

I.3: Smoke exhaust system for experimental hall at Indus Accelerator Complex

Safe escaping of occupants is of utmost importance in the event of fire in any building. A smoke exhaust system as per National Fire Protection Association (NFPA-92) standards is installed in the experimental hall at the Indus Accelerator Complex (IAC). The hall is logically divided into 16 zones covering 48 sectors from fire protection point of view. Each zone has a blower of 10000 m³ per hour capacity, which receives the smoke from a duct connected to six suction openings. There are thirteen direct driven blowers as shown in Figure I.3.1 and three belt driven blowers as shown in Figure I.3.2, which cater to the requirement of six air changes per hour as per the guidelines of Confederation of Fire Protection Associations Europe (CFPA-E).

The primary design objective is to contain smoke to the zone of origin and manage the smoke within a large volume along with un-separated space by forcefully releasing the smoke into the area open to the sky. In order to achieve effective exhaust of the smoke on actuation of the smoke detectors of a particular area, the existing Air Handling Units (AHUs) are utilized such that: (1) fresh air is supplied from the AHUs opposite to the exhaust fans; and (2) exhaust fire dampers of the AHUs on outer wall of that area are closed. This work has been accomplished as per the requirement of Atomic Energy Regulatory Board (AERB).

The experimental hall along with MPS and RF areas in IAC, which is approximately 26160 m³ in size, has been divided into 48 sectors. The maximum volume of the smoke to be handled per sector is 545 m³. As per the CFPA-E guidelines, if the fire compartment is greater than 4800 m² and if the height is 5 to 7.5 m, then it is recommended to have six air changes in an hour. Since the height of experimental hall is about 7 m and the enclosed area is about 3734 m², the system has been designed for six air changes per hour. This makes it necessary to have volumetric flow better than 3270 m³ per hour per sector. Accordingly, the blower rating for three consecutive sectors in a zone has been chosen to be 10000 m³ per hour.



Fig. I.3.1: A portion of the smoke exhaust system covering three sectors of a zone with a direct driven blower.



Fig. I.3.2: The smoke exhaust system with a belt-driven blower catering to MPS area of Indus-2 accelerator.



Fig. I.3.3: Two zones of smoke exhaust system installed on the roof of Indus Accelerator Complex.

The experimental hall, including magnet power supply (MPS) and RF areas, is divided into 16 zones covering 48 sectors. Each zone has six opening ducts, as shown in Figure I.3.1, an exhaust fan and a control panel. The exhaust system has been installed on the roof of IAC as shown in Figure I.3.3, adjacent to the windows, for proper evacuation of smoke. The other aspects taken into account while designing the exhaust system were: 1) keeping vibrations due to the fans and the motors within limit; 2) proper earth to the equipment; 3) mounting of fans at appropriate locations on the roof from load balancing point of view; and 4) emergency switch to cut off power while working at the site.

In order to keep the smoke exhaust system in healthy state, it is actuated manually every fortnight and once in every two months during Indus machine shutdown in automatic mode, wherein the system is actuated using fire detector output signals. At the same time, the other important parameters like flow rate, current drawn by the blowers, and vibration of each smoke exhaust unit are monitored. These parameters were checked at the time of pre-dispatch inspection and after commissioning for its proper functionality. A record of these readings would be maintained for cross-comparison.

After the commissioning of the smoke exhaust system in February 2019, the level of safety in IAC is enhanced.

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