S-1 SEQUENCE OF OPERATION

GENERAL:

The AHU is a mixed air variable volume system with a supply fan S-1, an exhaust/return fan ER-1, a chilled water coil, and a hot water preheat coil. S-1 is equipped with a variable frequency drive (VFD) for speed control of the fan.

START/STOP CONTROL:

The BAS starts ER-1 through an optimal start program for morning warm-up based on building occupation time, earliest and latest start times, outside air and space temperatures. When ER-1 is proven to be running via current sensing relay CSR-2, S-1 starts and ramps up to minimum speed. S-1 proof is accomplished via current sensing relay CSR-1. When building occupation time is reached, the outside and exhaust air dampers open, and the return air damper closes to their respective minimum positions. When the system goes into unoccupied mode, fans S-1 and ER-1 are stopped and the dampers go to their normal positions.

STATIC PRESSURE CONTROL:

Supply static pressure sensed by PTE-1 is reset from PTE-2 located 2/3 downstream of the supply. The S-1 VFD is modulated, controlling fan speed to maintain the supply static pressure setpoint of 2"W.C. (adj). A signal returns from the VFD to indicate fan speed for which ? monitoring purposes. PTE-3 sensing supply air flow is used for one monitoring purposes only. Hi fan static or suction sensed by DPS-1 or DPS-2 will shut down S-1 on such a condition. The fan is not allowed to start until the switch is reset.

DISCHARGE CONTROL:

The cooling valve V-1, the heating valve V-2, and the O.A./R.A./E.A. dampers are modulated in sequence to maintain the discharge air temperature setpoint of 55 degrees F (adj) sensed by TTE-1. The discharge humidifier is controlled from space humidity sensor at 30% RH (adj). Humidity hi limit H-1 shall override and control duct humidity at 85% RH (adj).

MIXED AIR CONTROL:

When the mixed air temperature sensed by TTE-2 falls below the setpoint of 55 degrees F (adj), the O.A./R.A./E.A. dampers are modulated closed to minimum position reducing the outside air intake and increasing the return air. Mixed air control shall be locked out and the O.A./R.A./E.A. dampers go to minimum position when the outside air temperature sensed by TTE-3 rises above 60 degrees F (adj). If a low temperature of 35 degrees F is sensed by LTDE-1 at the coils, S-1 will shut down and the O.A./R.A./E.A. dampers will close. The fan shall not be allowed to start again until the switch is reset.

NIGHT OVERRIDE:

During unoccupied mode, the system can be manually overrided into occupied mode for an extended period of one hour (adj) when the remote switch SW-1 is depressed. SW-1 has no effect during occupied mode.

S-1 SEQUENCE OF OPERATION

GENERAL:

The AHU is a mixed air variable volume system with a supply fan S-1, an exhaust/return fan ER-1, a chilled water coil, and a hot water preheat coil. S-1 is equipped with a variable frequency drive (VFD) for speed control of the fan.

START/STOP CONTROL:

The BAS starts ER-1 through an optimal start program for morning warm-up based on building occupation time, earliest and latest start times, outside air and space temperatures. When ER-1 is proven to be running via current sensing relay CSR-2, S-1 starts and ramps up to minimum speed. S-1 proof is accomplished via current sensing relay CSR-1. When building occupation time is reached, the outside and exhaust air dampers open, and the return air damper closes to their respective minimum positions. When the system goes into unoccupied mode, fans S-1 and ER-1 are stopped and the dampers go to their normal positions.

STATIC PRESSURE CONTROL:

Supply static pressure sensed by PTE-1 is reset from PTE-2 located 2/3 downstream of the supply. The S-1 VFD is modulated, controlling fan speed to maintain the supply static pressure setpoint of 2"W.C. (adj). A signal returns from the VFD to indicate fan speed for monitoring purposes. PTE-3 sensing supply air flow is used for monitoring purposes only. Hi fan static or suction sensed by DPS-1 or DPS-2 will shut down S-1 on such a condition. The fan is not allowed to start until the switch is reset.

DISCHARGE CONTROL:

The cooling valve V-1, the heating valve V-2, and the O.A./R.A./E.A. dampers are modulated in sequence to maintain the discharge air temperature setpoint of 55 degrees F (adj) sensed by TTE-1. The discharge humidifier is controlled from space humidity sensor at 30% RH (adj). Humidity hi limit H-1 shall override and control duct humidity at 85% RH (adj).

MIXED AIR CONTROL:

When the mixed air temperature sensed by TTE-2 falls below the setpoint of 55 degrees F (adj), the O.A./R.A./E.A. dampers are modulated closed to minimum position reducing the outside air intake and increasing the return air. Mixed air control shall be locked out and the O.A./R.A./E.A. dampers go to minimum position when the outside air temperature sensed by TTE-3 rises above 60 degrees F (adj). If a low temperature of 35 degrees F is sensed by LTDE-1 at the coils, S-1 will shut down and the O.A./R.A./E.A. dampers will close. The fan shall not be allowed to start again until the switch is reset.

NIGHT OVERRIDE:

During unoccupied mode, the system can be manually overrided into occupied mode for an extended period of one hour (adj) when the remote switch SW-1 is depressed. SW-1 has no effect during occupied mode.

S-3 SEQUENCE OF OPERATION

GENERAL:

The AHU is a mixed air variable volume system with a supply fan S-3, an exhaust/return fan ER-3, a chilled water coil, and a hot water preheat coil. S-3 and ER-3 are equipped with a variable frequency drives (VFD) for speed control of the fans.

START/STOP CONTROL:

The BAS starts ER-3 and ramps up to minimum speed through an optimal start program for morning warm-up based on building occupation time, earliest and latest start times, outside air and space temperatures. When ER-3 is proven to be running via current sensing relay CSR-2, S-3 starts and ramps up to minimum speed. S-3 proof is accomplished via current sensing relay CSR-1. When building occupation time is reached, the outside and exhaust air dampers open, and the return air damper closes to their respective minimum positions. When the system goes into unoccupied mode, fans S-3 and ER-3 are stopped and the dampers go to their normal positions.

STATIC PRESSURE CONTROL:

Supply static pressure sensed by PTE-1 is reset from PTE-2 located 2/3 downstream of the supply. The S-3 and ER-3 VFD's are modulated together, controlling fan speed to maintain the supply static pressure setpoint of 2"W.C. (adj). A signal returns from the VFD's to indicate fan speed for monitoring purposes. PTE-3 and PTE-4 sensing supply and return air flow are used for monitoring purposes only. Hi fan static or suction sensed by DPS-1, DPS-2, or DPS-3 will shut down the respective fan on such a condition. The fan is not allowed to start until the switch is reset.

DISCHARGE CONTROL:

The cooling valve V-1, and the O.A./R.A./E.A. dampers are modulated in sequence to maintain the discharge air temperature setpoint of 55 degrees F (adj) sensed by TTE-1. The discharge humidifier is controlled from space humidity sensor at 30% RH (adj). Humidity hi limit H-1 shall override and control duct humidity at 85% RH (adj).

MIXED AIR CONTROL:

When the mixed air temperature sensed by TTE-2 falls below the setpoint of 55 degrees F (adj), the O.A./R.A./E.A. dampers are modulated closed to minimum position reducing the outside air intake and increasing the return air. Mixed air control shall be locked out and the O.A./R.A./E.A. dampers go to minimum position when the outside air temperature sensed by TTE-3 rises above 60 degrees F (adj). If a low temperature of 35 degrees F is sensed by LTDE-1 at the coils, S-3 will shut down and the O.A./R.A./E.A. dampers will close. The fan shall not be allowed to start again until the switch is reset.

NIGHT OVERRIDE:

During unoccupied mode, the system can be manually overrided into occupied mode for an extended period of one hour (adj) when the remote switch SW-1 is depressed. SW-1 has no effect during occupied mode.

VAV BOX CONTROL

GENERAL:

The system consists of a VAV or CAV box with hot water reheat coil.

SPACE CONTROL:

Pneumatic thermostat T-1 modulates the VAV box damper and reheat coil valve in sequence to maintain a space temperature setpoint of 72 degrees F (adj). Below setpoint, air flow will be at minimum and the reheat valve V-1 is modulated open. Above setpoint, the valve is closed and the box damper is modulated open to provide cooling.

HOT WATER SUPPLY SYSTEM CONTROL

GENERAL:

The system consists of 2 boilers and associated pumps.

HOT WATER SUPPLY CONTROL:

Control of the HWS is internal thru boiler controls.

HOT WATER BYPASS CONTROL:

When the differential pressure sensed by DPR-1 across the HW pumps becomes excessive, valve V-1 is modulated to reduce pressure.

TERMINAL REHEAT HOT WATER BYPASS CONTROL:

When the differential pressure sensed by DPR-2 across the TRW pump becomes excessive, valve V-2 is modulated to reduce pressure.

TRW LOCKOUT:

When the outside air temperature rises above 60 degrees F (adj), the BAS closes valve V-3 restricting the flow of HWS to the VAV boxes.

BOILER COMBUSTION DAMPER CONTROL:

When either boiler is on, the interlocked combustion damper will open. Status of the boilers is monitored thru the BAS.

HOT WATER PUMP CONTROL:

Pumps are started and stopped thru the BAS based on occupancy. Status of the pumps is via current sensing relay.

LAB 2 CONTROL

GENERAL:

The system consists of a lab containing 2 fume hoods and a VAV box supplying the lab.

FUME HOOD START/STOP AND CONTROL:

A fume hood is started and stopped thru the operator panel. When the BAS receives a signal that any fume hood has been started, fume hood exhaust fan E-1 is started. If none of the hoods are in operation, E-1 is off. The fume hood controller FHC-1 maintains a constant air velocity of 100 fpm (adj) thru the fume hood sash based on the sash position and the air flow thru the fume hood exhaust duct, by modulating the fume hood exhaust damper.

PERCHLORIC FUME HOOD START/STOP CONTROL:

The perchloric fume hood exhaust fan E-3 is started directly thru the fume hood switch provided by others. Current sensing relay CSR-1 is for monitor only.

VAV BOX CONTROL:

Room sensor TTE-1, thru the BAS, modulates the VAV box damper and reheat coil valve in sequence to maintain a space temperature setpoint of 72 degrees F (adj). Below setpoint, air flow is at minimum and the reheat valve V-1 is modulated open. Above setpoint, the valve is closed and the box damper is modulated open to provide cooling.

LAB CONTROL:

The BAS monitors the supply air flow to the lab at the VAV box, the room exhaust air flow, and the fume hood exhaust air flow thru respective velocity sensors. Control of space temperature is thru the VAV box controls as supply air volume to the room is varied. Depending on how much air is supplied thru the VAV box and how much air is exhausted thru the fume hoods, the BAS modulates the room exhaust damper to maintain a CFM differential setpoint of 200 CFM (adj) total exhaust (room exhaust + fume hood exhaust + perchloric fume hood exhaust) air flow greater than room supply air flow, keeping the lab at a negative pressure.

If the CFM setpoint cannot be maintained as the differential rises above setpoint (supply too low or exhaust too high), the VAV box damper will be overridden to modulate open providing more supply CFM to the room, while the reheat valve will be modulated open attempting to maintain space temperature setpoint.

If the CFM setpoint cannot be maintained as the differential drops below setpoint (supply too high or exhaust too low with the possibility of the lab becoming positive), the VAV box damper will be overridden to modulate closed providing less supply CFM to the room.

LAB 3 CONTROL

GENERAL:

The system consists of a lab containing 2 fume hoods and a VAV box supplying the lab.

FUME HOOD START/STOP AND CONTROL:

A fume hood is started and stopped thru the operator panel. When the BAS receives a signal that any fume hood has been started, fume hood exhaust fan E-1 is started. If none of the hoods are in operation, E-1 is off. The fume hood controller FHC-1 or FHC-2 maintains a constant air velocity of 100 fpm (adj) thru the fume hood sash based on the sash position and the air flow thru the fume hood exhaust duct or by sensing wall air velocity, by modulating the fume hood exhaust damper.

VAV BOX CONTROL:

Room sensor TTE-1, thru the BAS, modulates the VAV box damper and reheat coil valve in sequence to maintain a space temperature setpoint of 72 degrees F (adj). Below setpoint, air flow is at minimum and the reheat valve V-1 is modulated open. Above setpoint, the valve is closed and the box damper is modulated open to provide cooling.

LAB CONTROL:

The BAS monitors the supply air flow to the lab at the VAV box, the `om exhaust air flow, and the fume hood exhaust air flow thru spective velocity sensors. Control of space temperature is thru the VAV box controls as supply air volume to the room is varied. Depending on how much air is supplied thru the VAV box and how much air is exhausted thru the fume hoods, the BAS modulates the room exhaust damper to maintain a CFM differential setpoint of 200 CFM (adj) total exhaust (room exhaust + fume hood exhaust) air flow greater than room supply air flow, keeping the lab at a negative pressure.

If the CFM setpoint cannot be maintained as the differential rises above setpoint (supply too low or exhaust too high), the VAV box damper will be overridden to modulate open providing more supply CFM to the room, while the reheat valve will be modulated open attempting to maintain space temperature setpoint.

If the CFM setpoint cannot be maintained as the differential drops below setpoint (supply too high or exhaust too low with the possibility of the lab becoming positive), the VAV box damper will be overridden to modulate closed providing less supply CFM to the room.

LAB 6 CONTROL

GENERAL:

The system consists of a lab containing 2 fume hoods and a VAV box supplying the lab.

FUME HOOD START/STOP AND CONTROL:

A fume hood is started and stopped thru the operator panel. When the BAS receives a signal that any fume hood has been started, fume hood exhaust fan E-1 is started. If none of the hoods are in operation, E-1 is off. The fume hood controller FHC-1 or FHC-2 maintains a constant air velocity of 100 fpm (adj) thru the fume hood sash based on the sash position and the air flow thru the fume hood exhaust duct, by modulating the fume hood exhaust damper.

VAV BOX CONTROL:

Room sensor TTE-1, thru the BAS, modulates the VAV box damper and reheat coil valve in sequence to maintain a space temperature setpoint of 72 degrees F (adj). Below setpoint, air flow is at minimum and the reheat valve V-1 is modulated open. Above setpoint, the valve is closed and the box damper is modulated open to provide cooling.

LAB CONTROL:

The BAS monitors the supply air flow to the lab at the VAV box, the room exhaust air flow, and the fume hood exhaust air flow thru respective velocity sensors. Control of space temperature is thru the V box controls as supply air volume to the room is varied. Depending on how much air is supplied thru the VAV box and how much air is exhausted thru the fume hoods, the BAS modulates the room exhaust damper to maintain a CFM differential setpoint of 200 CFM (adj) total exhaust (room exhaust + fume hood exhaust) air flow greater than room supply air flow, keeping the lab at a negative pressure.

If the CFM setpoint cannot be maintained as the differential rises above setpoint (supply too low or exhaust too high), the VAV box damper will be overridden to modulate open providing more supply CFM to the room, while the reheat valve will be modulated open attempting to maintain space temperature setpoint.

If the CFM setpoint cannot be maintained as the differential drops below setpoint (supply too high or exhaust too low with the possibility of the lab becoming positive), the VAV box damper will be overridden to modulate closed providing less supply CFM to the room.

LAB 7 CONTROL

GENERAL:

The system consists of a lab containing 2 fume hoods and a VAV box supplying the lab.

FUME HOOD START/STOP AND CONTROL:

A fume hood is started and stopped thru the operator panel. When the BAS receives a signal that any fume hood has been started, fume hood exhaust fan E-1 is started. If none of the hoods are in operation, E-1 is off. The fume hood controller FHC-1 or FHC-2 maintains a constant air velocity of 100 fpm (adj) thru the fume hood sash based on sensing wall air velocity, by modulating the fume hood exhaust damper.

VAV BOX CONTROL:

Room sensor TTE-1, thru the BAS, modulates the VAV box damper and reheat coil valve in sequence to maintain a space temperature setpoin of 72 degrees F (adj). Below setpoint, air flow is at minimum and the reheat valve V-1 is modulated open. Above setpoint, the valve is closed and the box damper is modulated open to provide cooling.

LAB CONTROL:

The BAS monitors the supply air flow to the lab at the VAV box, the room exhaust air flow, and the fume hood exhaust air flow thru respective velocity sensors. Control of space temperature is thru the VAV box controls as supply air volume to the room is varied. Depending on how much air is supplied thru the VAV box and how much air is exhausted thru the fume hoods, the BAS modulates the room exhaust damper to maintain a CFM differential setpoint of 200 CFM (adj) total exhaust (room exhaust + fume hood exhaust) air flow greater than room supply air flow, keeping the lab at a negative pressure.

If the CFM setpoint cannot be maintained as the differential rises above setpoint (supply too low or exhaust too high), the VAV box damper will be overridden to modulate open providing more supply CFM to the room, while the reheat valve will be modulated open attempting to maintain space temperature setpoint.

If the CFM setpoint cannot be maintained as the differential drops below setpoint (supply too high or exhaust too low with the possibility of the lab becoming positive), the VAV box damper will be overridden to modulate closed providing less supply CFM to the room.

LAB 8 CONTROL

GENERAL:

The system consists of a lab containing 1 fume hood and a VAV box supplying the lab.

FUME HOOD START/STOP AND CONTROL:

A fume hood is started and stopped thru the operator panel. When the BAS receives a signal that any fume hood has been started, fume hood exhaust fan E-1 is started. If none of the hoods are in operation, E-1 is off. The fume hood controller FHC-1 maintains a constant air velocity of 100 fpm (adj) thru the fume hood sash based on the sash position and the air flow thru the fume hood exhaust duct, by modulating the fume hood exhaust damper.

VAV BOX CONTROL:

Room sensor TTE-1, thru the BAS, modulates the VAV box damper and reheat coil valve in sequence to maintain a space temperature setpoint of 72 degrees F (adj). Below setpoint, air flow is at minimum and the reheat valve V-1 is modulated open. Above setpoint, the valve is closed and the box damper is modulated open to provide cooling.

LAB CONTROL:

The BAS monitors the supply air flow to the lab at the VAV box, the room exhaust air flow, and the fume hood exhaust air flow thru respective velocity sensors. Control of space temperature is thru the VAV box controls as supply air volume to the room is varied. Depending on how much air is supplied thru the VAV box and how much air is exhausted thru the fume hood, the BAS modulates the room exhaust damper to maintain a CFM differential setpoint of 200 CFM (adj) total exhaust (room exhaust + fume hood exhaust) air flow greater than room supply air flow, keeping the lab at a negative pressure.

If the CFM setpoint cannot be maintained as the differential rises above setpoint (supply too low or exhaust too high), the VAV box damper will be overridden to modulate open providing more supply CFM to the room, while the reheat valve will be modulated open attempting to maintain space temperature setpoint.

If the CFM setpoint cannot be maintained as the differential drops below setpoint (supply too high or exhaust too low with the possibility of the lab becoming positive), the VAV box damper will be overridden to modulate closed providing less supply CFM to the room.

EXHAUST FAN E-1 CONTROL:

Fume hood exhaust fan E-1 is started and stopped based on fume hc operation. The VFD is modulated to maintain a total suction static pressure setpoint of 1"W.C. (adj) in the fume hood exhaust. Suction static is sensed by PTE-1 & PTE-2 and is controlled by selecting the lower one requiring the greater suction.

EXHAUST FAN E-2 CONTROL:

Storage room exhaust fan E-2 is started and stopped based on occupancy. Current sensing relay CSR-2 indicates fan status. Retur air temperature sensor TTE-1 is for monitor only.

MISCELLANEOUS CONTROL

SUMP LEVEL STATUS:
The BAS monitors any sump basin high water level.

UNIT HEATER CONTROL:
The unit heater is cycled on if space temperature sensed by TE-1 goes below setpoint.

FLOOR TEMPERATURE/HUMIDITY MONITOR:
TTE-1 & 2 and HTE-1 & 2 are used for monitoring floor temperatur and humidity only.

LAB PRESSURIZATION MONITOR:
PTE-1 & PTE-2 are used for monitoring lab pressurization compare to hallway only.

LANDIS & GYR POWERS, INC. KEYSHEET						Revision Date :	
Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90	
Job Number: 220-E -5178-00						Eng: CJP	Page:
Mechanical System: SYSTEM S-1 CONTROL							
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
AP 1-2	2	332 2973	LANDIS & GYR	12-2	PM 331-10	#4 PNEU ACT,8-13PSI,UN MT,PO	
CSR 1/3-4	3,4	850 124	CYMATICS		CYMATICS	CURRENT SENSING RELAY, 2/12A	
DPS 1-2	2	AFS 460	CLEVELAND		SW141-1	DIFF PRESS SW, 1-12"WC MAN RES	
EP 1	1	265 1001	LANDIS & GYR	17-2	VE 265-2	EP265 3W AIR VLV 24VAC, 60HZ	
H 1	1	186 0090	LANDIS & GYR	4-4	HU 186-1	DUCT HYGROSTAT,55/95%RH,RA	
HTE 1	1	531 825			SE 1906	DEW PT 40/115F RH/SEN 120V	
LTDE 1	1	134 1504	LANDIS & GYR	4-2	ET 134-22	LOW TEMP STAT,15/55,1NO1NC,MAN	
PTE 1	1	ASH-XLDP-500	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR. 0-5.0 "WC	
PTE 2	1	ASH-XLDP-300	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR. 0-3.0 "WC	
PTE 3	1	ASH-XLDP-025	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.25 "WC	
SW 1	1	NAR-6A	AIPHONE			MOM. CONTACT WALL SWITCH/PLATE	
TTE 1	1	535 741	LANDIS & GYR		SE 1902-3	O/PT TEMP 40/150F THERMISTOR	
TTE 2	1	533 380	LANDIS & GYR		SE 1903-1	O/AV TEMP 20/120F SENSOR PLAT	
TTE 3	1	533 381	LANDIS & GYR		SE 1905-1	O/A TEMP -58/122F SENSOR PLAT	

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.

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CSR 10-50 AMPS

LANDIS & GYR POWERS, INC. KEYSHEET						Revision Date :	
Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90	
Job Number: 220-E -5178-00						Eng: CJP	Page:
Mechanical System: SYSTEM S-1 CONTROL							
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
AP 1-2	2	332 2973	LANDIS & GYR	12-2	PM 331-10	#4 PNEU ACT,8-13PSI,UN MT,PO	
CSR 1-3,4	3,4	850 124	CYMATICS		CYMATICS	CURRENT SENSING RELAY, 2/12A	
DPS 1-2	2	AFS 460	CLEVELAND		SW141-1	DIFF PRESS SW, 1-12"WC MAN RES	
EP 1	1	265 1001	LANDIS & GYR	17-2	VE 265-2	EP265 3W AIR VLV 24VAC, 60HZ	
H 1	1	186 0090	LANDIS & GYR	4-4	HU 186-1	DUCT HYGROSTAT,55/95%RH,RA	
HTE 1	1	531 825			SE 1906	DEW PT 40/115F RH/SEN 120V	
LTDE 1	1	134 1504	LANDIS & GYR	4-2	ET 134-22	LOW TEMP STAT,15/55,1NO1NC,MAN	
PTE 1	1	ASH-XLDP-500	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR. 0-5.0 "WC	
PTE 2	1	ASH-XLDP-300	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR. 0-3.0 "WC	
PTE 3	1	ASH-XLDP-025	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.25 "WC	
SW 1	1	NAR-6A	AIPHONE			MOM. CONTACT WALL SWITCH/PLATE	
TTE 1	1	535 741	LANDIS & GYR		SE 1902-3	D/PT TEMP 40/150F THERMISTOR	
TTE 2	1	533 380	LANDIS & GYR		SE 1903-1	D/AV TEMP 20/120F SENSOR PLAT	
TTE 3	1	533 381	LANDIS & GYR		SE 1905-1	O/A TEMP -58/122F SENSOR PLAT	

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.

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CSR 10-50 AMPS

LANDIS & GYR POWERS, INC. KEYSHEET						Revision Date :	
Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90	
Job Number: 220-E -5178-00						Eng: EJD	Page:
Mechanical System: SYSTEM S-3 CONTROL							
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
AP 1-2	2	332 2973	LANDIS & GYR	12-2	PH 331-10	#4 PNEU ACT,8-13PSI,UN MT,PO	
CSR 1-3	3	850 124 ✓	CYMATICS		CYMATICS	CURRENT SENSING RELAY, 2/12A	
DPS 1-3	3	AFS 460	CLEVELAND		SW141-1	DIFF PRESS SW, 1-12"WC MAN RES	
EP 1	1	265 1001	LANDIS & GYR	17-2	VE 265-2	EP265 3W AIR VLV 24VAC, 60HZ	
H 1	1	186 0090	LANDIS & GYR	4-4	HU 186-1	DUCT HYGROSTAT,55/95%RH,RA	
LTDE 1	1	134 1504	LANDIS & GYR	4-2	ET 134-22	LOW TEMP STAT,15/55,1NO1NC,MAN	
PTE 1	1	ASH-XLDP-500	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR. 0-5.0 "WC	
PTE 2	1	ASH-XLDP-300	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR. 0-3.0 "WC	
PTE 3-4	2	ASH-XLDP-025	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.25 "WC	
SW 1	1	NAR-6A	AIPHONE			MOM. CONTACT WALL SWITCH/PLATE	
TTE 1	1	535 741	LANDIS & GYR		SE 1902-3	D/PT TEMP 40/150F THERMISTOR	
TTE 2	1	533 380	LANDIS & GYR		SE 1903-1	D/AV TEMP 20/120F SENSOR PLAT	

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.

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LANDIS & GYR POWERS, INC. KEYSHEET						Revision Date :	
Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90	
Job Number: 220-E -5178-00						Eng: EJP	Page:
Mechanical System: VAV CONTROL							
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
T 1	40	192 202	LANDIS & GYR	1-1	TH 192-1	RM STAT SSP 45/85F 2P DA	
	46	192 256	LANDIS & GYR		TH 192-2	T'STAT CVR,CON/CON/CON,LOGO	

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.

LANDIS & GYR POWERS, INC. KEYSHEET						Revision Date :	
Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90	
Job Number: 220-E -5178-00						Eng: EJP	Page:
Mechanical System: HOT WATER SUPPLY SYSTEM							
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
AP 1-2	2	331 2973	LANDIS & GYR	12-2	PH 331-10	#4 PNEU ACT,8-13PSI,UNIV MT	
CSR 1-3	3	850 124	CYMATICS		CYMATICS	CURRENT SENSING RELAY, 2/12A	
DPR 1-2	2	378 1000	LANDIS & GYR	6-2	PR 378-1	DIFFER PRESSURE REGULATOR, DA	
EP 1-3	3	265 1002	LANDIS & GYR	17-2	VE 265-2	EP265 3W AIR VLV 120 VAC,60HZ	
RP 1-2	2	243 0009	LANDIS & GYR	14-2	RL 243-6	MINI RELAY, MULTI-PURPOSE	

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.

LANDIS & GYR POWERS, INC. KEYSHEET						Revision Date :	
Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90	
Job Number: 220-E -5178-00						Eng: CSP	Page:
Mechanical System: LAB 2 CONTROL							
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
AP 1-2	2	331 3048	LANDIS & GYR	12-1	PM 331-9	#3 PNU ACT,8-13PSI,7/8"SFT,U-M	
CSR 1	1	850 124	CYMATICS		CYMATICS	CURRENT SENSING RELAY, 2/12A	
FHC 1	1	537 725	LANDIS & GYR			FUME HOOD CONTROLLER BOARD	
	1	537 752	LANDIS & GYR			FUME HOOD CONTROLLER ENCLOSURE	
OP 1	1	537 720	LANDIS & GYR			FUME HOOD CTLR OPERATER PANEL	
PSE 1	1	537 811	LANDIS & GYR			FUME HOOD VERT SASH SENSOR 36"	
PT 1-2	2	VOLU-PROBE/1	AIR MONITOR			FUME HOOD AIR VELOCITY SENSOR	
PTE 1-2	2	ASH-XLDP-050 ~	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.5 "WC	
PTE 4	1	ASH-XLDP-025	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.25 "WC	
TTE 1	1	536 195 ✓	LANDIS & GYR		SE 1901-3	ROOM SENS THERMISTOR 40/120F	
XDR 1	1	537 789	LANDIS & GYR			LAB AO-P MODULE	
XDR 3-4	2	PXP7 ✓	ACT		ACT	I/P TRANSDUCER 4-20MA/3-15PSI	

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.

LANDIS & GYR POWERS, INC. KEYSHEET						Revision Date :
Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90
Job Number: 220-E -5178-00						Eng: EJO Page:
Mechanical System: LAB 3 CONTROL						
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description
Field Mounted Devices						
AP 1-3	3	331 3048	LANDIS & GYR	12-1	PH 331-9	#3 PNU ACT,8-13PSI,7/8"SFT,U-H
FHC 1-2	2	537 725	LANDIS & GYR			FUME HOOD CONTROLLER BOARD
	2	537 752	LANDIS & GYR			FUME HOOD CONTROLLER ENCLOSURE
OP 1-2	2	537 720	LANDIS & GYR			FUME HOOD CTLR OPERATER PANEL
PSE 1	1	537 811	LANDIS & GYR			FUME HOOD VERT SASH SENSOR 36"
PT 1-3	3	VOLU-PROBE/1	AIR MONITOR			FUME HOOD AIR VELOCITY SENSOR
PTE 1-3	3	ASH-XLDP-050	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.5 "WC
PTE 4	1	ASH-XLDP-025	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.25 "WC
TTE 1	1	536 195 ✓	LANDIS & GYR		SE 1901-3	ROOM SENS THERMISTOR 40/120F
VTE 1	1	537 79X	LANDIS & GYR			FUME HOOD WALL VELOCITY SENSOR
XDR 1-2	2	537 789	LANDIS & GYR			LAB AO-P MODULE
XDR 3-4	2	PXP7 ✓	ACT		ACT	I/P TRANSDUCER 4-20MA/3-15PSI

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.

LANDIS & GYR POWERS, INC. KEYSHEET						Revision Date :	
Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90	
Job Number: 220-E -5178-00						Eng: EJP	Page:
Mechanical System: LAB 6 CONTROL							
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
AP 1-3	3	331 3048	LANDIS & GYR	12-1	PM 331-9	#3 PNU ACT,8-13PSI,7/8"SFT,U-M	
FHC 1-2	2	537 725	LANDIS & GYR			FUME HOOD CONTROLLER BOARD	
	2	537 752	LANDIS & GYR			FUME HOOD CONTROLLER ENCLOSURE	
OP 1-2	2	537 720	LANDIS & GYR			FUME HOOD CTLR OPERATER PANEL	
PSE 1-2	2	537 811	LANDIS & GYR			FUME HOOD VERT SASH SENSOR 36"	
PT 1-3	3	VOLU-PROBE/1	AIR MONITOR			FUME HOOD AIR VELOCITY SENSOR	
PTE 1-3	3	ASH-XLDP-050	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.5 "WC	
PTE 4	1	ASH-XLDP-025	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.25 "WC	
TTE 1	1	536 195	LANDIS & GYR		SE 1901-3	ROOM SENS THERMISTOR 40/120F	
XDR 1-2	2	537 789	LANDIS & GYR			LAB AO-P MODULE	
XDR 3-4	2	PXP7	ACT		ACT	I/P TRANSDUCER 4-20MA/3-15PSI	

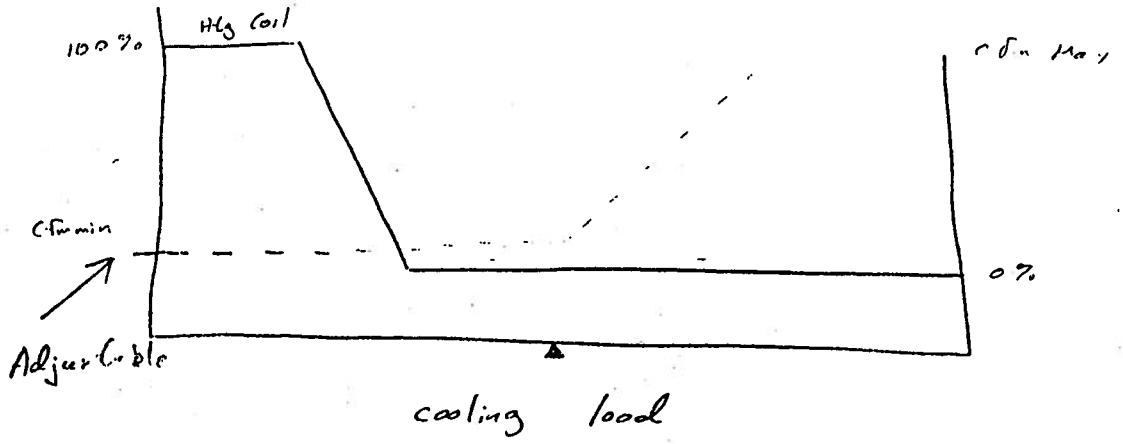
NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.

LANDIS & GYR POWERS, INC. KEYSHEET						Revision Date :	
Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90	
Job Number: 220-E -5178-00						Eng: GJP	Page:
Mechanical System: LAB 7 CONTROL							
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
AP 1-4	4	331 3048	LANDIS & GYR	12-1	PH 331-9	#3 PNU ACT,8-13PSI,7/8"SFT,U-H	
FHC 1-2	2	537 725	LANDIS & GYR			FUME HOOD CONTROLLER BOARD	
	2	537 752	LANDIS & GYR			FUME HOOD CONTROLLER ENCLOSURE	
OP 1-2	2	537 720	LANDIS & GYR			FUME HOOD CTLR OPERATER PANEL	
PT 1-3	3	VOLU-PROBE/1	AIR MONITOR			FUME HOOD AIR VELOCITY SENSOR	
PTE 1-3	3	ASH-XLDP-050	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.5 "WC	
PTE 4	1	ASH-XLDP-025	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.25 "WC	
TTE 1	1	536 195 ✓	LANDIS & GYR		SE 1901-3	ROOM SENS THERMISTOR 40/120F	
VTE 1-2	2	537 79X	LANDIS & GYR			FUME HOOD WALL VELOCITY SENSOR	
XDR 1-2	2	537 789	LANDIS & GYR			LAB AO-P MODULE	
XDR 3-4	2	PXP7 ✓	ACT		ACT	I/P TRANSDUCER 4-20MA/3-15PSI	

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.

LANDIS & GYR POWERS, INC. KEYSHEET						Revision Date :	
Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90	
Job Number: 220-E -5178-00						Eng: EJP	Page:
Mechanical System: LAB & CONTROL							
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
AP 1-2	2	331 3048	LANDIS & GYR	12-1	PM 331-9	#3 PNU ACT,8-13PSI,7/8"SFT,U-H	
FHC 1	1	537 725	LANDIS & GYR			FUME HOOD CONTROLLER BOARD	
	1	537 752	LANDIS & GYR			FUME HOOD CONTROLLER ENCLOSURE	
OP 1	1	537 720	LANDIS & GYR			FUME HOOD CTLR OPERATER PANEL	
PSE 1	1	537 811	LANDIS & GYR			FUME HOOD VERT SASH SENSOR 36"	
PT 1-2	2	VOLU-PROBE/1	AIR MONITOR			FUME HOOD AIR VELOCITY SENSOR	
PTE 1-2	2	ASH-XLDP-050	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.5 "WC	
PTE 4	1	ASH-XLDP-025	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.25 "WC	
TTE 1	1	536 195 ✓	LANDIS & GYR		SE 1901-3	ROOM SENS THERMISTOR 40/120F	
XDR 1	1	537 789	LANDIS & GYR			LAB AO-P MODULE	
XDR 3-4	2	PXP7 ✓	ACT		ACT	I/P TRANSDUCER 4-20MA/3-15PSI	

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.



Job Name: CLEAN AIR ENGINEERING						Submittal Date: 09/27/90	
Job Number: 220-E -5178-00						Eng: Head	Page:
Mechanical System: MISC. EXHAUST FAN DETAILS.							
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
CSR 1-2	1 2	850 124 ✓	CYMATICS		CYMATICS	CURRENT SENSING RELAY, 2/12A	
DPS 1	1	AFS-460	CLEVLAND	16-3	SW141-1	DIFF PRESS SW, 1-12"WG MAN RES	
PTE 1-2	2	ASH-XLDP-300	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR. 0-3.0 "WC	
TTE 1	1	535 741	LANDIS & GYR		SE 1902-3	D/PT TEMP 40/150F THERMISTOR	

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.

CSR-1 1 850-128

Job Name: CLEAN AIR ENGINEERING						Revision Date :	
Job Number: 220-E -5178-00						Submittal Date: 09/27/90	
Mechanical System: MISC. DETAILS						Eng: Wead	Page:
Control Device	Qty	Product Number	Manufacturer	SD Num	Technical Ref Num	Description	
Field Mounted Devices							
AP 1	1	331 2973	LANDIS & GYR	12-2	PH 331-10	#4 PNEU ACT,8-13PSI,UNIV MT	
HTE 1-2	2	536 296 ✓	536-298				
PTE 1-2	2	ASH-XLDP-010	ASHCROFT		ASHCROFT	DIFF. PRESS. XMTR 0/0.1 "WC	
TE 1	4	134 1085	LANDIS & GYR	2-4	ET 134-55	T'STAT,H/C,LINE VOLT,HVY DUTY	
TTE 1-2	2	536 195 ✓	LANDIS & GYR		SE 1901-3	ROOM SENS THERMISTOR 40/120F	

NOTE: SEE VALVE SCHEDULE FOR VALVE INFORMATION.
SEE DAMPER SCHEDULE FOR DAMPER INFORMATION.