

# RECIRCULATING ROOFTOP UNIT - RTU

THE VARIABLE VOLUME AIR HANDLING UNIT CONSISTS OF A MIXED AIR SECTION WITH OUTDOOR AIR, EXHAUST AIR AND RE-CIRCULATION AIR DAMPERS, RETURN AIR DAMPERS, PRE AND FINAL AIR FILTERS, MODULATION GAS-FIRED FURNACE, DIRECT EXPANSION COOLING SECTION, AND SUPPLY FAN. THE UNIT IS DDC CONTROLLED USING ELECTRIC ACTUATION.

THE AIR HANDLING UNIT IS SCHEDULED FOR AUTOMATIC OPERATION ON A TIME OF DAY BASIS FOR OCCUPIED AND UNOCCUPIED MODES.

THE AIR HANDLING UNIT OPERATES IN WARM-UP, OCCUPIED, UNOCCUPIED, AND SAFETY MODES AS FOLLOWS (ALL SUGGESTED SET POINTS AND SETTINGS SHALL BE ADJUSTABLE):

### WARM-UP

THE SUPPLY FAN STARTS. THE MIXING DAMPERS ARE POSITIONED FOR 100% RETURN AIR, THE GAS VALVE SHALL MODULATE TO MAINTAIN THE WARM-UP SUPPLY AIR TEMPERATURE SET POINT. WHEN TIME REACHES THE START TIME DURING THE WARM-UP MODE, THE OUTDOOR AIR DAMPER OPENS TO ITS MINIMUM POSITION. THE SYSTEM IS PREVENTED FROM ENTERING THE WARM-UP MODE MORE THAN ONCE PER DAY.

### COOL-DOWN

THE OUTSIDE AND EXHAUST AIR DAMPERS CLOSE. RE-CIRC DAMPER OPENS AND THE SUPPLY FAN STARTS, AND THE GAS-FIRED FURNACE SHALL BE OFF, AND COOLING SYSTEM SHALL BE MODULATED TO MAINTAIN SPACE DISCHARGE SETPOINT. MORNING COOL-DOWN SHALL OCCUR (1 HR. ADJ.) PRIOR TO UNIT SCHEDULED OCCUPIED START TIME (TIME PERIOD SHALL BE ADJUSTED THRU CONTROLLER'S OPTIMIZED START LOGIC UTILIZING UNIT TREND DATA). ECONOMIZER MODE OF OPERATION SHALL OVER-RIDE NORMAL COOL-DOWN MODE OF OPERATION.

### OCCUPIED

THE FAN STARTS AND CONTINUES TO RUN AND THE UNIT IS CONTROLLED AS FOLLOWS:

THE OUTSIDE AIR DAMPER IS CONTROLLED TO MAINTAIN THE MINIMUM OUTSIDE AIRFLOW SET POINT (AS DETERMINED FROM THE CO2 LEVEL IN THE RETURN, AND SHALL BE OPENED AS CO2 LEVELS INCREASE. THE EXHAUST AIR DAMPER SHALL RECEIVE THE SAME SIGNAL AS THE OUTSIDE AIR DAMPER AND THE RETURN AIR DAMPER SHALL MODULATE IN SEQUENCE. THE UNITS COOLING AND HEATING FUNCTION SHALL BE CONTROLLED BY THE UNIT DDC CONTROLLER TO MAINTAIN DISCHARGE TEMPERATURE SET-POINT ( 80°F ADJ.)

### ECONOMIZER

THE UNIT SHALL BE EQUIPPED WITH A COMPARATIVE ENTHALPY ECONOMIZER MODE OF OPERATION. DURING THIS MODE, THE GAS FURNACE & DX COOLING SHALL BE DE-ENERGIZED. THE MIXING DAMPERS RAMP OPEN SLOWLY TO MINIMIZE OVERSHOOTING.

### UNOCCUPIED (NORMAL OFF)

THE SUPPLY FAN IS OFF, AND THE MIXING DAMPERS CLOSE TO THE OUTDOOR AIR UNIT TO ACTIVATE ONCE EVERY HOUR(ADJ.) TO SAMPLE BUILDING TEMP. ON A SENSED TEMP OF 40°F (ADJ.) OR BELOW UNIT SHALL ACTIVATE AND RUN IN 100% RE-CIRCULATION MODE UNTIL BUILDING TEMP REACHES DESIRED SET POINT.

### CO2 CONTROL

AS THE RETURN AIR CO2 LEVEL RISES, THE MINIMUM OUTSIDE AIR-FLOW SET POINT SHALL BE RESET. THE OUTSIDE AIR DAMPER WILL BE OVERRIDDEN TO MODULATE OPEN TO INTRODUCE MAX O.A. CFM AS INDICATED IN SCHEDULE TO REDUCE CO2 LEVELS BACK TO LEVELS BELOW SET POINT. WHILE THE EXHAUST AIR DAMPER TRACKS AND MAINTAINS THE SAME POSITION AS THE OUTSIDE AIR DAMPER, AND THE RETURN AIR DAMPER POSITION MODULATES IN SEQUENCE. ONCE THE LEVEL OF CO2 IS REDUCED BELOW SET POINT (900 PPM, ADJ.), THE DAMPERS WILL REVERT TO NORMAL OPERATION.

### SAFETY

DISCHARGE HIGH STATIC CUTOUT, SMOKE DETECTOR AND FAN FAULT ALARMS DE-ENERGIZE THE FAN UPON ACTIVATION. WHEN THE OAT IS LESS THAN 45°F, THE GAS VALVE MODULATES TO MAINTAIN A UNIT MIXED AIR TEMPERATURE AT 45°F (ADJ.). ALL OTHER DAMPERS AND VALVES POSITION TO THEIR NORMAL POSITION AFTER THE FANS ARE DE-ENERGIZED.

CURRENT SWITCHES ARE INSTALLED ON THE LOAD SIDE OF THE SUPPLY MOTOR. THE DDC SYSTEM USES THE SWITCHES TO CONFIRM THE FANS ARE IN THE DESIRED STATE (I.E. ON OR OFF) AND GENERATES THE ALARM IF THE STATUS DEVIATES FROM DDC START/STOP CONTROL. THE DDC SYSTEM GENERATES A MOTOR TROUBLE ALARM INDEPENDENT FROM THE FAN STATUS.

### OCCUPIED/ UNOCCUPIED OVER-RIDE CONTROL

THE SPACE TEMPERATURE SENSOR SHALL BE EQUIPPED WITH A PUSH-BUTTON OVER-RIDE SWITCH. ACTIVATION OF SWITCH SHALL ENABLE UNIT TO OPERATE IN OCCUPIED MODE FOR A 2-HOUR (ADJ.) PERIOD.

### LOW LEAVING TEMPERATURE

UPON A LOW LEAVING TEMPERATURE CONDITION (38°F ADJ.) SENSED BY THE SA-T SENSOR, THE OUTSIDE AIR AND EXHAUST AIR DAMPERS SHALL CLOSE, AND THE SUPPLY AND EXHAUST AIR FANS SHALL SHUT DOWN AND AN ALARM SHALL BE GENERATED.

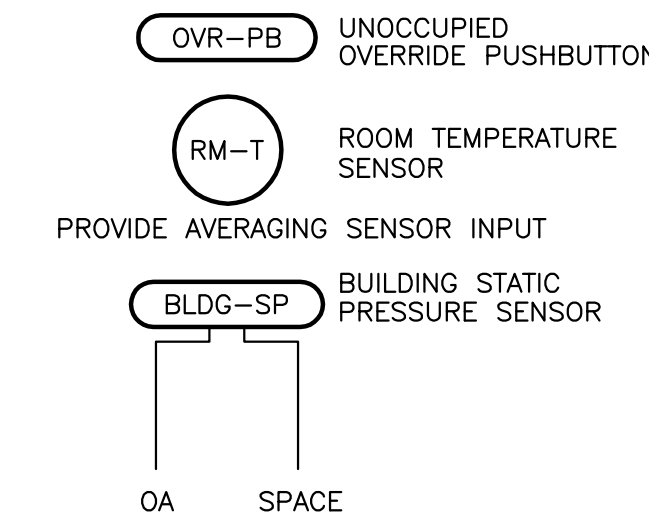
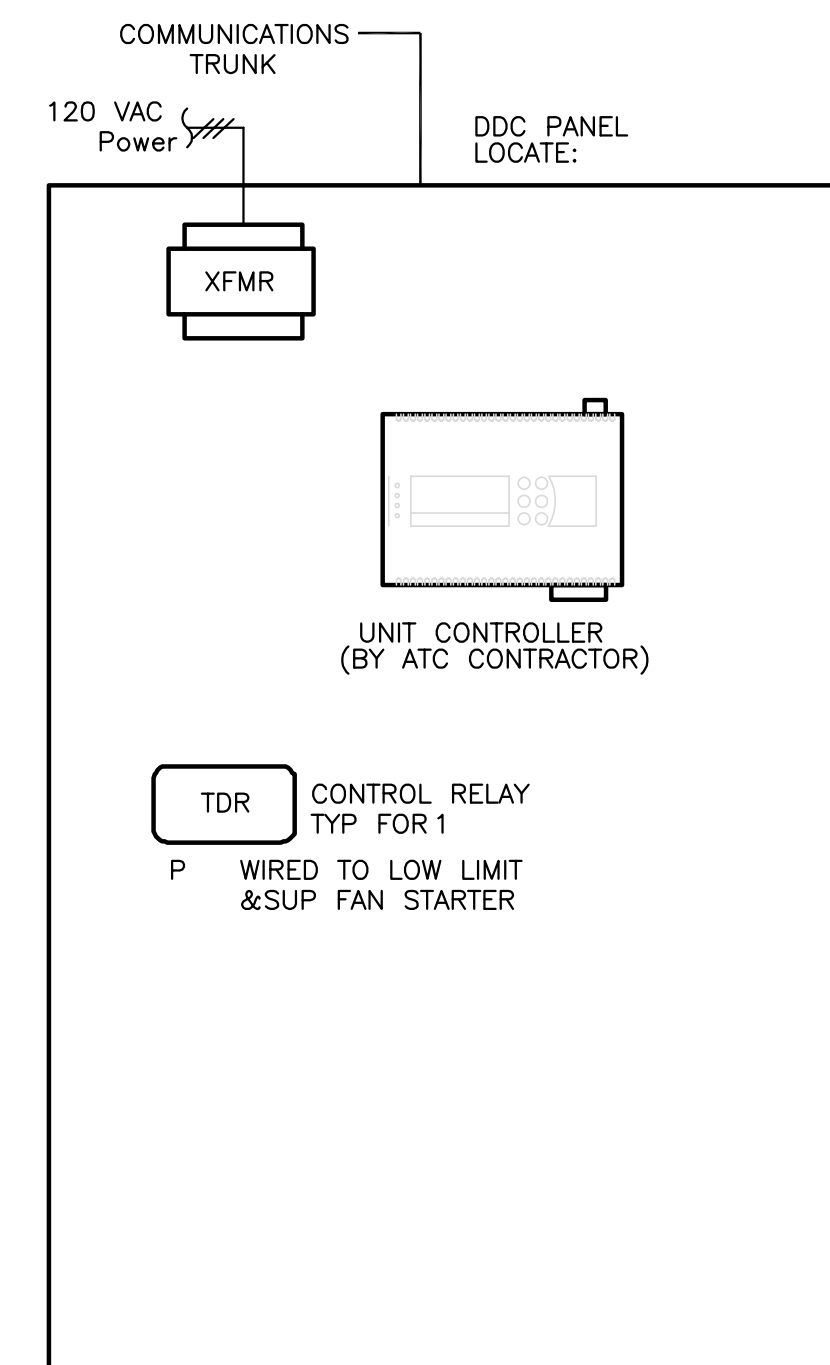
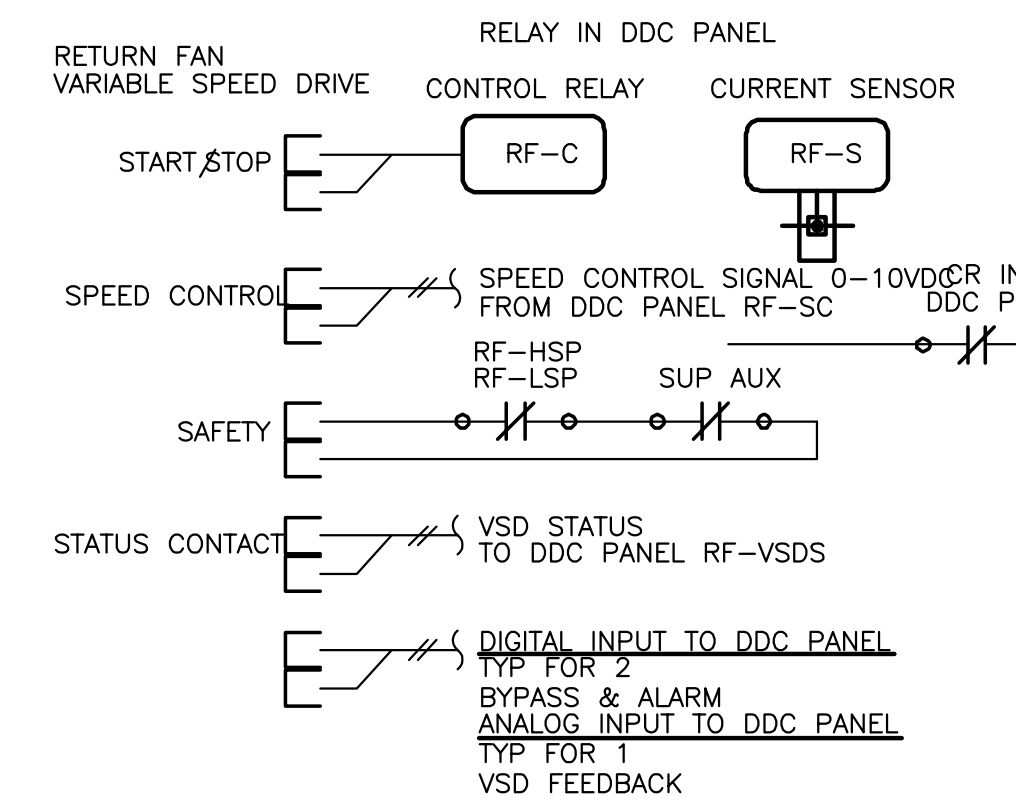
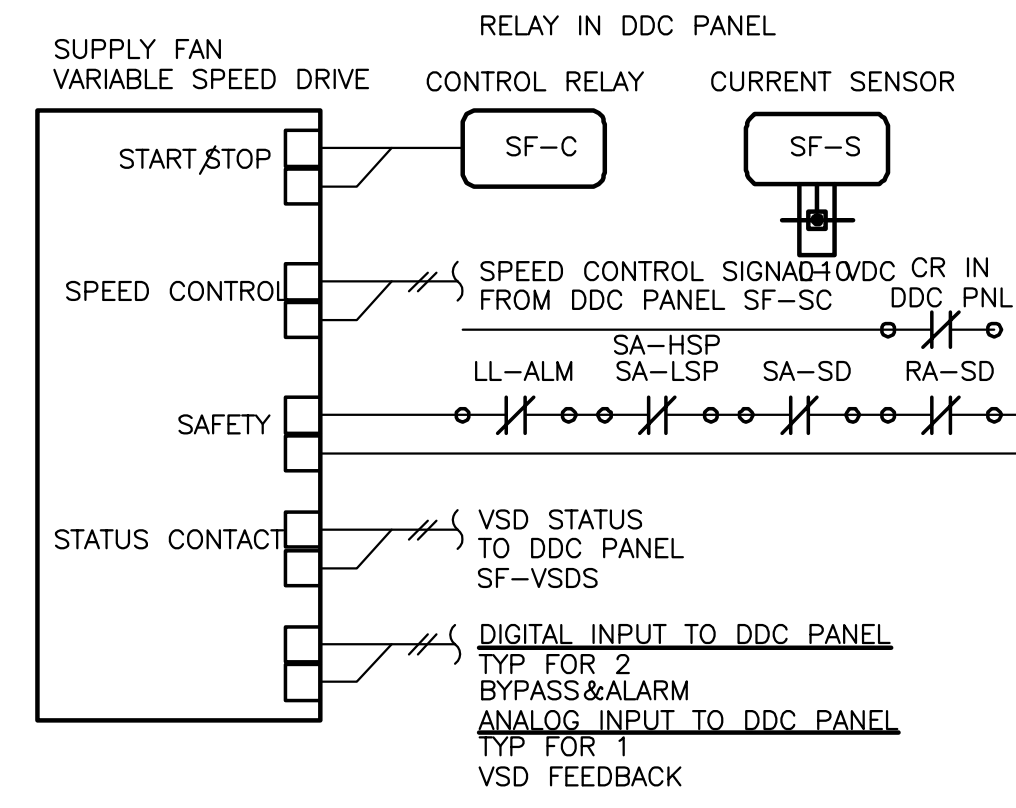
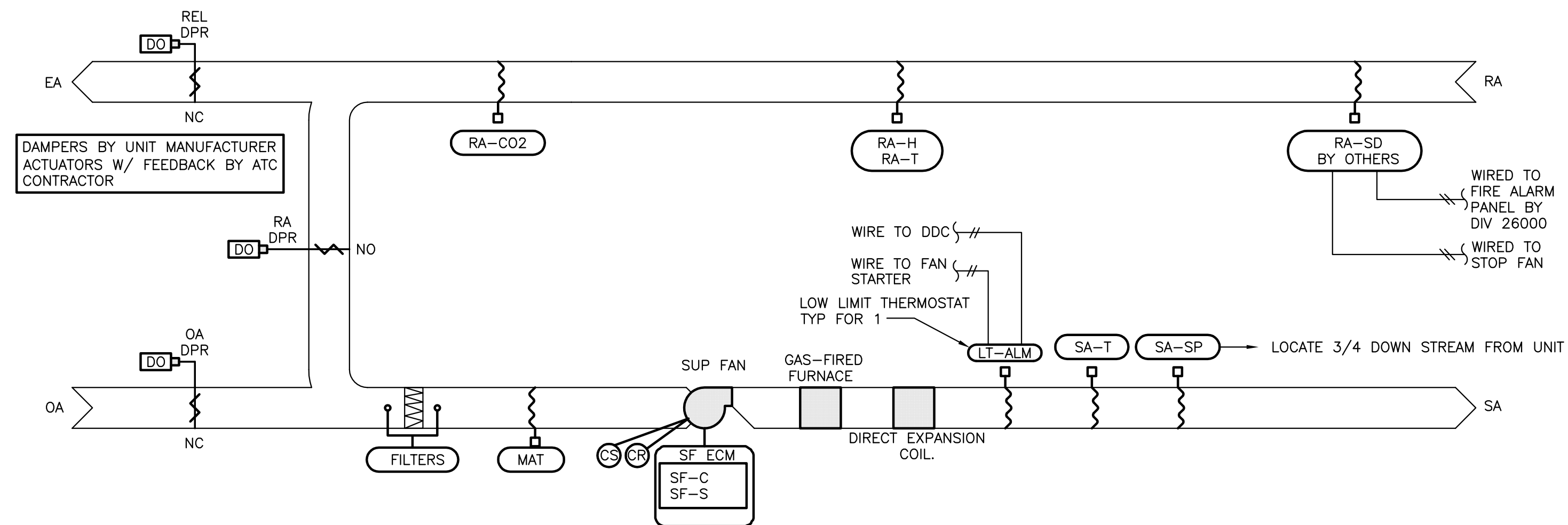
### VAV DIFFUSER CONTROL

THE SUPPLY DUCT MOUNTED STATIC PRESSURE SENSOR SHALL POSITION THE SUPPLY FAN MOTOR TO MAINTAIN THE SYSTEM STATIC PRESSURE SETPOINT. SETPOINT SHALL BE ACHIEVED BY THE BALANCER WITH ALL THE VAV DIFFUSERS OPEN TO THEIR MAX POSITION AS INDICATED IN THE SCHEDULE. THE SUPPLY FAN MOTOR SHALL RAMP DOWN TO MAINTAIN THIS ADJUSTABLE STATIC PRESSURE SETPOINT & THE REVERSE SHALL OCCUR IF THE STATIC PRESSURE DROPS BELOW SETPOINT.

HVAC RTU (RTU)	AI	AO	DI	DO	ALARM	REMARKS
SUPPLY FAN S/S & STATUS		X	X	X	X	
MIXED AIR TEMP.	X					
RETURN AIR TEMP.	X					
RETURN AIR %RH	X					
RA/EA/OA DAMPER POS./COMMAND (EACH)		X	X		X	
FILTER STATUS			X		X	
LOW LIMIT THERMOSTAT			X		X	
CO2	X				X	
SUPPLY S.P.	X					
SUPPLY AIR TEMP.	X					
AIRFLOW CFM (OA) BY TEMP. CALC.	X					SEE NOTE 1
COOLING CONTROL		X			X	
HEATING CONTROL		X			X	
OUTSIDE AIR TEMP.	X					FROM CENTRAL LOCATION
OUTSIDE AIR %RH	X					FROM CENTRAL LOCATION
SMOKE DETECTOR			X		X	

### NOTES:

1. PROVIDE % OUTSIDE AIR VIA CALCULATION %O.A. =  $\frac{(RAT-MAT)}{(RAT-OAT)} \times 100\%$



### ABBREVIATIONS

- ALM ALARM
- AQ AQUASTAT
- ATC AUTOMATIC TEMPERATURE CONTROLS
- BLDG BUILDING
- BMS BUILDING MANAGEMENT SYSTEM (ENERGY & AUTOMATION)
- COMB COMBUSTION
- CO2 CARBON DIOXIDE
- CR CONTROL RELAY
- CS CURRENT SENSOR
- CUV CABINET UNIT VENTILATOR
- D DAMPER
- DA DISCHARGE AIR
- DAS DISCHARGE AIR SENSOR
- DCW DOMESTIC COLD WATER
- DHW DOMESTIC HOT WATER
- DDC DIRECT DIGITAL CONTROL
- DO DAMPER OPERATOR
- DP DIFFERENTIAL PRESSURE
- DPR DAMPER
- EA EXHAUST AIR
- EF EXHAUST FAN
- FB FACE & BYPASS
- FD FIRE DAMPER
- H HUMIDITY
- HT HIGH TEMPERATURE
- HTG HEATING
- HR HEAT RECOVERY
- HWR HOT WATER RETURN
- HWS HOT WATER SUPPLY
- LT LOW TEMPERATURE
- M MOTOR
- MAT MIXED AIR TEMPERATURE
- NAC NETWORK APPLICATION CONTROLLER
- NC NORMALLY CLOSED
- NO NORMALLY OPEN
- OA OUTSIDE AIR
- OVR OVERRIDE
- P PRESSURE
- PB PUSH BUTTON
- PNL PANEL
- RA RETURN AIR
- REL RELIEF AIR
- RF RETURN FAN
- RFC RETURN FAN CONTROLLER
- RM ROOM
- SA SUPPLY AIR
- SD SMOKE DAMPER
- SF SUPPLY FAN
- SFC SUPPLY FAN CONTROLLER
- SP STATIC PRESSURE
- T TEMPERATURE
- TEC TERMINAL EQUIPMENT CONTROLLER
- UV UNIT VENTILATOR
- VAC VOLTS - ALTERNATING CURRENT
- VDC VOLTS - DIRECT CURRENT
- VFD SEE VSD
- VLV VALVE
- VP VELOCITY PROBE (AIRFLOW)
- VSD VARIABLE SPEED (FREQUENCY) DRIVE
- XFMR TRANSFORMER

### ATC/BMS GENERAL NOTES

- ALL SETPOINTS INDICATED IN THE SEQUENCE OF OPERATIONS SHALL BE ADJUSTABLE.
- ALL HOT WATER VALVES SHALL BE MODULATING, SPRING RETURN FAIL OPEN



TectonArchitects inc

HARTFORD CONNECTICUT  
860 548 0802  
tectonarchitects.com

Notice:  
This drawing is the property of Tecton Architects | Inc. The use, re-use or reproduction of this drawing for any purpose whatsoever without an expressed written agreement between Tecton Architects | Inc and the user is prohibited. Rights to use the information on this sheet are not transferred until payment has been received for services rendered. Any rights so granted are non-transferable to other parties without the prior expressed written consent of Tecton Architects | Inc

© 2010 Tecton Architects | Inc



GARCIA-GALUSKA-DESOUZA  
CONSULTING ENGINEERS, INC  
370 Faunce Corner Road, Dartmouth, MA 02747-1271  
508-998-5700 • FAX 508-998-0883 • E-MAIL info@tg-y.com

Owner

TOWN OF WILBRAHAM

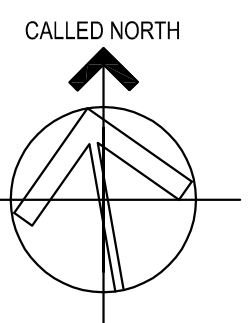
240 SPRINGFIELD STREET  
WILBRAHAM, MA

Project

Wilbraham Fire Station

2770 Boston Road  
Wilbraham, MA

Key Plan



Seals

BID SET

Issues	Date	Description

Revisions	No.	Date	Description

Drawing Title

HVAC  
CONTROLS  
DRAWING

Issue Date: 01/19/12

Project No: TA-01-01 Scale: NTS

Project Manager: JM Production Leader:

Project Architect: JB Peer Reviewer:

Drawing Number

M5.03