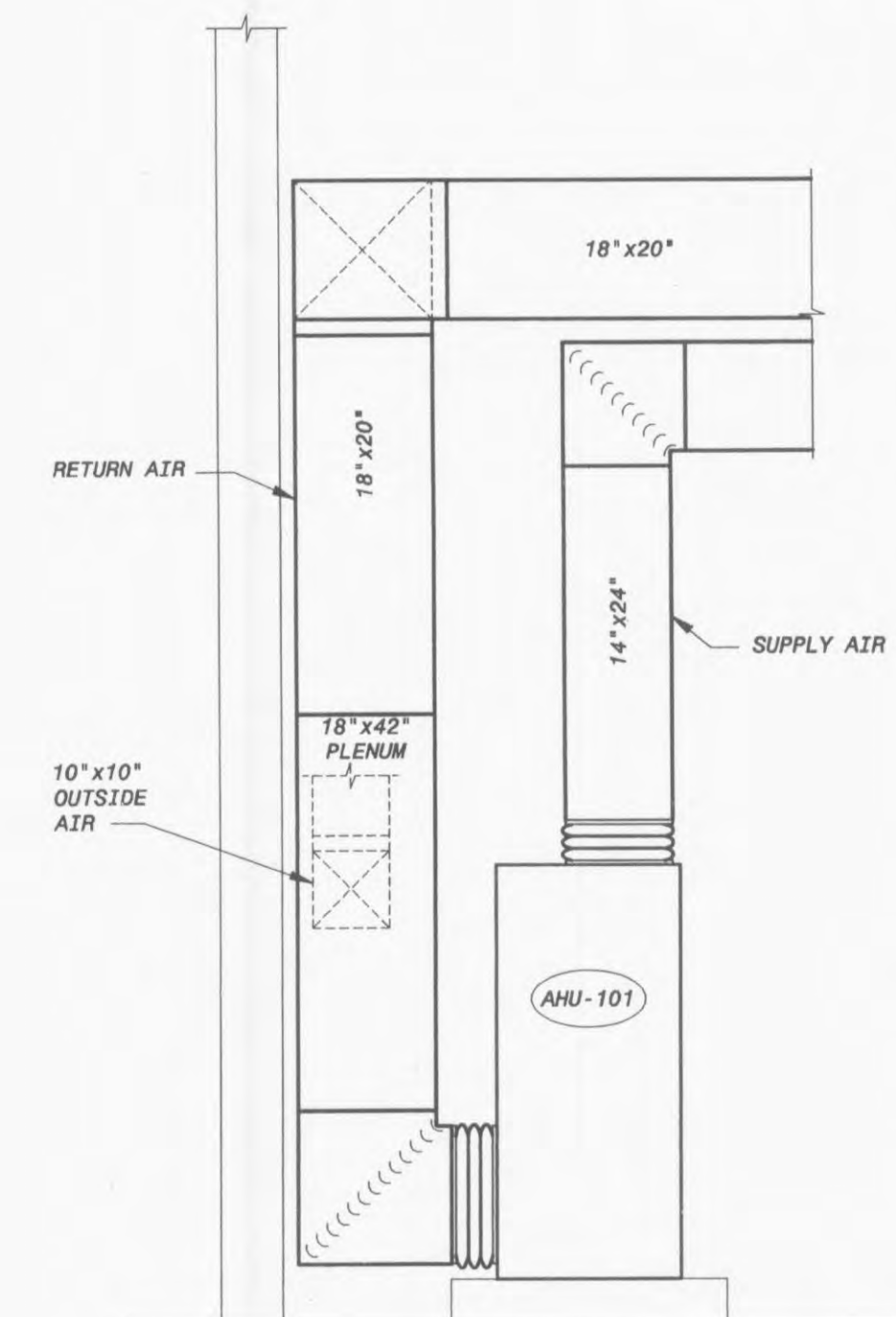


HVAC - SEQUENCE OF OPERATIONS

EQUIPMENT TAG NUMBER	CONTROL SWITCH TYPE	CONTROL SWITCH LOCATION	AUTOMATIC CONTROL INTERLOCK	CONTROL DAMPER INTERLOCK	EMERGENCY VENTILATION SHUTOFF SWITCH INTERLOCK	GAS DETECTOR INTERLOCK	SMOKE DETECTOR INTERLOCK	HIGH FILTER LOSS	VENT FAN FAILURE	THERMOSTATS			HUMIDITY-STATS	REMARKS
										ROOM	LOW TEMP	SUPPLY		
AHU-101														
CU-101														
GDH-101	0-0-A	MCC	VVTCP	CD-125	-	-	SMD-101	-	-	-	-	-	-	NOTE 23
PAC-101	UFT	-	T-102	-	-	-	SMD-102	-	-	T-102	-	-	-	NOTE 14
MAU-101	0-0	ECP	-	-	-	-	-	PDS-101	PDS-102	-	T-103	T-104	-	-
DF-101	0-0	WMD	AHU-101	CD-110	-	-	-	-	-	-	-	-	-	-
DF-102	0-0-A	MCC	T-105	CD-109,126	-	-	SMD-104	-	-	T-105	-	-	-	-
DF-103	0-0-A	TCP-101	T-128	CD-113	-	-	-	-	-	T-128	-	-	-	-
DF-104	0-0-A	TCP-101	T-126	CD-114,115	-	-	-	-	-	T-126	-	-	-	-
DF-105	0-0-A	TCP-101	DF-110	CD-116	-	-	SMD-103	-	-	-	-	-	-	-
DF-106	0-0-A	TCP-101	MAU-101	CD-121,127	-	-	-	-	PDS-103	-	-	-	-	-
DF-107	0-0-A	TCP-101	MAU-101	CD-122,128	-	-	-	-	PDS-104	-	-	-	-	-
DF-108	0-0-A	TCP-101	MAU-101	CD-123,129	-	-	-	-	PDS-105	-	-	-	-	-
DF-109	0-0-A	TCP-101	MAU-101	CD-124,130	-	-	-	-	PDS-106	-	-	-	-	-
DF-110	0-0-A	TCP-101	T-108	CD-120	-	-	-	-	-	T-108	-	-	-	-
DF-111	0-0-A	TCP-101	DF-103	CD-119	-	-	-	-	-	-	-	-	-	-
PF-101	0-0-A	MCC	T-109	CD-102,105	-	-	-	-	-	T-109	-	-	-	-
PF-102	0-0-A	MCC	T-110	CD-101,108	-	-	-	-	-	T-110	-	-	-	-
PF-103	0-0-A	MCC	T-111	CD-103,107	-	-	-	-	-	T-111	-	-	-	-
PF-104	0-0-A	MCC	T-112	CD-104,106	-	-	-	-	-	T-112	-	-	-	-
PF-105	0-0-A	MCC	T-113	CD-111,117	-	-	-	-	-	T-113	-	-	-	-
PF-106	0-0-A	MCC	T-114	CD-112,118	-	-	-	-	-	T-114	-	-	-	-



AHU-101 SECTION 1
1/2" = 1'-0"

HVAC SEQUENCE OF OPERATIONS NOTES:

1. CONTROL SWITCH TYPE

THE FOLLOWING CONTROL SWITCH TYPE ABBREVIATIONS SHALL APPLY TO THE SEQUENCE OF OPERATIONS:

- 0-0 ON-OFF
- 0-0-A ON-OFF-AUTO
- UFT UNIT FURNISHED THERMOSTAT (SYSTEM: HEAT-OFF-COOL, FAN: ON-AUTO)

2. CONTROL SWITCH LOCATION

THE FOLLOWING CONTROL SWITCH LOCATION ABBREVIATIONS SHALL APPLY:

- ECP EQUIPMENT CONTROL PANEL
- MCC ON THE MOTOR STARTER AT THE MOTOR CONTROL CENTER
- TCP MOUNTED ON A TEMPERATURE CONTROL PANEL
- WMD WALL MOUNTED INSIDE THE SPACE NEAR AN ENTRANCE

3. AUTOMATIC CONTROL

WHEN THE CONTROL SWITCH IS PLACED IN THE AUTO POSITION, THE EQUIPMENT SHALL BE INTERLOCKED WITH THE INDICATED EQUIPMENT OR CONTROLLED BY THE INDICATED CONTROL DEVICE. THE EQUIPMENT SHALL DE-ENERGIZE WHEN THE AUTOMATIC CONTROL INTERLOCK EQUIPMENT IS DE-ENERGIZED.

4. CONTROL DAMPER INTERLOCKS

UNLESS OTHERWISE INDICATED, THE CONTROL DAMPERS SHALL BE PROVEN OPEN BEFORE THE EQUIPMENT IS ALLOWED TO ENERGIZE AND CLOSE WHEN THE EQUIPMENT IS DE-ENERGIZED.

5. EMERGENCY VENTILATION SHUTOFF SWITCH INTERLOCK

EMERGENCY BREAK-GLASS SWITCHES SHALL BE PROVIDED AT THE ENTRANCES TO THE SPACES SERVED BY THE CONTROLLED EQUIPMENT. ACTIVATION OF AN EMERGENCY SHUTOFF SWITCH SHALL DE-ENERGIZE ALL VENTILATION EQUIPMENT LISTED TO BE INTERLOCKED WITH THE SWITCH. A NAMEPLATE LABELED "VENTILATION SYSTEM EMERGENCY SHUTOFF" SHALL BE MOUNTED BELOW EACH SWITCH.

6. NOT USED

7. SMOKE DETECTOR INTERLOCK

SMD-103 DUCT MOUNTED SMOKE DETECTOR SHALL BE ON A SUPERVISED CIRCUIT AND SEND SIGNALS OF BOTH "SMOKE DETECTED" AND "SMOKE DETECTOR MALFUNCTION" TO THE SMOKE DETECTOR REMOTE TEST STATION MOUNTED ON THE ASSOCIATED CONTROL PANEL. THE ASSOCIATED EQUIPMENT ITEM AND ALL INTERLOCKED EQUIPMENT SHALL BE DE-ENERGIZED IN THE EVENT SMOKE IS DETECTED.

SMD-101, 102, AND 104 DUCT MOUNTED SMOKE DETECTORS SHALL BE ON A SUPERVISED CIRCUIT AND SEND SIGNALS OF BOTH "SMOKE DETECTED" AND "SMOKE DETECTOR MALFUNCTION" TO THE SMOKE DETECTOR REMOTE TEST STATION. THE ASSOCIATED EQUIPMENT ITEM AND ALL INTERLOCKED EQUIPMENT SHALL BE DE-ENERGIZED IN THE EVENT SMOKE IS DETECTED.

8. HIGH FILTER

A DIFFERENTIAL PRESSURE SWITCH MOUNTED ACROSS THE UNIT FILTER SECTION SHALL SEND AN INDICATION OF DIRTY FILTER CONDITION TO THE ASSOCIATED CONTROL PANEL WHEN THE PRESSURE DIFFERENCE ACROSS THE FILTER SECTION EXCEEDS 0.5 INCHES WATER COLUMN. A DIRTY FILTER ALARM INDICATING LIGHT SHALL BE PROVIDED ON THE ASSOCIATED CONTROL PANEL.

9. VENTILATION FAILURE

A DUCT MOUNTED DIFFERENTIAL PRESSURE SWITCH SHALL ENERGIZE A "VENTILATION FAILURE" INDICATING LIGHT ON THE FACE OF THE ASSOCIATED CONTROL PANEL WHEN THERE IS A LOSS OF VENTILATION AIRFLOW. ISOLATED CONTACTS SHALL BE PROVIDED IN THE CONTROL PANEL TO SEND A COMMON ALARM SIGNAL TO THE PLANT CONTROL SYSTEM, AND ENERGIZE VENTILATION FAILURE VISUAL AND AUDIBLE ALARMS LOCATED AT EACH ENTRANCE TO THE SPACE.

10. THERMOSTATS - ROOM

THE ROOM THERMOSTAT SHALL ENERGIZE THE PIECE OF EQUIPMENT TO MAINTAIN THE ROOM TEMPERATURE SETPOINT.

11. THERMOSTATS - LOW TEMPERATURE

IN THE EVENT THE DISCHARGE AIR FALLS BELOW THE LOW TEMPERATURE THERMOSTAT SETPOINT, THE EQUIPMENT SHALL DE-ENERGIZE AND A "LOW DISCHARGE AIR TEMPERATURE" INDICATING LIGHT ON THE FACE OF THE ASSOCIATED CONTROL PANEL SHALL BE ENERGIZED. INDICATION OF "LOW DISCHARGE AIR TEMPERATURE" SHALL BE SENT FROM THE ASSOCIATED CONTROL PANEL TO THE PLANT CONTROL SYSTEM. AN ADJUSTABLE 0 TO 60 SECOND TIME DELAY RELAY SHALL BE PROVIDED TO PREVENT NUISANCE SHUTDOWNS ON UNIT START UP DURING COLD WEATHER.

12. THERMOSTATS - SUPPLY

THE SUPPLY AIR THERMOSTAT LOCATED IN THE UNITS DISCHARGE DUCTWORK SHALL MODULATE THE UNIT OUTPUT CAPACITY TO MAINTAIN THE SUPPLY AIR SETPOINT.

13. NOT USED

14. PACKAGED DRY-BULB ECONOMIZER CONTROLS

THE UNIT SHALL COME WITH FACTORY INSTALLED DRY BULB ECONOMIZER CYCLE CONTROLS WITH 65 F CHANGE OVER AS INDICATED IN THE SPECIFICATIONS

15. NOT USED

16. NOT USED

17. NOT USED

18. NOT USED

19. NOT USED

20. HEATERS

UNIT HEATERS SHALL BE CONTROLLED BY THEIR RESPECTIVE THERMOSTATS.

- GUH-101 T-115
- GUH-102 T-117
- GUH-103 T-107
- GUH-104 T-116
- GUH-105 T-118
- GUH-106 T-120
- GUH-107 T-127
- GUH-108 T-125
- GUH-109 T-124
- GUH-110 T-129
- GUH-111 T-106
- GUH-112 T-119
- GUH-101 T-121
- GUH-102 T-123
- GUH-103 T-122

21. TEMPERATURE AND EQUIPMENT CONTROL PANELS

TEMPERATURE AND EQUIPMENT CONTROL PANELS SHALL BE PROVIDED WITH THE INDICATING LIGHTS, RUNNING LIGHTS, AND SELECTOR SWITCHES AS INDICATED IN THE SEQUENCE OF OPERATIONS. RUNNING LIGHTS SHALL BE PROVIDED FOR EACH CONTROL SWITCH TO INDICATE BOTH ENERGIZED AND DE-ENERGIZED STATUS. INDICATING LIGHT COLORS SHALL BE AS FOLLOWS:

- RED - DE-ENERGIZED
- GREEN - ENERGIZED
- AMBER - ALARM
- WHITE - STATUS

TEMPERATURE CONTROL PANELS SHALL BE PROVIDED WITH ALARM CONDITION INDICATING LIGHTS WITH AN ELECTRICALLY ISOLATED CONTACT FOR EACH ALARM CONDITION. A COMMON ALARM ISOLATED CONTACT SHALL CLOSE IN THE EVENT THAT ANY ALARM CONDITION EXISTS, AND SHALL PROVIDE REMOTE ANNUNCIATION OF THE COMMON ALARM TO THE PLANT CONTROL SYSTEM.

UNLESS OTHERWISE NOTED, THE CONTROL PANEL LISTED SHALL PROVIDE ALL NECESSARY CONTROLS AND INTERLOCKS TO OPERATE ALL ASSOCIATED CONTROL EQUIPMENT WITH THE EQUIPMENT ITEM AS INDICATED IN THE SEQUENCE OF OPERATION. CONTROL PANELS SHALL PROVIDE A SINGLE ISOLATED CONTACT OUTPUT WHICH CLOSURES TO ENERGIZE THE EQUIPMENT ITEM AND OPENS TO DE-ENERGIZE THE EQUIPMENT ITEM.

22. THERMOSTAT SETPOINTS

THERMOSTAT SETPOINTS SHALL BE AS FOLLOWS UNLESS INDICATED OTHERWISE.

- LOW TEMPERATURE THERMOSTATS - 40 F
- HEATERS - 60 F
- MAKEUP AIR SUPPLY HEATING - 60 F
- VENTILATING EQUIPMENT - 90 F
- 2-SPEED VENTILATING EQUIPMENT - 85 / 90 F
- AIR CONDITIONED ELECTRICAL RM - 75 F
- PROGRAMMABLE THERMOSTATS - 78 F COOLING
- 72 F HEATING

23. PACKAGE AIR CONDITIONING SYSTEM WITH VARIABLE VOLUME AND TEMPERATURE (VVT) CONTROL. THE VVT CONTROL SYSTEM SHALL CONTROL AIR HANDLING UNIT AHU-101, CONDENSING UNIT CU-101, GAS DUCT HEATER GDH-101, ZONE DAMPERS ZD-101, THROUGH ZD-106, AND BYPASS DAMPER BD-101.

AIR HANDLING UNIT AHU-101 SHALL BE CONTROLLED BY AN "ON-OFF-AUTO" SELECTOR SWITCH LOCATED IN ROOM 102. WHEN THE SWITCH IS PLACED IN THE "AUTO" POSITION, THE AIR HANDLING UNIT SHALL BE CONTROLLED BY THE VVT CENTRAL CONTROL PANEL WHICH RECEIVES INPUTS FROM THE SYSTEM TEMPERATURE SENSOR S-101 SYSTEM STATIC PRESSURE SENSOR SPS-101 AND THE VVT OPERATORS PANEL. THE VVT SYSTEM SHALL ENERGIZE THE UNIT FAN DURING PROGRAMMED OCCUPIED PERIODS.

WHEN THE SELECTOR SWITCH IS PLACED IN THE "ON" POSITION THE UNIT FAN SHALL BE ENERGIZED AND THE VVT SYSTEM DAMPERS WILL REMAIN IN THEIR LAST POSITION.

BEFORE THE AIR HANDLING UNIT CAN BE ENERGIZED, THE OUTSIDE AIR CONTROL DAMPER CD-125 SHALL BE PROVEN OPEN. AFTER THE FAN IS DE-ENERGIZED, CD-125 SHALL CLOSE.

BYPASS DAMPER BD-101 SHALL BE CONTROLLED BY THE VVT CENTRAL CONTROL PANEL BASED ON INPUT FROM THE SYSTEM STATIC PRESSURE SENSOR SPS-101. THE STATIC PRESSURE SENSOR SHALL SENSE THE SUPPLY DUCT STATIC PRESSURE AND THE SET SUPPLY DUCT STATIC PRESSURE. THE SETPOINT SHALL BE ADJUSTABLE AND THE INITIAL SETPOINT SHALL BE DETERMINED DURING SYSTEM BALANCING.

ZONE DAMPERS ZD-101 THROUGH ZD-106 SHALL BE CONTROLLED BY THEIR RESPECTIVE VVT SYSTEM ZONE SENSOR AND THE OPERATIONS PANEL. DURING OCCUPIED PERIODS, THE ZONE SENSOR SHALL MODULATE THE RESPECTIVE ZONE DAMPERS TO MAINTAIN THE SPACE TEMPERATURE. THE ZONE DAMPERS SHALL MAINTAIN A MINIMUM AIRFLOW AS INDICATED IN THE ZONE AND BYPASS DAMPER SCHEDULE. THE RELATIONSHIP OF EQUIPMENT SHALL BE AS INDICATED BELOW.

ZONE DAMPER	ZONE SENSOR
ZD-101	ZS-101
ZD-102	ZS-102
ZD-103	ZS-103
ZD-104	ZS-104
ZD-105	ZS-105
ZD-106	ZS-106

CONDENSING UNIT CU-101 AND GAS DUCT HEATER GDH-101 SHALL BE CONTROLLED BY THE VVT CENTRAL CONTROL PANEL. THE CONTROL PANEL SHALL MONITOR ZONE CONDITIONS AND SUPPLY AIR TEMPERATURE AND DETERMINE WHEN COOLING OR HEATING IS REQUIRED. THE CONTROL PANEL SHALL ENERGIZE THE CONDENSING UNIT OR GAS DUCT HEATER AS REQUIRED TO MAINTAIN THE SET SUPPLY AIR TEMPERATURE. AT NO TIME SHALL BOTH CU-101 AND GDH-101 OPERATE.

NO.	BY	CK	APP
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CONFORMED TO CONSTRUCTION RECORDS

DATE: 10/08/01

REVISIONS AND RECORD OF ISSUE

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*THIS DRAWING WAS ORIGINALLY APPROVED FOR CONSTRUCTION BY DAVID W. NELSON ON 10/08/01 AND SEALED BY DAVID W. NELSON, A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF MISSOURI, NO. E-28940.

BLACK & VEATCH
Corporation
St. Louis, Missouri

CITY OF O'FALLON, MISSOURI
WATER TREATMENT PLANT
MECHANICAL - HVAC
SEQUENCE OF OPERATIONS

DESIGNED: TRD
DETAILED: JMC,LDW
CHECKED: DWN
APPROVED: DWN
DATE: 10/08/01

PROJECT NO.
97515

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SHEET
55 OF 96