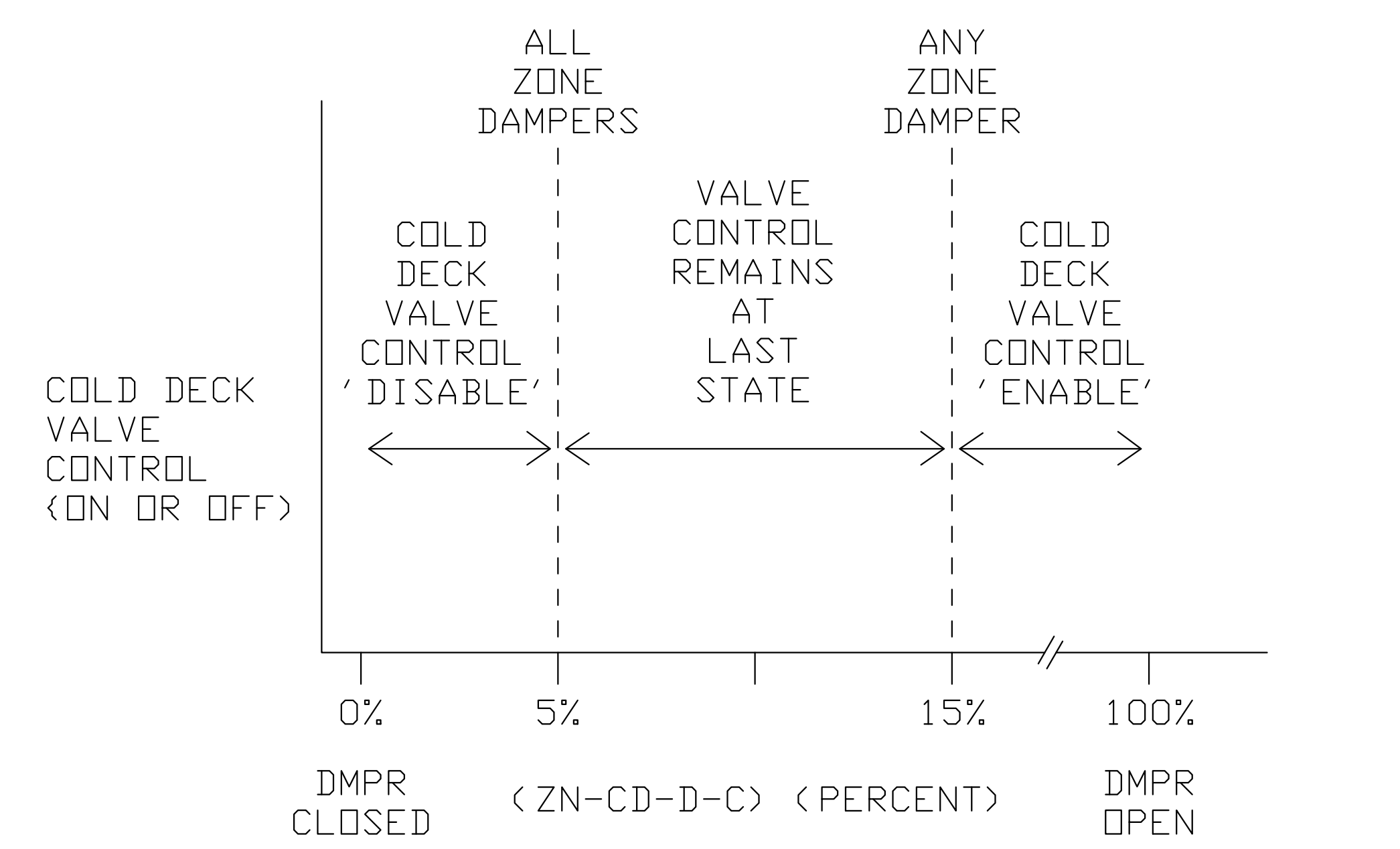


FAN CAPACITY CONTROL LOOP
ZONE HEATING/COOLING LOAD DETERMINATION

SUPPLY FAN CAPACITY CONTROL LOOP
(_) ENTRIES ARE FOR EXAMPLE ONLY



HOT DECK VALVE CONTROL (ON or OFF)
BASED ON HOT DECK ZONE DAMPER COMMAND



COLD DECK VALVE CONTROL (ON or OFF)
BASED ON COLD DECK DAMPER COMMAND

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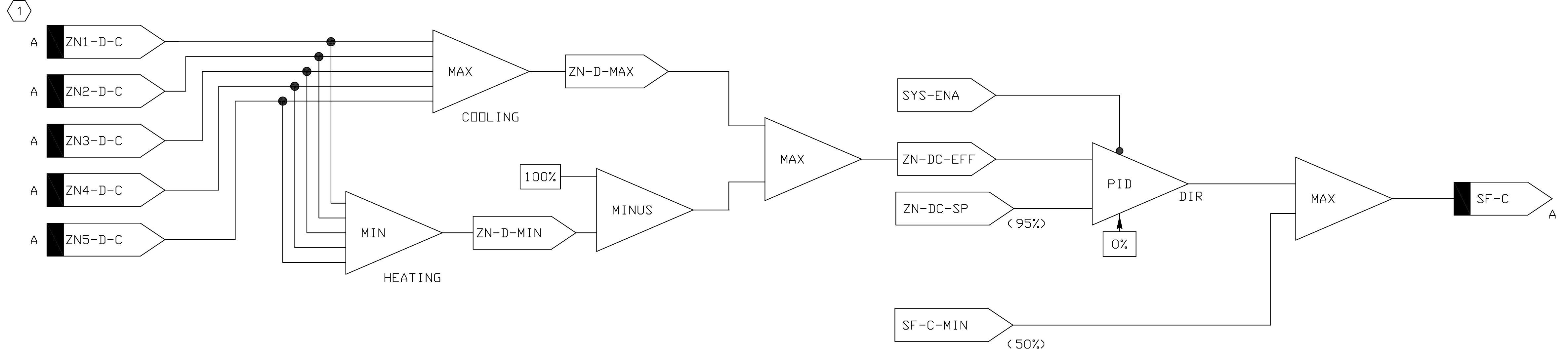
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MULTI-ZONE TO VARIABLE VOLUME
CONTROLS RETROFIT
CONVENTIONAL WITH RETURN FAN
CONTROL LOGIC DIAGRAMS

MULTI-ZONE TO VARIABLE VOLUME
CONTROLS RETROFIT
CONVENTIONAL WITH RETURN FAN
CONTROL LOGIC DIAGRAMS

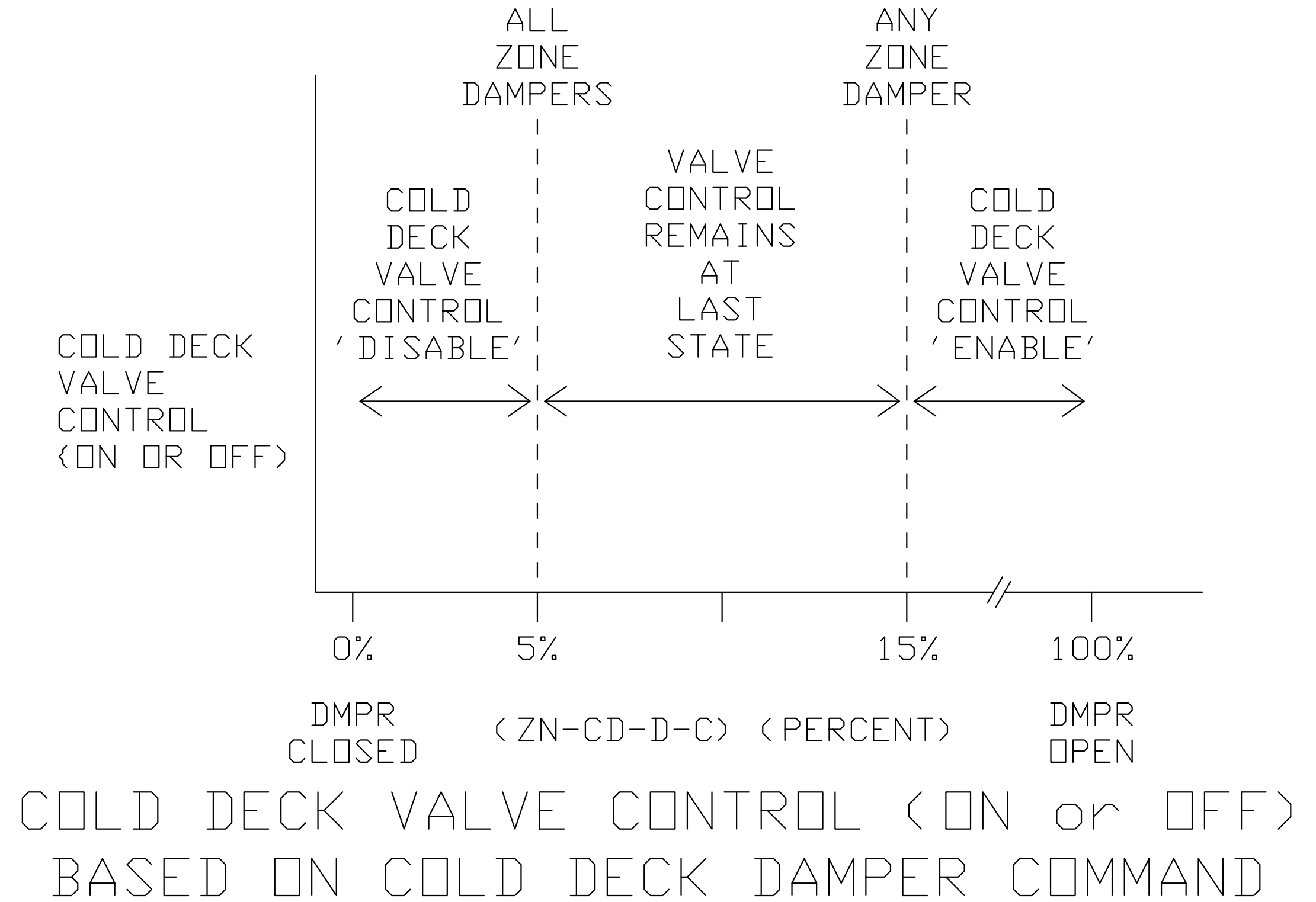
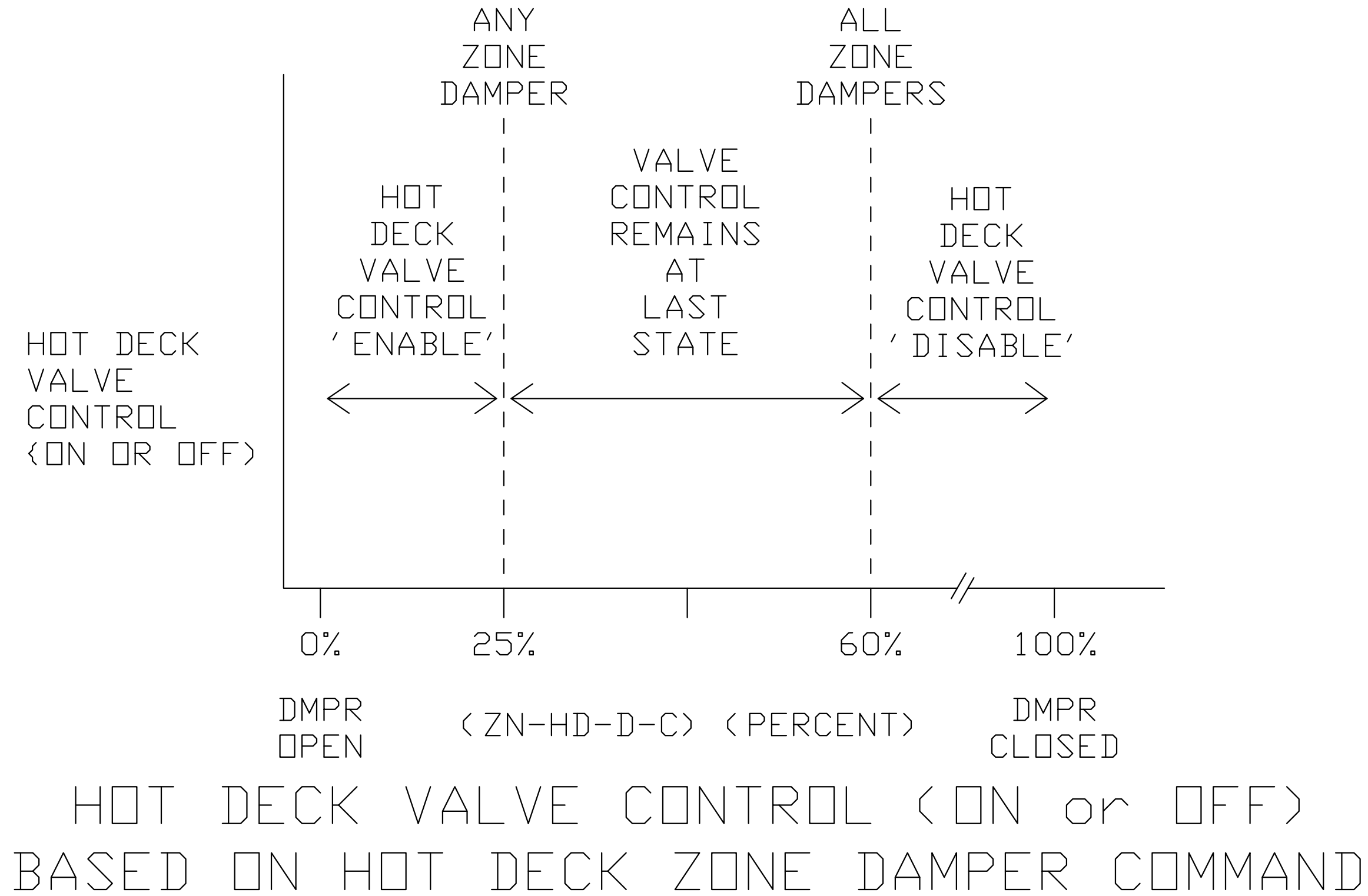
KEYED NOTES:

1. THE 'ZONE HEATING/COOLING LOAD DETERMINATION' CONTROL LOGIC DIAGRAM IS A FUNCTIONAL REPRESENTATION SHOWING FIVE ZONES. THE PROJECT-SPECIFIC REQUIREMENT IS THAT EVERY ZONE'S DAMPER COMMAND WILL SERVE AS AN INPUT TO THE FAN CAPACITY CONTROL LOOP.



FAN CAPACITY CONTROL LOOP
ZONE HEATING/COOLING LOAD DETERMINATION

SUPPLY FAN CAPACITY CONTROL LOOP
(_) ENTRIES ARE FOR EXAMPLE ONLY



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MULTI-ZONE TO VARIABLE VOLUME CONTROLS RETROFIT CONVENTIONAL WITHOUT RETURN FAN CONTROL LOGIC DIAGRAMS

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NOTE: INSERT PROJECT-SPECIFIC SEQUENCE OF OPERATION.

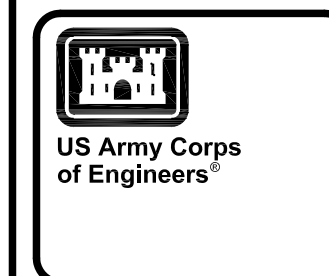


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MULTI-ZONE TO VARIABLE VOLUME
CONTROLS RETROFIT
CONVENTIONAL
SEQUENCE OF OPERATIONS

SHEET
IDENTIFICATION
M-623d1
SHEET 10 OF 12



ENABLED LOOPS BY OCCUPANCY MODE

MODES	FAN CAPACITY CONTROL	OA FLOW CONTROL	MIXED AIR LOW LIMIT	MIXED AIR TEMPERATURE CONTROL WITH ECONOMIZER	HEATING VALVE CONTROL	CD TEMPERATURE CONTROL	ZONE TEMPERATURE CONTROL	PREHEAT COIL CONTROL (IF REQUIRED)
OCCUPIED	X	X	X	X	X	X	X	X
UNOCCUPIED, MAX(ZN-T) > ZN-T-HL < DEADBAND = 5 DEG F ADJUSTABLE	X		X	X		X	X	X
UNOCCUPIED, MAX(ZN-T) < ZN-T-HL AND > ZN-T-LL < DEADBAND = 5 DEG F ADJUSTABLE	(NO LOOPS ENABLED)							
UNOCCUPIED, MIN(ZN-T) < ZN-T-LL < DEADBAND = 5 DEG F ADJUSTABLE	X		X	X	X		X	X
WARM-UP/COOL-DOWN	X		X	X	X	X	X	X

NOTE: BLDG-T MAX AND MIN IS REFERENCING THE SPACE SENSOR MODULE THERMOSTATS

SPACE SENSOR MODULE (THERMOSTAT) AND ZONE SENSOR SCHEDULE

SYSTEM SERVICE (BLDG & AHU)	ZONE	SPACES SERVED	SSM/STAT LOCATION	ZN-T DISPLAY	ZN-T-SP ADJUST	UNOCC OVERRIDE PUSHBUTTON	UNOCC OVERRIDE TIME	OCC SENSOR	CO2 SENSOR	RH SENSOR	OTHER
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[]		RM-[]	RM-[]	[]	[]	[]	[]	[]	[]	[]	[]
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NOTE: OCCUPANCY SENSORS MUST BE CEILING MOUNTED UNLESS OTHERWISE SPECIFIED

OCCUPANCY SCHEDULE

SYSTEM	OCCUPIED	UNOCCUPIED	WARM-UP
[]	M-F 0800-1800	OTHERWISE	M-F 0700-0800

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MULTI-ZONE TO VARIABLE VOLUME
CONTROLS RETROFIT
CONVENTIONAL
CONTROL SCHEDULES

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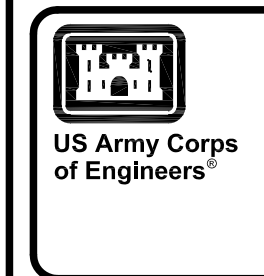
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NOTE TO DESIGNER : INSERT PROJECT-SPECIFIC POINTS SCHEDULE HERE.
 AN EXCEL SPREADSHEET WITH TEMPLATE POINTS SCHEDULE INSTRUCTIONS ARE AVAILABLE
 WITH THE MZ TO VV RETROFIT 'DESIGN GUIDE'. POINTS SCHEDULE INSTRUCTIONS ARE
 AVAILABLE IN UFC 3-410-02 - DDC FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.
 POINTS SCHEDULE INSTRUCTIONS ARE AVAILABLE AT THIS LOCATION -
<https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-410-02>



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MULTI-ZONE TO VARIABLE VOLUME
 CONTROLS RETROFIT
 CONVENTIONAL
 POINTS SCHEDULE

SHEET IDENTIFICATION
M-623f1
 SHEET 12 OF 12