# 9.3 Process Auxiliaries

## 9.3.1 Compressed Air System

The compressed air system (CAS) consists of compressors, dryers, filters, receivers and other equipment required for performing its non-safety-related functions.

### 9.3.1.1 Design Bases

The CAS provides compressed air for the following services:

- Instrument air for non-safety-related valves and other equipment located in the Conventional Island (CI).
- Instrument air for opening the containment ventilation purge valves.
- Instrument air to valves, pumps and other equipment located in the Radioactive Waste Building, blowdown demineralization, fuel handling and other systems for non-safety-related functions.
- Service air throughout the plant (for using air-operated tools and purging tanks).

The containment isolation features for the containment penetrations in the CAS are described in Section 6.2.4.

There are no air-operated valves (AOV) or air-operated equipment required to function in response to an accident where the compressed air is provided by the CAS.

The design of the CAS is in compliance with the resolution of NUREG-0933, Generic Safety Issue 43, Reliability of Air Systems (Reference 1).

The CAS is designed for a single unit and is not shared with other units.

Instrument air is designed to meet ANSI/ISA 7.0.01-1996 (Reference 3).

Refer to Section 12.3.6.5.10 for compressed air system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

### 9.3.1.2 System Description

#### 9.3.1.2.1 General Description

The CAS consists of a compressed air generation system and a compressed air distribution system. The compressed air generation system is located entirely in the Turbine Building (TB). It supplies compressed air to the compressed air distribution systems in the Nuclear Island (NI) and CI. The location of the compressed air generation system in the TB minimizes the likelihood of leakage from radioactive systems being ingested into the CAS.

Figure 9.3.1-1—Compressed Air Generation System, shows a schematic diagram of the compressed air generation system while Figure 9.3.1-2—Compressed Air Distribution System, shows a schematic diagram of the NI and CI compressed air distribution system.

Refer to Section 12.3.6.5.10 for compressed air system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

### Component Description

Table 3.2.2-1 provides the seismic and other design classifications for the components in the CAS. The containment isolation valves (CIV) and penetrations are the only safety-related components in the CAS.

### Instrument Air

Two 100 percent oil-free rotary screw compressors are provided. They are connected for parallel operation and provide clean, dry, oil-free instrument air. During normal plant operation, one instrument air compressor operates continuously, loaded and unloaded depending on the system demand. The other instrument air compressor is in standby and is started in the event the operating compressor fails or if the system pressure drops below a preset value. Each compressor is equipped with an inlet air filter, aftercooler and moisture separator to condition the compressed air.

Two instrument air receivers serve as a storage volume to supply a limited amount of compressed air following a compressor failure. Overpressure protection is provided via pressure relief valves located on the air receivers.

Duplex prefilters are provided at the instrument air dryer inlet in order to protect the adsorption dryer units. Prefilter elements are constructed of corrosion-resistant materials.

Duplex afterfilters are provided at the instrument air dryer outlet to prevent the carryover of desiccant dust. These filters also remove rust, scale and dirt. Afterfilter elements are constructed of corrosion resistant materials. The duplex afterfilters have an automatic drain trap to remove accumulated condensate.

An air dryer is installed downstream of each instrument air compressor to remove moisture from the air.

### Service Air

A single oil-free rotary screw compressor provides service air. During normal operation, the service air compressor operates continuously, loaded and unloaded depending on the system demand. The compressor is equipped with an inlet air filter, aftercooler and moisture separator to condition the compressed air.

A service air aftercooler–moisture separator is provided immediately downstream of the compressor to cool the flow of air from the air compressor and remove entrained moisture.

The service air receiver located directly after the aftercooler–moisture separator serves as a storage volume to supply a limited amount of compressed air following a compressor failure. Overpressure protection is provided via pressure relief valves located on the air receiver.

A duplex filter is provided downstream of the service air receiver discharge to remove rust, scale and dirt that might be present in the service air distribution system.

#### 9.3.1.2.2 System Operation

##### Normal Operation

During normal plant operation, one instrument air compressor provides the required pressure in the instrument air receivers.

The service air compressor is in operation and provides the required pressure to the service air receiver. Service air is not required inside containment during normal plant operation.

The CAS supplies the opening function of the containment ventilation valves for the containment building ventilation system (CBVS). However, compressed air is not required to perform the safety-related function in this system; for these containment valves, air is required to keep the valves open, a non-safety-related function. The containment valves close on spring pressure. Refer to Section 9.4.7 for a description of the CBVS.

##### Accident Conditions

The CAS is not required to operate during or following an accident condition.

The CIVs maintain containment integrity, including an accident with a loss of offsite power and a loss of an emergency diesel generator. The instrument air motor-operated CIVs are actuated by a safety-related I&C System following a containment isolation signal (CIS). The service air manual CIVs are locked in the closed position during normal plant operation and remain closed during any accident condition.

The CAS does not provide compressed air to the diesel generator starting air system (DGSAS). Refer to Section 9.5.6 for a description of the DGSAS.

### 9.3.1.3 Safety Evaluation

The safety evaluation of the containment isolation system is given in Section 6.2.4.

The U.S. EPR does not use air operators on safety-related valves, except for the non-safety function of opening normally-closed containment ventilation valves. This practice effectively avoids the problems noted in NUREG-1275 (Reference 2).

The CAS is not required for any safety function. Failure of the CAS does not affect any accident mitigation function. Failure of the CAS does not cause degradation of barriers to radiation releases during normal operation.

### 9.3.1.4 Inspection and Testing Requirements

The CAS components are inspected and tested during initial plant startup as part of the initial test program. Refer to Section 14.2 (test abstract #178) for initial plant startup test program.

### 9.3.1.5 Instrumentation Requirements

The instrument air CIVs are actuated by a safety-related I&C System. The actuator control logic of the CIVs is periodically tested. The CIVs are actuated from the main control room or the remote shutdown station. Section 7.3 describes the safety-related instrumentation associated with containment isolation. All other I&C functions are performed by non-safety-related I&C Systems described in Section 7.1.

### 9.3.1.6 References

1. NUREG-0933, "A Prioritization of Generic Safety Issues," U.S. Nuclear Regulatory Commission, Revision 21, September 2007, (includes Supplements 1-31).

2. NUREG-1275, Volume 2, "Operating Experience Feedback Report - Air Systems Problems," U.S. Nuclear Regulatory Commission, December 1987.

3. ANSI/ISA 7.0.01-1996, "Quality Standard for Instrument Air," The Instrumentation, Systems, and Automation Society, 1996.

Next File