

2.6.3 Annulus Ventilation System

Design Description

1.0 System Description

The annulus ventilation system (AVS) maintains a negative pressure in the annulus to collect leaks from the Reactor Containment Building. The exhaust air is filtered before releasing to the environment via the vent stack.

The AVS consists of three trains, one for normal operation and two accident trains for abnormal plant operating conditions.

The AVS provides the following safety-related functions:

- Isolation of the secondary containment.
- Maintain a negative pressure in the annulus during accident operation.
- Collection of containment building leakage and removal of particulates from the contaminated air prior to release to the plant vent stack.

The AVS provides the following non-safety related functions:

- Maintain ambient air temperature in the annulus.
- Maintain a negative pressure in the annulus during normal plant operation.

2.0 Arrangement

2.1 The functional arrangement of the AVS is as described in the Design Description of Section 2.6.3, Tables 2.6.3-1—Annulus Ventilation System Equipment Mechanical Design and 2.6.3-2—Annulus Ventilation System Equipment I&C and Electrical Design, and as shown on Figures 2.6.3 1—Annulus Ventilation System Normal Operation Train Functional Arrangement and 2.6.3 2—Annulus Ventilation System Accident Filtration Train Functional Arrangement.

2.2 Deleted.

2.3 Physical separation exists between the AVS iodine filtration trains located in the Fuel Building as listed in Table 2.6.3-1 and as shown on Figure 2.6.3-1.

3.0 Mechanical Design Features

3.1 Deleted.

3.2 Class 1E dampers listed in Table 2.6.3-2 will function to change position as listed in Table 2.6.3-1 under normal operating conditions.

3.3 Equipment identified as Seismic Category I in Table 2.6.3-1 can withstand seismic design basis loads without a loss of safety function(s).

3.4 Deleted.

3.5 Deleted.

3.6 Equipment listed in Table 2.6.3-1 as ASME AG-1 Code are fabricated, installed, inspected, and tested in accordance with ASME AG-1 Code requirements.

4.0 I&C Design Features, Displays, and Controls

4.1 Displays listed in Table 2.6.3-2 are indicated on the PICS operator workstations in the MCR and the RSS.

4.2 Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.6.3-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.3-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.

5.0 Electrical Power Design Features

5.1 Equipment designated as Class 1E in Table 2.6.3-2 are powered from the Class 1E division as listed in Table 2.6.3-2 in a normal or alternate feed condition.

5.2 Deleted.

6.0 Environmental Qualifications

6.1 Equipment designated as harsh environment in Table 2.6.3-2 can perform the function listed in Table 2.6.3-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.

7.0 Equipment and System Performance

7.1 The AVS maintains a negative pressure between the inner and outer containment walls, while operating in a design basis accident alignment.

7.2 Upon receipt of containment isolation signal, the following actions occur automatically:

- Isolation of the normal operation train by closing the isolation dampers listed in Table 2.6.3-1 for Normal Operation Train.
- Start of the accident filtration trains and opening of the dampers listed in Table 2.6.3-1 for Accident Filtration Train.



Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.6.3-3 lists the AVS ITAAC.

**Table 2.6.3-1—AVS Equipment Mechanical Design
Sheet 1 of 2**

Description	Tag Number ⁽¹⁾	Location	ASME AG-1 Code	Function	Seismic Category
Normal Operation Train					
Motor Operated Supply Air Dampers	30KLB34AA002 30KLB34AA003	Fuel Building Fuel Building	Yes	Close	I
Motor Operated Exhaust Air Dampers	30KLB44AA002 30KLB44AA003	Fuel Building Fuel Building	Yes	Close	I
Accident Filtration Train					
Motor Operated Dampers	30KLB21AA003 30KLB24AA003	Fuel Building Fuel Building	Yes	Open	I
Electric Heaters Two stage	30KLB21AH001A/B 30KLB24AH001A/B	Fuel Building Fuel Building	Yes	On / Off	I
Prefilters	30KLB21AT001 30KLB24AT001	Fuel Building Fuel Building	Yes	N/A	I
Post Filters	30KLB21AT002 30KLB24AT002	Fuel Building Fuel Building	Yes	N/A	I
Carbon Absorbers	30KLB21AT003 30KLB24AT003	Fuel Building Fuel Building	Yes	N/A	I
Post Filters	30KLB21AT004 30KLB24AT004	Fuel Building Fuel Building	Yes	N/A	I
Motor Operated Dampers	30KLB21AA004 30KLB24AA004	Fuel Building Fuel Building	Yes	Open	I
Exhaust Fans	30KLB21AN001 30KLB24AN001	Fuel Building Fuel Building	Yes	Run	I
Backdraft Dampers	30KLB21AA006 30KLB24AA006	Fuel Building Fuel Building	Yes	Open / Close	I

**Table 2.6.3-1—AVS Equipment Mechanical Design
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Description	Tag Number ⁽¹⁾	Location	ASME AG-1 Code	Function	Seismic Category
Moisture Separators	30KLB21AT005 30KLB24AT005	Fuel Building Fuel Building	Yes	N/A	1

1. Equipment tag numbers are provided for information only and are not part of the certified design.

**Table 2.6.3-2—AVS Equipment I&C and Electrical Design
Sheet 1 of 3**

Description	Tag Number ⁽¹⁾	Location	IEEE Class 1E ⁽²⁾	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
Normal Operation Train							
Motor Operated Supply Air Damper	30KLB34AA002	Fuel Building	1 ^N 2 ^A	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Supply Air Damper	30KLB34AA003	Fuel Building	4 ^N 3 ^A	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Exhaust Air Damper	30KLB44AA002	Fuel Building	1 ^N 2 ^A	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Exhaust Air Damper	30KLB44AA003	Fuel Building	4 ^N 3 ^A	Yes	Yes	Position / Position	Open-Close / Open-Close
Accident Filtration Train							
Motor Operated Supply Air Damper	30KLB21AA003	Fuel Building	1 ^N 2 ^A	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Supply Air Damper	30KLB24AA003	Fuel Building	4 ^N 3 ^A	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Exhaust Air Dampers	30KLB21AA004	Fuel Building	1 ^N 2 ^A	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Exhaust Air Dampers	30KLB24AA004	Fuel Building	4 ^N 3 ^A	Yes	Yes	Position / Position	Open-Close / Open-Close

**Table 2.6.3-2—AVS Equipment I&C and Electrical Design
Sheet 2 of 3**

Description	Tag Number ⁽¹⁾	Location	IEEE Class 1E ⁽²⁾	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
Exhaust Fan	30KLB21AN001	Fuel Building	1 ^N 2 ^A	Yes	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Exhaust Fan	30KLB24AN001	Fuel Building	4 ^N 3 ^A	Yes	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Electrical Heater Two stage	30KLB21AH001A/B	Fuel Building	1 ^N 2 ^A	Yes	Yes	On-Off / On-Off	Start-Stop / Start-Stop
Electrical Heater Two stage	30KLB24AH001A/B	Fuel Building	4 ^N 3 ^A	Yes	Yes	On-Off / On-Off	Start-Stop / Start-Stop
Instruments							
Annulus Pressure	30KLB21CP001 30KLB24CP001	Fuel Building	N/A	Yes	N/A	Press / Press	N/A
Temperature Upstream of Heaters	30KLB21CT001 30KLB24CT001	Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A
Temperature Limit Switch for Heaters	30KLB21CT002 30KLB24CT002	Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A
Temperature Regulation for Heaters	30KLB21CT003 30KLB24CT003	Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A
Temperature downstream of carbon adsorbers	30KLB21CT004 30KLB24CT004	Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A
Pressure Limit Switch Exhaust Fans	30KLB21CP002 30KLB24CP002	Fuel Building	N/A	Yes	N/A	Press / Press	N/A

**Table 2.6.3-2—AVS Equipment I&C and Electrical Design
Sheet 3 of 3**

Description	Tag Number⁽¹⁾	Location	IEEE Class 1E⁽²⁾	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
Accident Filtration Train Differential Pressure	30KLB21CP505 30KLB24CP505	Fuel Building	N/A	Yes	N/A	Press / Press	N/A
Accident Filtration Train Flow	30KLB21CF001A 30KLB21CF001B	Fuel Building	N/A	Yes	N/A	Flow / Flow	N/A
Radiation Monitors (R-27)	30KLB21CR001 30KLB21CR002	Fuel Building	N/A	N/A	N/A	Radioactivity level / Radioactivity level	N/A

1. Equipment tag numbers are provided for information only and are not part of the certified design.
2. ^N denotes division the equipment is normally powered from, while ^A denotes the equipment is powered from when alternate feed is implemented.

Table 2.6.3-3—Annulus Ventilation System ITAAC
Sheet 1 of 5

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The functional arrangement of the AVS is as described in the Design Description of Section 2.6.3, Tables 2.6.3-1 and 2.6.3-2, and as shown on Figures 2.6.3-1 and 2.6.3-2.	An inspection of the as-built AVS functional arrangement will be performed.	The AVS conforms to the functional arrangement as described in the Design Description of Section 2.6.3, Tables 2.6.3-1 and 2.6.3-2, and as shown on Figures 2.6.3-1 and 2.6.3-2.
2.2	Deleted.	Deleted.	Deleted.
2.3	Physical separation exists between AVS iodine filtration trains located in the Fuel Building as listed in Table 2.6.3-1 and as shown on Figure 2.6.3-1.	An inspection will be performed to verify that the as-built AVS iodine filtration trains are located in separate rooms in the Fuel Building.	The AVS iodine filtration trains are located in separate rooms in the Fuel Building as listed in Table 2.6.3-1 and as shown on Figure 2.6.3-1.
3.1	Deleted.	Deleted.	Deleted.
3.2	Class 1E dampers listed in Table 2.6.3-2 will function to change position as listed in Table 2.6.3-1 under normal operating conditions.	Tests will be performed to verify the ability of Class 1E dampers to change position under normal operating conditions.	Class 1E dampers listed in Table 2.6.3-2 change position as listed in Table 2.6.3-1 under normal operating conditions.

**Table 2.6.3-3—Annulus Ventilation System ITAAC
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	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
3.3	Equipment identified as Seismic Category I in Table 2.6.3-1 can withstand seismic design basis loads without a loss of safety function(s).	<p>a. Type tests, analyses, or a combination of type tests and analyses will be performed on the equipment identified as Seismic Category I in Table 2.6.3-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements.</p> <p>b. An inspection will be performed of the as-built equipment identified as Seismic Category I in Table 2.6.3-1 to verify that the equipment, including anchorage, are installed in a condition bounded by the tested or analyzed condition.</p>	<p>a. Test/analysis reports conclude that the equipment identified as Seismic Category I in Table 2.6.3-1 can withstand seismic design basis loads without a loss of safety function(s).</p> <p>b. Inspection reports conclude that the equipment identified as Seismic Category I in Table 2.6.3-1, including anchorage, are installed in a condition bounded by the tested or analyzed condition.</p>
3.4	Deleted.	Deleted.	Deleted.
3.5	Deleted.	Deleted.	Deleted.
3.6	Equipment listed in Table 2.6.3-1 as ASME AG-1 Code are fabricated, installed, inspected, and tested in accordance with ASME AG-1 Code requirements.	An inspection of the as-built construction activities and documentation for ASME AG-1 Code equipment will be conducted.	A report concludes that ASME AG-1 Code equipment listed in Table 2.6.3-1 are fabricated, installed, inspected, and tested in accordance with ASME AG-1 Code requirements.
4.1	Displays listed in Table 2.6.3-2 are indicated on the PICS operator workstations in the MCR and the RSS.	<p>a. Tests will be performed to verify that the displays listed in Table 2.6.3-2 are indicated on the PICS operator workstations in the MCR.</p> <p>b. Tests will be performed to verify that the displays listed in Table 2.6.3-2 are indicated on the PICS operator workstations in the RSS.</p>	<p>a. Displays listed in Table 2.6.3-2 are indicated on the PICS operator workstations in the MCR.</p> <p>b. Displays listed in Table 2.6.3-2 are indicated on the PICS operator workstations in the RSS.</p>

**Table 2.6.3-3—Annulus Ventilation System ITAAC
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Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.2	Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.6.3-2.	<ul style="list-style-type: none"> a. Tests will be performed using controls on the PICS operator workstations in the MCR. b. Tests will be performed using controls on the PICS operator workstations in the RSS. 	<ul style="list-style-type: none"> a. Controls on the PICS operator workstations in the MCR perform the function listed in Table 2.6.3-2. b. Controls on the PICS operator workstations in the RSS perform the function listed in Table 2.6.3-2.
4.3	Equipment listed as being controlled by a PACS module in Table 2.6.3-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.	A test will be performed using test input signals to verify equipment controlled by a PACS module responds to the state requested and provides drive monitoring signals back to the PACS module.	Equipment listed as being controlled by a PACS module in Table 2.6.3-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.
5.1	Equipment designated as Class 1E in Table 2.6.3-2 are powered from the Class 1E division as listed in Table 2.6.3-2 in a normal or alternate feed condition.	<ul style="list-style-type: none"> a. Testing will be performed by providing a test input signal in each normally aligned division. b. Testing will be performed by providing a test input signal in each division with the alternate feed aligned to the divisional pair. 	<ul style="list-style-type: none"> a. The test input signal provided in the normally aligned division is present at the respective Class 1E equipment identified in Table 2.6.3-2. b. The test input signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E equipment identified in Table 2.6.3-2.
5.2	Deleted.	Deleted.	Deleted.

**Table 2.6.3-3—Annulus Ventilation System ITAAC
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	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
6.1	<p>Equipment designated as harsh environment in Table 2.6.3-2 can perform the function listed in Table 2.6.3-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.</p>	<p>a. Type tests or type tests and analysis will be performed to demonstrate the ability of the equipment designated as harsh environment in Table 2.6.3-2 to perform the function listed in Table 2.6.3-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.</p> <p>b. An inspection will be performed of the as-built equipment designated as harsh environment in Table 2.6.3-2 to verify that the equipment, including the associated cables, wiring, and terminations located in a harsh environment, are bounded by the type test or combination of type tests and analyses.</p>	<p>a. EQDPs conclude that the equipment designated as harsh environment in Table 2.6.3-2 can perform the function listed in Table 2.6.3-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions, including the time required to perform the listed function.</p> <p>b. A report exists and concludes that the equipment designated as harsh environment in Table 2.6.3-2, including the associated cables, wiring, and terminations located in a harsh environment, are bounded by the type test or combination of type tests and analyses.</p>
7.1	<p>The AVS maintains a negative pressure between the inner and outer containment walls, while operating in a design basis accident alignment.</p>	<p>A test will be performed using test input signals to verify the capability of the AVS to provide a negative pressure between the inner and outer containment walls, while operating in a design basis accident alignment.</p>	<p>The AVS maintains a negative pressure of less than or equal to -0.25 inches water gauge within 305 seconds after receipt of a test input signal from the PACS module, while operating in a design basis accident alignment.</p>

**Table 2.6.3-3—Annulus Ventilation System ITAAC
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	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
7.2	<p>Upon receipt of containment isolation signal, the following actions occur automatically:</p> <ul style="list-style-type: none"> ● Isolation of the normal operation train by closing the isolation dampers listed in Table 2.6.3-1 for Normal Operation Train. ● Start of the accident filtration trains and opening of the dampers listed in Table 2.6.3-1 for Accident Filtration Train. 	<p>A test will be performed to verify that upon receipt of containment isolation test input signal, the following actions occur automatically:</p> <ul style="list-style-type: none"> ● The normal operation train isolates by closing the isolation dampers. ● The accident filtration trains start, and the dampers for Accident Filtration Train to the iodine filtration train are aligned to the open position. 	<p>The following actions occur automatically within 60 seconds after receipt of an isolation test input signal from the PACS module:</p> <ul style="list-style-type: none"> ● The normal operation train is isolated by closing the isolation dampers listed in Table 2.6.3-1 for Normal Operation Train. ● The accident filtration trains start, and the dampers listed in Table 2.6.3-1 for Accident Filtration Train are aligned to the open position.