

Fire Fighting Training Facilities & Simulators

FIRE FIGHTING TRAINING FACILITIES & SIMULATORS

1. BREATHING APPARATUS (BA) TRAINING GALLERY

The Breathing Apparatus (BA) Training Gallery system shall comprise the following components and specifications:

1.1 Training Maze

- MS fabricated Training Maze with an Orientation section and Obstacles.
- Includes a 26-meter crawl space and a 26-meter walkway.

1.2 Control and Safety Features

- Control desk equipped with PLC, HMI, keyboard, and circuit boards.
- Temperature Measuring and Control System.
- Room Lighting.
- Personal Announcing System.
- Television Monitoring System with night vision cameras (4 nos) for orientation aid.
- Ventilation system.

1.3 Simulation Equipment

- Heat simulator.
- Smoke Generation unit.
- Noise effect systems.
- Strobe light effect systems.

1.4 Work Room Equipment

- Bicycle ergometer.
- Endless ladder.
- Treadmill.

1.5 Spatial Requirements

- Training Maze Room: 8.5m (W) x 11m (L) x 3.5m (H)
- Control Room & Work Room: 8.5m (L) x 4.0m (W) x 3.5m (H)

2. FIRE FIGHTING TRAINING SIMULATOR

2.1 General Overview

The technical specification details the design, installation, and commissioning of the 'FIRE FIGHTING TRAINING SYSTEM' for the Bihar Fire Training Institute. It is developed to meet both safety-related regulatory requirements and operational training needs. The equipment shall permit safe and repeatable training for the use of firefighting equipment under emergency conditions, with an expected serviceable life of 20 years.

2.2 Objectives

- Acquire knowledge and practice skills for firefighting in a near-realistic environment.
- Comprehend fundamental principles and concepts necessary to mitigate, solve, and control an emergency whilst exposed to confined space entry, smoke, fire, and heat within a compartment.
- Tackle emergencies in confined and realistic fire-prone environments.
- Tackle emergencies in various disaster scenarios, such as domestic and industrial fires, smoke, confined space rescue, chemical spillage, rope training, and car accident rescue.
- Practice the correct use of Personal Protective Equipment (PPE) and Internal Protection Devices.

2.3 Technical Requirements (Modules)

The facility shall comprise the following fire simulation modules:

- Generator fire
- Transformer fire
- Car parking fire
- Office Desk fire
- Electric switch Board Fire
- Hospital Bed Fire
- Cable tray fire along with TV/computer fire

- Shopping Rack fire
- Bed fire
- Flash-over fire (Central air conditioner/duct fire with flashover effect)
- Kitchen fire with cylinder fireball effect
- Fuel storage and supply system
- Control room (Ground floor)
- PLC Based fire simulation system and safety systems
- Ventilation and Electrical distribution systems
- Thermal Imaging Cameras (TIC) and Smoke Simulation

2.4 General Layout

The building accommodating the simulators is to be constructed with a basement, ground, and three upper floors in an approximate area of 42 x 30 meters.

- Basement / Outside: Generator fire. The transformer fire simulation mock-up can be placed outside the building or in the basement based on site suitability.
- Ground Floor: Office desk fire, car parking fire, and the Main Control Room.
- First Floor: Shopping rack fire, hospital bed fire, electric switchboard fire, and cable tray fire.
- Second Floor: Flashover fire, bunk bed fire, and two separate smoke generators in the classroom.
- Third Floor: Kitchen fire with gas cylinder fireball effect.
- Control Room: Installed on the ground floor, housing the main PLC-based control panel, CCTV, TIC display units, and controls for safety gears, ventilation, and exhaust systems.
- Fuel Storage & Supply: An adequate capacity gas tank (LPG/Propane) shall be installed nearby to supply continuous gas with proper flow and pressure up to the service regulator.

2.5 Construction and Fabrication Work

- Civil Works: Involves the construction of fire brick masonry and normal brick partitions (in the scope of the Corporation).
- Fabrication Works: Mock-ups and trunks shall be fabricated using IS 2062 standard steel. Gas piping shall comply with the IS 1239 standard. Internal grid frames and ceiling

weather steel shall be fabricated as per IS 2062, while burning equipment shall be made of weather-resistant steel. Detailed designs must be based on a thorough site survey and structural force analysis.

2.6 Applicable Codes and Standards

- Fire Brigade Training Facilities (Gas-Operated): DIN 14097-2
- Structural Fabrication: IS 2062
- Gas Burner: BS EN 746-2
- Gas Piping: ASME B31.3
- Utility Piping: IS 1239
- Welding: ASME IX

2.7 Fire Simulation Equipment Design

- Materials: Must withstand the training environment (heat, thermal shock, and extinguishing water forces) without producing harmful toxic effects. Equipment subjected to excessive heat shall use corrosion-resistant materials.
- Fire Point Mock-ups: Materials must resist continuous, rapid temperature increases and rapid cooling. Igniting systems must be installed to absorb thermal expansion without permanent deformation.
- Burn Room Cladding: Environments close to fire points shall be cladded with Refractory Brick/steel cladding/Insulation Material on walls (up to 800°C) and ceilings (up to 1000°C) to prevent structural damage.

2.8 Fire Point Control Components

- Flame Generation: Burners, extractors, and remote control panels must be heat-resistant, waterproof, and positioned to avoid damage from extinguishing action.
- Flame Signature & Height: Gas liberated through spray nozzles enhances flame depth. Varying fuel flow rates control flame height and thermal intensity.
- Pilot Flame: Each fire point must have at least one pilot flame with an automatic control system and an electric safety valve that closes if the pilot goes out.
- Flame Extinguishing Control: Fires shall react to the trainee's application of extinguishing media (water). Includes manual control by the instructor via remote and automatic control via sensors evaluating the duration of extinguishing agent application.

2.9 Ventilation & Smoke Generation

- **Ventilation:** Designed for emergency purges with a minimum of 80 air exchanges per hour (1.33 per minute) as per DIN 14097-2. Automatically activates during start-up, emergency stops, system failures, high temperatures, un-burnt gas detection, and post-session smoke clearance.
- **Combustion Air:** Regulated automatically; any irregularity safely deactivates the flames.
- **Smoke Generation:** Fluid must be neutral, safe, non-polluting, and non-flammable. Must reproduce realistic smoke stratification. The container must hold enough liquid for 8 hours of continuous use.

2.10 Fire Place Thermal Output

- Generator fire: 500 KW
- Transformer open fire: 500 KW
- Car parking fire: 500 KW
- Kitchen fire with fireball effect: 500 KW
- Office Desk fire: 350 KW
- Hospital bed fire: 350 KW
- Cable tray fire: 350 KW
- Shopping rack fire: 350 KW
- Central AC/duct fire with flashover: 350 KW
- Bed bunk fire: 350 KW
- Electric Switch Board fire: 250 KW

2.11 Control System

- **Computerized System:** Managed by a modern graphical operating system utilizing an 11-inch HMI screen. Protected against power surges with an automatic UPS back-up.
- **Software & Diagnostics:** Allows parameter adjustments for different fire scenarios. Includes auto-diagnosis of all instruments, emergency stops, ventilation, temperature controls, and gas levels prior to start-up.
- **Hand-held Devices:** Wired/wireless pendants allow instructors to control pilot lights, main flames, ventilation, and smoke remotely. Includes Emergency Stop and Alarm functions.

2.12 Safety Systems

- Emergency Stop Buttons: Located at the operator station and inside training areas. Activation immediately shuts off fuel flow and triggers maximum ventilation.
- Gas Detection: Independent system operating 24/7. At 10% LEL, alarms sound and ventilation activates. At 25% LEL, gas supply automatically shuts down.
- Temperature Monitoring: Sensors at 100 cm height (alarm at 250°C) and ceiling height (auto shut-off and max purge at 350°C).
- Intrinsic Safety & Fail-Safe Valves: Valves close automatically upon electrical power loss.
- Lighting: Internal areas equipped with standard and battery-backed emergency lighting. Outside warn lights indicate active fire operations.

2.13 Documentation, Training, and Warranty

- Documentation: The Contractor shall provide comprehensive Operation and Maintenance (O&M) Manuals, including technical data sheets and troubleshooting guides.
- Training: The Contractor shall provide a minimum 2-day training course for up to 8 staff members and 4 supervisors on system operation and maintenance.
- Warranty & AMC: The entire system shall be warranted against defects for a period of one (1) year post-commissioning. The Contractor must provide an Annual Maintenance Contract (AMC) offer for five (5) years following the warranty period.

3. PARADE GROUND SPECIFICATIONS

- Soling: 100 mm thick
- Tack Coat: 50 mm thick
- Carpet: 25 mm thick
- Seal Coat: 5 mm thick

Note: The specification for above work is suggestive and not exhaustive. The detail specification drawing shall be prepared by Contractor with close consultation with R.I.C and submit for approval of competent authority.