ame..can warming and ventilating inc 0 INDIAN WOOD CIRCLE • MAUMEE, OHIO 43537	DO MENT NO. 80278-741
	REV. NO.
	DATE: 10/11/84
ENGINEERING	PAGE: 1 OF 12

TITLE: Damper Test Report

MODEL NO.: NBD-70 & NBD-71

UTILITY: Houston Lighting and Power Co.

FACILITY: South Texas Project - Unit 1 & 2

ENGINEER: Bechtel Energy Corporation - Houston

BECHTEL JOB NO.: 14926-001

PURCHASE ORDER NO.: 35-1197-4168

SPECIFICATION NO.: 3V289VS0008

AWV PRODUCTION NO. 80278/130

AWV DRAWING SERIES: 80278-023 & 024

FOR APPROVAL

OCT 12 1984

A W & V

PREPARED BY: [signature] DATE: 10/12/84

APPROVED BY: [signature] DATE: 10/12/84

REV.	DATE	DESCRIPTION	BY	APPROVALS

TEST RESULTS FOR NBD-70 & NBD-71 DAMPERS

Two (2) Dampers were tested for Bechtel Energy Corp., South Texas Project, AWV Job No. 80278/130, in accordance with the approved Test Procedure 80278-702 Rev. D. The damper tag no.'s are: (NBD-70) 3V111VDA277 & (NBD-71) 3V111VDA276.

TABLE OF CONTENTS

DAMPER CYCLE TEST

Each damper was successfully cycled 25 times in accordance with Test Procedure 80278-702. No rework was required upon completion of the cycle testing.

Damper Tag #	Size (in.)	Successfully Cycled 25 Times	Rework Required
3V111VDA277	12 x 12	Yes	None
3V111VDA276	24 x 42	Yes	None

BLADE DEFLECTION TEST DUE TO PRESSURE (NBD-70 & NBD-71)

The test damper was mounted to the end of the test chamber and the differential pressure across the damper was gradually increased from zero to the design pressure or the system's maximum pressure.

Two deflection gauges were read under pressure and recorded. Both gauges were measuring on the axle centerline; gauge no. 1 was at the blade end and gauge no. 2 was at the midspan centerline. The pressure was released and both gauges returned to with $\pm$ .002" of the zero set point.

The reading from gauge no. 1 was subtracted from the gauge no. 2 reading for actual blade deflection at the test pressure. This was converted to blade deflection at the design pressure so that it could be compared to the allowable deflection.

$$\text{BLADE DEFLECTION (in) @ DESIGN } \Delta P = \left(\begin{matrix} \text{GAUGE \#1} \\ \text{(in)} \end{matrix} - \begin{matrix} \text{GAUGE \#2} \\ \text{(in)} \end{matrix} \right) \times \frac{\text{Design } \Delta P}{\text{Test } \Delta P}$$

The dampers were tested in accordance with Procedure No. 80278-702 Rev. D.

Table No. 1 lists the damper tag no., damper size, design differential pressure, blade deflection at the design differential pressure and the allowable blade deflection.

In each case actual deflection was less than the allowable deflection. No rework was necessary.

TEST RESULTS

TABLE NO. 1

TAG NO.	TEST NO.	SIZE (in)	DES. ΔP (in-w.g.)	BLADE DEFL. (in) @ DES. ΔP	ALLOWABLE DEFLECTION (in) @ DESIGN ΔP
3V111VDA277	84-0767	12 x 12	83	.001	.033
3V111VDA276	84-0819	24 x 42	83	.020	.067

LEAKAGE TEST

The test damper was mounted to the end of the test chamber and the differential pressure across the device was gradually increased from zero to the maximum chamber limitation. Leakage readings were taken at 60, 70, 80, 90 and 100% of this pressure. The leakage was calculated, corrected to standard air and plotted. The measured leakage was determined by extending the curve to the design pressure.

Table # 2 lists the damper tag number, the allowable leakage and the measured leakage results.

In each case the measured leakage is less than or equal to the allowable leakage.

LEAKAGE TEST RESULTS

Table # 2

Tag No.	Test No.	Damper Size(in)	Design Pressure (in. w.g.)	Allowable leakage (scfm)@Des. Press	Measured Leakage (scfm)@Des.Press
3V111VDA277	84-0768	12 x 12	83 (3 PSI)	137	113
3V111VDA276	84-0820	24 x 42	83	638	638

DEFINITIONS FOR ABBREVIATIONS

USED ON TEST LABORATORY

PRINT OUTS

DET - Determination

D6 - Represents the diameter (in feet) of single nozzle that has an area equal to the sum of the areas of all the nozzles used in a particular combination.

DN - A term used to represent the nozzle coefficient of discharge for the particular nozzle combination being used.

DPS - Static pressure differential across the device under test.

PD - Pressure differential across nozzle.

SP5 - Static pressure at plane 5.

DB5 - Dry-bulb temperature at plane 5.

DBA - Dry-bulb temperature in general test area.

WBA - Wet-bulb temperature in general test area.

BPA - Barometeric pressure.

TB - Barometric temperature.

AMERICAN WARMING & VENTILATING INC.

BLADNER, OHIO

PAGE 7 OF 12
AWV: 80278-741

JOB NUMBER: 80278/130
TEST NUMBER: 84--0767
DATE OF TEST: 10/8/84

TEST UNIT
MANUFACTURER: AWV
TRADE NAME: DAMPER
MODEL NO.: NBD-70
SIZE: 12 X 12
NO. OF BLADES: 1

TEST METHOD PER AMCA STANDARD 500-75
TEST SETUP APPARATUS:FIGURE 5.4
AIR FLOW MEASUREMENT APPARATUS:FIGURE 6.3
TEST TYPE:STRUCTURAL INTEGRITY TEST

DETERMINATIONS:

DET	D6	DN	DPS	PD	SPS	DB5	DBA	WBA	BPA	TB
1	0.15770	0.11606	46.150	1.250	46.150	68.7	73.0	55.0	29.49	73.0

RESULTS

	AT TEST CONDITIONS			AT STANDARD AIR DENSITY	
DET	DENSITY	DELTA PS	CFM	DELTA PS	CFM
1	0.07287	46.150	85.6	47.493	85.6

REMARKS
TAG # 3V111VDA277

	GAUGE READING (in)	GAUGE RETURN (in)
GAUGE NO. 1:	.004	.000
GAUGE NO. 2:	.0035	.000

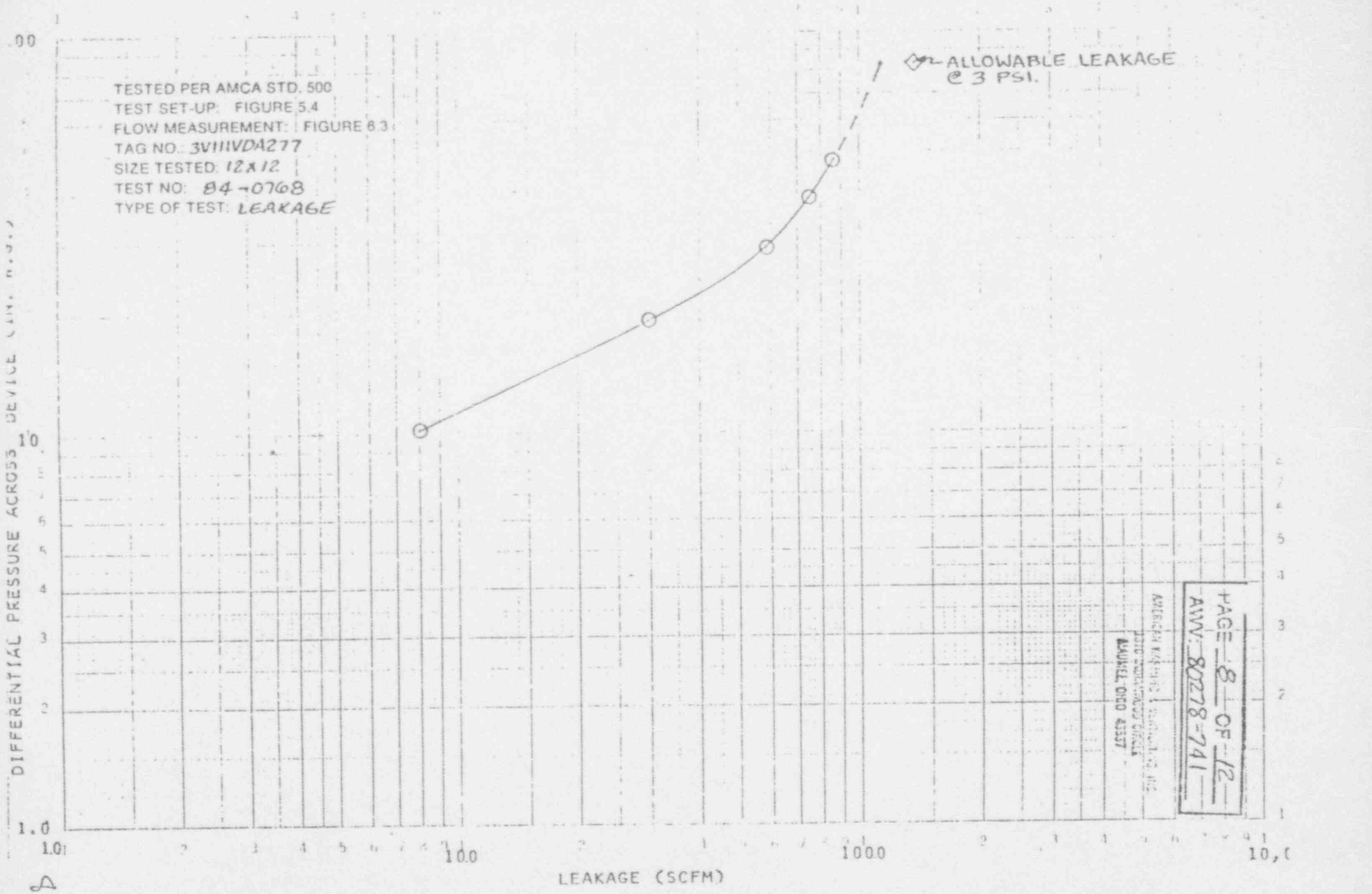
BLADE DEFLECTION (in) @ DESIGN ΔP

$$= \left(\text{GAUGE NO. 1 READING (in)} - \text{GAUGE NO. 2 READING (in)}\right) \times \left(\frac{\text{DESIGN } \Delta P}{\text{TEST } \Delta P}\right)$$

$$= (.004 - .0035) \times \left(\frac{83}{46.15}\right)$$

$$= \underline{.001 \text{ (in)}}$$

7


TESTED PER AMCA STD. 500
TEST SET-UP: FIGURE 5.4
FLOW MEASUREMENT: FIGURE 6.3
TAG NO.: 3V111VDA277
SIZE TESTED: 12X12
TEST NO: 84-0768
TYPE OF TEST: LEAKAGE
ALLOWABLE LEAKAGE @ 3 PSI.
DIFFERENTIAL PRESSURE ACROSS DEVICE
LEAKAGE (SCFM)
1.0
10.0
100.0
PAGE 8 OF 12
AWV: 802278-741
MAUMEE, OHIO 43537

AMERICAN WARMING & VENTILATING INC.

BRADNER, OHIO

JOB NUMBER: 80278/130
TEST NUMBER: 84-0820
DATE OF TEST: 10/9/84

TEST UNIT
MANUFACTURER: AWV
TRADE NAME: DAMPER
MODEL NO.: NBD-71
SIZE: 24 X 42
NO. OF BLADES: 4
TYPE OF SEALS: D-BULB & EPT-4
CLOSING TORQUE: N/A

TEST METHOD PER AMCA STANDARD 500-75
TEST SETUP APPARATUS:FIGURE 5.4
AIR FLOW MEASUREMENT APPARATUS:FIGURE 6.3
TEST TYPE:LEAKAGE

DETERMINATIONS:

DT	DS	DN	DPS	PD	SPS	DBS	DBA	WBA	BPA	TB
1	0.25000	0.25000	8.730	0.120	8.730	72.2	72.5	65.0	29.59	71.0
2	0.25000	0.25000	17.700	0.410	17.700	71.7	72.0	64.0	29.59	71.0
3	0.25000	0.25000	25.180	0.820	25.180	71.1	72.0	64.0	29.59	71.0
4	0.25000	0.25000	34.460	1.760	34.460	69.8	72.0	64.0	29.59	71.0
5	0.25000	0.25000	43.830	3.000	43.830	68.2	72.0	64.0	29.59	71.0

RESULTS

	AT TEST CONDITIONS			AT STANDARD AIR DENSITY	
DET	DENSITY	DELTA PS	CFM	DELTA PS	CFM
1	0.07291	8.730	66.5	8.979	66.5
2	0.07301	17.700	123.9	18.182	123.9
3	0.07301	25.180	182.0	25.865	182.0
4	0.07301	34.460	257.7	35.398	257.7
5	0.07301	43.830	336.2	45.023	336.2

REMARKS
TAG # 3V111VDA276

AMERICAN WARMING & VENTILATING INC.

BRADNER, OHIO

JOB NUMBER: 80278/130
TEST NUMBER: 84-0819
DATE OF TEST: 10/9/84

TEST UNIT
MANUFACTURER: AWV
TRADE NAME: DAMPER
MODEL NO.: MBD-71
SIZE: 24 X 42
NO. OF BLADES: 4

TEST METHOD PER AMCA STANDARD 500-75
TEST SETUP APPARATUS: FIGURE 5.4
AIR FLOW MEASUREMENT APPARATUS: FIGURE 6.3
TEST TYPE: STRUCTURAL INTEGRITY TEST

DETERMINATIONS:

DET	D6	DM	DPS	PD	SPS	DBS	DBA	WBA	BPA	TB
1	0.33341	0.33341	46.300	1.050	46.300	66.2	70.0	63.0	29.59	71.0

ESULTS

	AT TEST CONDITIONS			AT STANDARD AIR DENSITY	
DET	DENSITY	DELTA PS	CFM	DELTA PS	CFM
1	0.0722[illegible]	46.300	353.3	47.375	353.3

REMARKS
TAG # 3V111VDA276

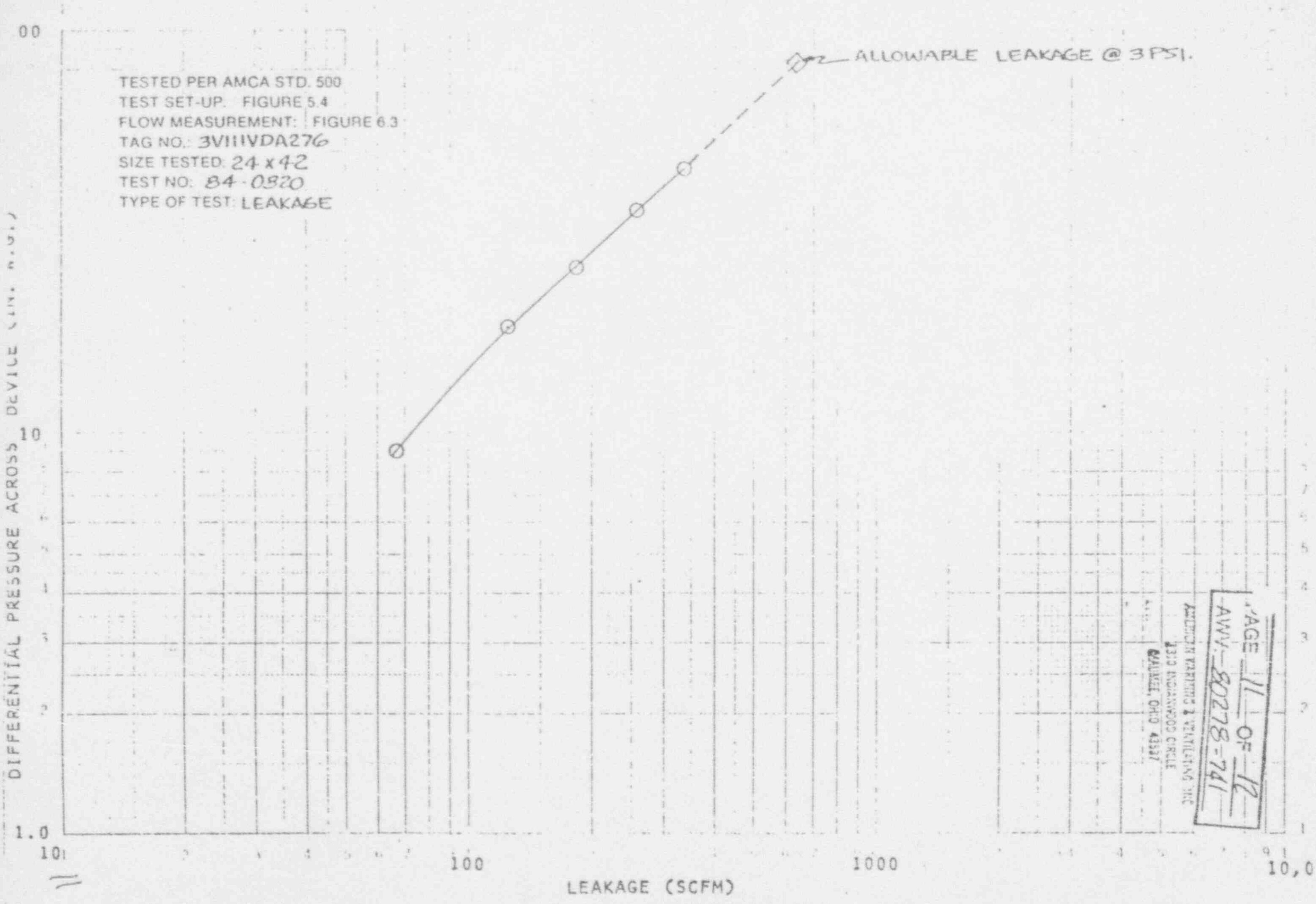
	GAUGE READING (in)	GAUGE RETURN (in)
GAUGE NO. 1:	.015	.0015
GAUGE NO. 2:	.004	.001

BLADE DEFLECTION (in) @ DESIGN ΔP

$$= \left(\text{GAUGE NO. 1 READING (in)} - \text{GAUGE NO. 2 READING (in)}\right) \times \left(\frac{\text{DESIGN } \Delta P}{\text{TEST } \Delta P}\right)$$

$$= (.015 - .004) \times \left(\frac{83}{46.3}\right)$$

$$= \underline{.020 \text{ (in)}}$$


TESTED PER AMCA STD. 500
TEST SET-UP: FIGURE 5.4
FLOW MEASUREMENT: FIGURE 6.3
TAG NO.: 3VIIIVDA276
SIZE TESTED: 24 x 42
TEST NO: 84-0820
TYPE OF TEST: LEAKAGE
ALLOWABLE LEAKAGE @ 3 PSI.
DIFFERENTIAL PRESSURE ACROSS DEVICE
LEAKAGE (SCFM)
1.0
10
100
1000
PAGE 11 OF 12
AWV-80278-741

AMERICAN WARMING & VENTILATING INC.

BRADNER, OHIO

JOB NUMBER: 80278/130
TEST NUMBER: 84-0768
DATE OF TEST: 10/8/84

TEST UNIT
MANUFACTURER: AWV
TRADE NAME: DAMPER
MODEL NO.: NBD-70
SIZE: 12 X 12
NO. OF BLADES: 1
TYPE OF SEALS: EPT-4 & D-BULB
CLOSING TORQUE: OPERATOR CLOSING

TEST METHOD PER AMCA STANDARD 500-75
TEST SETUP APPARATUS:FIGURE 5.4
AIR FLOW MEASUREMENT APPARATUS:FIGURE 6.3
TEST TYPE:LEAKAGE

DETERMINATIONS:

DET	D6	DN	DPS	PD	SPS	DBS	DBA	WBA	BPA	TB
1	0.08383	0.08383	9.820	0.145	9.820	70.2	74.0	56.0	29.47	72.0
2	0.08383	0.08383	18.550	1.910	18.550	69.8	73.0	55.0	29.49	73.0
3	0.15778	0.11606	27.950	0.590	27.950	69.4	73.0	55.0	29.49	73.0
4	0.15778	0.11606	37.300	0.950	37.300	69.0	73.0	55.0	29.49	73.0
5	0.15778	0.11605	46.150	1.250	46.150	68.9	73.0	55.0	29.49	73.0

RESULTS

	AT TEST CONDITIONS			AT STANDARD AIR DENSITY	
DET	DENSITY	DELTA PS	CFM	DELTA PS	CFM
1	0.07268	9.820	8.0	10.133	8.0
2	0.07287	18.550	29.8	19.089	29.8
3	0.07287	27.950	58.5	28.763	58.5
4	0.07287	37.300	74.5	38.385	74.5
5	0.07287	46.150	85.6	47.493	85.6

REMARKS
TAG # 3V111VDA277

ATTACHMENT 2

SOUTH TEXAS NUCLEAR PROJECT

DESIGN BASIS DOCUMENT

EXTERNAL ENVIRONMENT

5N209MB1035

VOLUME 1 OF 1

where W_w = Tornado wind load due to wind velocity pressure

W_p = Tornado differential pressure load

W_m = Single tornado generated missile load

The following Category I structures are designed as non-vented with respect to tornado depressurization effects (i.e., systems and components located inside these structures will be protected from depressurization effects):

A. Mechanical Auxiliary Building (except for truck bay)

B. Electrical Auxiliary Building

C. Fuel Handling Building

D. Reactor Containment Building

E. Auxiliary Feedwater Storage Tank

Details on protective measures are provided in Section 4.1.

3.1.3.2 Non-Category I Structures and Systems

Design wind velocity for non-Category I structures, systems and components except nonsafety-related piping and supports and PAR-KUT Model 43 security booths and supports is 120 mph at 30 feet above ground level. (Reference 6.3.1) This wind speed is based on the maximum recorded, sustained hurricane winds in the Texas coastal area. (Reference 6.1.10)

Nonsafety-related piping and supports and PAR-KUT Model 43 security booths and supports are designed to withstand a wind velocity of 90 mph at 30 feet above ground level. (Reference 6.3.1)

4.0 PROTECTIVE MEASURES

This Section discusses specific protection features provided at STP for the Design Basis Events identified in Section 3. Refer to Table T-12 for a matrix which identifies hazards discussed in this DBD along with the appropriate section number. The bulk of Table T-12 comes from the South Texas Project Probabilistic Safety Assessment Summary Report. (Reference 6.2.19)

4.1 TORNADO AND WIND

4.1.1 Category I Structures

A minimum thickness of 2 feet is provided for the roof slab of the ECWIS to protect against tornado missiles. (Reference 6.3.22) At the ECW Discharge Structure, the slab above the walls and on the sides of the discharge piping is 2 feet thick and is designed for protection against tornado missiles. (Reference 6.3.22) The minimum thickness of concrete walls and roofs provided for all Category I structures to resist the effects of postulated tornado winds and missiles is 2 feet, except for the Auxiliary Airlock Shield structure roof which is 1 foot. The integrity of this 1 foot structure has been analyzed and determined to provide the necessary protection for missile impact. (Reference 6.3.35)

The Mechanical and Electrical Auxiliary Building is provided with tornado resistant doors as listed in References 6.3.46 and 6.3.47. The Diesel Generator Building, Essential Cooling Water Intake Structure, and Fuel Handling Building are considered as vented buildings with no tornado protection provided at the outside openings. It should be noted that the door between the Fuel Handling Building and the Mechanical Auxiliary Building is designed for a tornado. The inside of these buildings will see tornado depressurization.

See Open Item OI-EE-09.

4.1.2 Non-Category I Structures

Reference 6.5.33 provides an analysis showing that the TGB will not collapse onto any nearby Category I structures. In addition, since the elevator and stair tower structure on the east side of the TGB is adjacent to the DGB, this tower structure is designed for the tornado loads. (Reference 6.3.20)

The deaerator structure is designed to resist the tornado loads in the north-south direction. A potential failure of this structure in the east-west direction will not impair the integrity and functionality of any Category I structure. (Reference 6.3.20)

4.1.3 HVAC Openings

All outside air intake and exhaust openings of the EAB main control room HVAC system and EAB main area HVAC system are protected by tornado dampers designed to close automatically within 0.25 seconds during tornado conditions. (References 6.3.6 and 6.3.9)

All EAB technical support center HVAC system penetration openings in the EAB outside walls or roof are protected with tornado dampers designed to close automatically within 0.25 seconds during tornado conditions. (Reference 6.3.10)

The outside air intake opening of the FHB supply air system is provided with a tornado damper with a closing time not to exceed 0.25 seconds. (Reference 6.3.11)

See Open Item OI-EE-10.

The outside air intake and exhaust air openings of the MAB main supply and exhaust system are provided with tornado dampers with a closing time not to exceed 0.25 seconds. (Reference 6.3.12)

ATTACHMENT 3

ATTACHMENT 4

SYSTEM DESCRIPTION COVER SHEET
SOUTH TEXAS PROJECT
JOB NO. 14926-001

System EAB HVAC

Revision 7 Revision Date ~~1-10-90~~ 1-15-90 TPNS Number 5V119VD0106

Date of Origin 04/24/85

Revision Rationale: Revised to reflect as-built conditions and min/max motor HP for EAB return fan.

RECEIVED
JAN 16 1990

APPROVAL SIGNATURES

Paul Berthelot — EGL (Origin) Date	M. McLemore 11/5/88 — EGS (Origin) Date	N/A — Chief Date
N/A — PSSG EGS Date	N/A — Plant Design EGS Date	N/A — Mechanical EGS Date
N/A — Electrical EGS Date	N/A — Civil EGS Date	N/A — Controls EGS Date
N/A — Nuclear EGS Date	N/A — Architectural EGS Date	E.D. Hite 11/7/88 — PQE Date
N/A — Startup Date		11/7/88 — Project Engineer Date

DCN's	FCN's	FCR's

7 REV — HL&P 14926-001 — 1/10/90 DATE

1.0 FUNCTION

The Electrical Auxiliary Building (EAB) heating, ventilating, and air conditioning (HVAC) system consists of the EAB main area HVAC subsystem, the main control room envelope HVAC subsystem, and the technical support center (TSC) HVAC subsystem. The function of these subsystems is to ensure the safety and comfort of plant personnel and operability of plant equipment during normal conditions and postulated accident conditions.

2.0 DESIGN BASES

2.1 SAFETY DESIGN BASES

2.1.1 Safety Design Bases for the EAB Main Area HVAC Subsystem

A. The EAB main area HVAC subsystem, except for the heating system for areas other than ESF battery rooms and elevator machine room HVAC system, is designed to remain functional during and after all upset and faulted conditions.

B. The EAB main area HVAC subsystem is designed so that a single failure of any active component, assuming loss of offsite power, cannot result in a loss of safety-related HVAC function in the building.

C. The battery rooms have a redundant, separate exhaust system designed as Safety Class 3 with spark-proof fan and motor. Controls are provided to alarm loss of air flow in each battery room.

D. Each battery room ventilation maintains the hydrogen concentration below 2 percent by volume, which is less than the lower flammability level of 4 percent.

E. The EAB main area HVAC subsystem components except for electrical penetration area normal HVAC system, heating system for areas other than ESF battery rooms and elevator machine room HVAC system, are designed as Safety Class 3 and seismic category I. The nonsafety equipment and ductwork supports are designed as Safety Class 7 per Seismic II/I design criteria.

F. The subsystem consists of three 50-percent-capacity trains. Each train consists of an air-handling unit (AHU) with makeup/return air mixing box, prefilter, high efficiency filter, supply air fan, cooling coil, heating coil, and a return-air/smoke purge fan. The efficiencies of prefilters and high-efficiency filters are 85 percent and 95 percent, respectively, based on ASHRAE Standard 52. Reheat coils, return-air riser, exhaust-air riser, outside air, and supply air riser are common to all trains. An outside air intake louver (partly MAB intake louver) and its ductwork are shared with control room envelope and TSC subsystems. The electrical penetration area safety-related subsystem consists of three 100-percent fan coil units, one for each of the three train-separated penetration areas. The AHU and fan coil units cooling coils are served by the essential chilled water system.

G. The subsystem is designed to maintain the room temperatures given in Table 1.

H. Design outside temperature conditions are as follows:

Winter	29°F DB minimum
Summer	95°F DB maximum
	81°F WB maximum
	16°F daily range

I. Controls are provided to trip the nonsafety heating coils during faulted condition, to prevent inadvertent operation.

J. The battery room exhaust fans are operated at all times. The battery room is maintained at a slightly negative pressure by providing exhaust air flow greater than supply.

K. All outside air intake and exhaust openings are protected by tornado dampers designed to close automatically subsequent to 3 psig differential pressure within 0.25 seconds during tornado conditions.

L. The HVAC equipment trains are separated from each other with physical barriers such that a common-mode failure of any train does not jeopardize the other trains.

M. A monitoring system is provided to indicate fan status and air flow failure, filter loading, high temperature in critical areas, and operable dampers status.

2.1.2 Safety Design Bases for the Main Control Room (MCR) Envelope HVAC Subsystem

A. The radiation exposure of control room personnel through the duration of any postulated design-basis accident does not exceed the guidelines set by 10CFR50, Appendix A, General Design Criterion 19.

B. Through the duration of any postulated design-basis accident, the subsystem maintains the control room envelope atmosphere at temperatures suitable for prolonged occupancy and equipment operation. Sufficient ventilation is provided for people occupying the MCR envelope during all operating modes.

C. The MCR HVAC subsystem is capable of automatic transfer from its normal operational mode to its emergency or isolation modes upon detection of conditions that could result in induction of airborne hazardous chemicals (anhydrous ammonia, vinyl acetate, ammonium hydroxide, HCL, acetaldehyde, acetic acid and naphtha)

above permissible concentrations (Regulatory Guides 1.78 and 1.95), outside air smoke into the control room, or exposure of control room personnel to a high level of airborne radioactivity.

D. The subsystem is designed so that a single failure of any active component assuming loss of offsite power cannot result in the inability of this subsystem to comply with paragraphs 2.1.2.A, B, and C, above.

E. The MCR HVAC components (except for the toilet/kitchen exhaust system, computer room, HVAC system, and heating system) are designed as Safety Class 3 and seismic category I. Those components that are nonsafety-related have equipment and duct supports that are designed as Safety Class 7 per Seismic II/I design criteria.

F. The subsystem consists of three 50-percent capacity trains. Each train consists of an AHU, RA/SP fan, emergency cleanup filter train (ECFT) unit, and makeup filter train (MFT) unit. The supply air duct, return air duct, and reheat coil(s) are shared by each of the three 50-percent trains. The outside air intake louver (partly MAB intake louver) and its ductwork is shared with the subsystem in paragraph 2.1.1 above.

Each AHU consists of a prefilter, high-efficiency filter, chilled-water cooling coil, and supply fan. The efficiencies of the prefilter and high-efficiency filters is 30 percent and 95 percent, respectively, based on ASHRAE 52. The cooling coils are served by the essential chilled water system.

P. All outside air intake and exhaust openings are protected by tornado dampers designed to close automatically within 0.25 seconds during tornado conditions.

Q. The HVAC equipment trains are separated by physical barriers such that a common mode failure of any train does not jeopardize the other trains.

R. Air locks are provided for doors at the control room envelope boundary which may be used following accidents. Other boundary doors are locked during accident conditions.

2.1.3 Safety Design Bases for the Technical Support Center (TSC) HVAC Subsystem

The TSC HVAC subsystem has no safety design bases.

2.2 POWER GENERATION DESIGN BASES

2.2.1 Power Generation Design Bases for the EAB Main Area HVAC Subsystem

A. This subsystem provides a secondary means of removing smoke from the main area upon a manual start after fire detection.

B. The outside air quantity is increased to 100 percent when required to purge the main area of smoke after a fire.

C. Electric heating coils for areas other than ESF battery rooms are powered from the non-Class 1E ac auxiliary power distribution system.

D. A room thermostat is provided for each electric duct heating coil.

E. Chilled water flow to the cooling coil is controlled to maintain 55°F supply air temperature during normal operation and uncontrolled with full flow through the coil during accident conditions.

F. Outside air is provided for the elevator machine room ventilation to maintain a room temperature of 104°F. The system is nonsafety and consists of one 100-percent exhaust fan with an outside air intake.

G. The following design bases apply to the penetration space HVAC subsystem:

1. The cooling subsystem is designed as nonsafety and nonseismic for normal operation.

B. Tornado dampers in the intake and exhaust openings close subsequent to receipt of 3 psig differential pressure within 0.25 seconds. Under this condition, the HVAC equipment internal to the EAB is protected from the rapid depressurization. The damper will automatically open subsequent to the absence of this differential pressure. No operator intervention is required under this condition since the depressurization occurs for a very brief period, except in case of battery room exhaust fans which would tend to keep the damper closed. Therefore, following a tornado the operator is required to shut the exhaust fans momentarily to allow the tornado dampers to open.

C. A smoke detector is installed in the return duct downstream of each return fan. Upon receipt of a smoke alarm, the return air dampers are shut, the outside air dampers are fully opened, and the smoke purge dampers are opened manually. The outside air intake damper 8V101VDA221 in MAB is opened manually to provide additional outside air during smoke purge. Under this condition, all the return air is discharged via the common exhaust riser with 100 percent outside air supply. Normal damper lineup must be reestablished manually, subsequent to the absence of a smoke alarm.

D. In the event that a smoke alarm is observed during winter operation, an electric heating coil in the common outside air intake riser is energized manually. This coil will elevate the temperature of the inlet air and thus prevent possible freezing of the AHU cooling coils.

E. On receipt of an ESF signal, all heating coils and reheat coils (except for the battery room) will be automatically deenergized in order to prevent inadvertent operation and consequent degradation of cooling.

F. On receipt of an ESF and/or LOOP signal, the control valve for main AHU cooling coil chilled water flow fails in full-open position through the coil. Also, the electrical penetration area emergency AHUs are started. During this operating condition, the electrical penetration area normal AHUs and exhaust fans are not required to operate.

G. During single train shutdown, specific EAB fire dampers require manual isolation to preclude shutdown areas from exceeding temperature limits (refer to Section 5.G for required administrative actions and Reference 6.D for overall shutdown description).

3.2.1.3 Shutdown

Shutdown of this subsystem is accomplished by deenergizing the fans at either the MCR or the auxiliary shutdown panel, and the heaters by local room thermostats.

3.2.2 Control Room Envelope Subsystem

3.2.2.1 Startup

A. Startup of this subsystem is identical to the EAB main area HVAC subsystem regarding verification of damper position and fan energizing at the MCR. It is noted, however, that in addition, 1) two bubble-tight dampers at the outside air inlet for each main AHU and the exhaust fan inlet are open; 2) opposed blade emergency bypass damper in each main AHU return air inlet are fully open; 3) return air inlet damper for each cleanup filter unit are closed; and 4) halon isolation dampers in the supply and return ducts for relay and computer room are open. Also, after establishing the chilled water flow, one of the two AHUs for the computer room is started from the MCR. None of the control room HVAC subsystem is controlled at the auxiliary shutdown panel. The makeup and cleanup filter units do not operate during normal operation.

B. The duct reheat coils for all the rooms are energized and controlled by local room thermostats. Each heating coil is interlocked with a flow switch to prevent energization in case of low air flow through the coil.

C. Consistent with the design of the EAB main area HVAC subsystem, the following controls are provided: 1) chilled water valves to maintain supply air temperature at 53°F; 2) pressure differential indication and alarms across the fans and filters; and 3) high-temperature alarms in critical areas.

D. The main system supplies a total of 34,800 scfm of conditioned air, returns a total of 32,800 scfm, and exhausts 1000 scfm during normal operation. The excess 1000 scfm maintains slightly positive pressure during normal operation.

E. The computer room AHUs are controlled by a thermostat and humidistat furnished as part of the unit package.

3.2.2.2 Operation

A. HVAC operation continues as discussed in Section 3.2.2.1 above except for the following off-normal conditions:

   1. Receipt of an ESF signal

The makeup unit heating coil maintains the humidity level at less than 70-percent relative humidity as required for suitable operation of carbon filters. The cleanup unit does not require a heating coil since the return air and makeup air mixture is previously conditioned, such that humidity is always less than 70-percent relative humidity.

D. Consistent with EAB main area HVAC design, on receipt of an ESF signal the duct reheat coils are deenergized and the control valves for main AHU cooling-coil chilled water fail in the full flow-through coil position.

E. Smoke purge operation is the same as for EAB main area HVAC system. See section 3.2.1.2.C.

F. Tornado dampers at the intake and exhaust openings are shared with the EAB main area HVAC system, and operation during a tornado is the same as for EAB main area system. See section 3.2.1.2.B.

3.2.2.3 Shutdown

Shutdown of this subsystem is accomplished by deenergizing the fans at the MCR, and heaters by local room thermostats.

3.2.3 <u>TSC HVAC Subsystem</u>

The subsystem is nonsafety-related with the exception of the safety-related tornado dampers which are Class 3 dampers. The subsystem is reliable based on having the TSC diesel as an alternate power source. In addition, the supply and return air fans as well as the chilled water system is designed with 100 percent redundancy.

3.2.3.1 Startup

A. Operation of this subsystem is controlled locally in the TSC area, which has all the controls and system monitoring. The system operation is similar to control room HVAC system, except this is a single-train system with 100 percent redundancy for the supply and return fans only. Prior to manual start of the fans, the outside air inlet damper and return air dampers for the main AHU and normal exhaust damper are verified to be open. The smoke purge exhaust damper is similarly verified to be closed. After damper position verification and establishing chilled water flow through the main AHU cooling coil, the supply, return, and exhaust fans are started. Only one supply and return fan is required to operate; the other is on standby. Also, after establishing the chilled water flow, one of the two AHUs for computer room is started. The makeup filter unit does not operate during normal operation.

ATTACHMENT 5