DØ COLLISION HALL
OUTDOOR FRESH AIR MAKEUP

ENGINEERING NOTE

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Revision A

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Scope

This note will briefly describe the collision hall ventilation system and how DØ will monitor outside air makeup and what actions occur in the event of system failures.

Revision A Scope

Modifies the AHU-1 operation section. Updates the entire note.

Objective

The Dzero collision hall has two different fresh air makeup conditions it must meet. They are:

1. Tunnel Barriers removed-Fresh air makeup=4500 CFM
2. Tunnel Barriers in place-Fresh air makeup=2800 CFM

This note demonstrates how the fresh air minimums are met and guaranteed.

EF-6 & EF-7 Operation

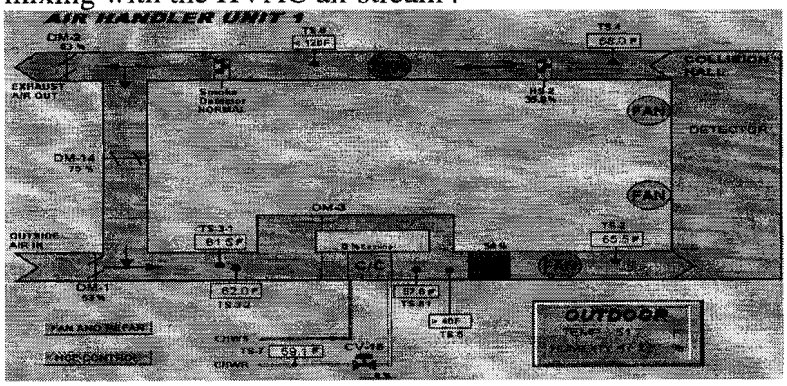
EF-6(13,000 cfm) and EF-7 (4500 cfm) pull air out of the collision hall via the calorimeter spill trough-duct network and discharge it in the South parking lot outside. EF-6 is emergency ventilation and is energized during certain conditions such as an ODH alarm. We will deal with EF-7 here since it is **normal** ventilation.

EF-7 has a rated capacity of 4500 cfm and a measured flow of 5600 cfm. EF-7's intake has three sources. They are pipe chase(100 cfm), assembly hall(900 cfm), and the balance from the collision hall spill trough. EF-7 is monitored by a paddle switch in the discharge duct directly above the blower. It is activated by the air movement upward through the blower pushing the lever arm up against the spring.

AHU1 operation

AHU1 is the fixed building ventilation blower that circulates air in the collision hall for HVAC reasons. AHU1 discharges air high into the collision hall and returns air from low in the collision hall. AHU1's capacity rating is 18,000 cfm, however it has been measured to be 19,200 cfm.

AHU1 has 3 controllable dampers, Outside Air, Return Air, and Exhaust Air. The combined positions of these three dampers determine the percentage of outdoor fresh air mixing with the HVAC air stream .



The position of these dampers is controlled by a Programmable Logic Controller(PLC). The PLC has been programmed with a minimum and maximum software position for each of these dampers.

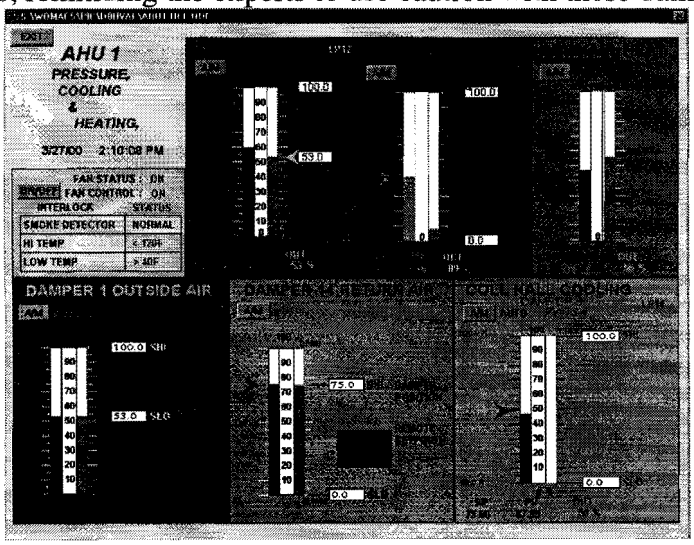
The **fresh air intake flow** for AHU1 has been measured to be 4500 cfm, with the dampers in the following positions.
Outside Air Damper Position > 55% open.
And
Exhaust Air Damper Position > 55% open
And
Return Air Damper Position < 75% open

The **fresh air intake flow** for AHU1 has been measured to be 2800 cfm, with the dampers in the following positions.
Outside Air Damper Position > 50% open.
And
Exhaust Air Damper Position > 50% open
And
Return Air Damper Position < 75% open

The software limits for these dampers will be set based on the tunnel barrier status. These software limits will be protected from modification in two ways.

The first is that damper software travel limits have been assigned a security level of "HVAC Expert". When people login to the control system, the computer grants them security privileges. When any system modifications are attempted the computer compares the users security privileges against the action requested and will allow or deny the attempt accordingly. One person assigns Dzero's security areas and privileges. There are currently two people with an "HVAC Expert" security clearance at Dzero. Keeping this security group small should minimize the chance for accidentally repositioning these damper limits.

The second is highlighting these limits with color and text in the graphics pictures, reminding the experts to use caution with these damper limits.



Software damper limits have been chosen over hardware limits because there are other safety systems that override the PLC's control of these dampers, including ODH,

Fire and Smoke, and Halon systems. Setting mechanical limits on these dampers would interfere with these other safety systems attempt to move the dampers closed or open depending on the emergency.

AHU1's operation is monitored by a differential pressure switch measuring the static difference between the discharge duct of AHU1 and the inlet duct of AHU1. This pressure switch is manufactured by Penn, model #P32AF-2, adjustable from .05" to 5 " w.c..

Measuring Air Flow:

Since most of the ducts involved are over 3' in diameter and have many bends, the flow through them is very turbulent. A cross section of any of these ducts has a very uneven distribution of velocities contained in it. This uneven distribution of velocities is also what makes the air flow difficult to continuously measure and quantify.

The "measured flows" referred to in this note were measured using a hand held velocity meter. The method of measuring is by taking many readings across the opening of a duct and averaging them together, then multiplying by the cross sectional area to get a result in CFM. This method of physically measuring the air flow will be used at least once during setup of EF-7 and AHU1.

Reliability of Measuring Air Flow:

The paddle switches on EF-7 and EF-6 are wired using a method known as fail-safe. It is fail-safe because if the signal is lost it is considered failed by the programmed logic.

AHU1 uses a pressure differential switch from inlet to outlet of the blower. It is wired in a fail-safe configuration. This differential pressure switch has been set and tested to insure proper operation.

System Responses:

1. EF-6 & EF-7 <1000cfm	<u>Software Response</u> -Energize Platform ODH horns and strobes -An Autodialer paging alarm to the HVAC personnel list at Dzero <u>Hardwired Response</u> None
2. AHU1 Off	<u>Software Response</u> -A computer alarm activates notifying Dzero Personel. <u>Hardwired Response</u> None
3. Fire Alarm	<u>Software Response</u> -Turns Off AHU1 -Closes AHU1 Outside Air, Exhaust Air, and Return Dampers. <u>Hardwired Response</u> -Turns Off AHU1

-Closes AHU1 Outside Air, Exhaust Air, and Return Dampers.

3. Pit Halon Dump

-Turns Off AHU1
-Closes AHU1 Outside Air, Exhaust Air, and Return Dampers.
Hardwired Response
-Turns Off AHU1
-Closes AHU1 Outside Air, Exhaust Air, and Return Dampers.

4. Platform ODH Alarm

Software Response
- EF-6 energizes(13,000 cfm)
-Turns On AHU1
-Opens AHU1 Outside Air, Exhaust Air, and Closes Return Dampers.
Hardwired Response
-Energize Platform ODH horns and strobes
- EF-6 energizes(13,000 cfm)
-Turns On AHU1
-Opens AHU1 Outside Air, Exhaust Air, and Closes Return Dampers.

6. EF-7 Fails

Software Response
- EF-6 energizes(13,000 cfm)
-An Autodialer paging alarm to the Cryo personnel list at Dzero
Hardwired Response
None

7. Commercial Power Failure

Software Response
-An Autodialer paging alarm to the multiple Dzero personnel lists
-Restarts Emergency Power equipment after Generator established
Hardwired Response
- EF-6, EF-7, and AHU1 transfer to emergency diesel generator power

Conclusion:

The air flow paths and ducts at DØ for both AHU1 and EF-7 are fixed. The blower throughputs are not variable. The software stops on AHU1's dampers will be set for a minimum of 2800 cfm or 4500 cfm of outdoor air continuously added to the HVAC flow stream depending on the tunnel barrier state.

AHU1 and EF-7 both have monitoring that can determine reliably as to whether the respective blower is on or off. Since the outside air makeup is fixed as long as the blowers are running, and the software AHU1 damper limits are set, we can rely on the blower status indicators to determine as to whether the collision hall is receiving the proper amount of outside makeup air.