भारतीय मानक

Indian Standard

IS 9297 : 2024

बांधों के भीतर प्रकाश, संवातन एवं अन्य सुविधाएँ — अनुशंसाएँ

(पहला पुनरीक्षण)

Lighting, Ventilation and Other Facilities Inside Dams — Recommendations

(First Revision)

ICS 93.160

भारतीय मानक ब्यूरो

BUREAU OF INDIAN STANDARDS

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Dams and Spillways Sectional Committee, WRD 09

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Dams and Spillways Sectional Committee, had been approved by the Water Resources Division Council.

This standard lays the guidelines for the provision of various facilities such as lighting, ventilation, water supply, etc inside dams to achieve maximum productivity coupled with a high standard of safety and welfare.

Proper lighting inside dams is essential for creating a good visual environment and for permitting a high degree of efficiency in seeing whatever equipment/machinery is of special importance. Lighting is considered good when it is suitable both in quality and quantity.

To cater to the requirement of fresh air inside the dam galleries which are not normally connected to the outside atmosphere, the provision of a good ventilation system to ensure the required number of air changes is essential.

The other facilities recommended in this standard for provision inside dams include water supply, compressed air supply, drainage system, firefighting system, communication system, elevators, entrance doors, and first-aid.

This standard was first published in 1979. This revision of the standard has been brought out based on wide field experience and international practices, also updating the references. In this revision, the following changes have been made:

a) The provision of LED lamps has been recommended for more efficient lighting; and
b) The provision of galvanized iron pipeline for drinking water supply has been deleted.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded-off value should be the same as that of the specified value in this standard.

Indian Standard

LIGHTING, VENTILATION AND OTHER FACILITIES INSIDE DAMS — RECOMMENDATIONS

(First Revision)

1 SCOPE

This standard covers the requirements of lighting, ventilation, and other facilities such as water supply, compressed air supply, drainage, firefighting, communication system, elevators, and first aid inside dams and the methods of achieving the same.

2 REFERENCES

The standards given below contain provision which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on these standards are encouraged to investigate the possibility of applying the most recent edition of these standards:

IS No.	*Title*
IS 1172 : 1993	Code of basic requirements for water supply, drainage and sanitation (*fourth revision*)
IS 10135 : 1985	Code of practice for drainage system for gravity dams, their foundations and abutments (*first revision*)

3 LIGHTING

3.1 General

Good and proper lighting is a necessity inside all dams and has certain primary requirements. Lighting installation should provide satisfactory illumination to allow personnel to carry out their task without any strain on the eye. There should be a spatial distribution of light. This includes the combination of diffused and directional light, the distribution of luminance, the amount of homogeneity, and the amount of glare. It is necessary not only to provide a sufficient quantity of light but also to ensure proper quality of light depending upon the type, location, and brightness of the light source. The light source should provide minimum glare; its brightness should be kept to a low value and shall be located in such a way that it does not come within the direct line of vision. In further combating glare, good screening of light sources shall be ensured. The mounting height can also help in preventing glare. The light source shall be placed higher up, to remove the disturbing brightness as far as possible from the center of visual field.

3.1.1 An important aspect of lighting is to select the proper colour for the walls, ceiling, floor, and equipment in the area to reduce the brightness contrast between adjacent surfaces. In the selection of room colours, the reflection factors of the colours shall be given due consideration. Glossy paints and highly polished surfaces, especially those of metals are often a source of eye irritation and should be avoided.

3.1.2 Another important aspect of lighting is that it determines the atmosphere in a location to a larger extent that is cool, warm, pleasant, and sober. Efficient lighting not only makes the space visible but its quality accentuates its character and thus becomes an integral part of the dam.

3.1.3 In the event of sudden failure of supply, it is necessary to have provision for emergency lighting at essential points like stairways, adits, cross galleries and near instruments, etc.

3.2 Illumination Levels

The general illumination levels required for various locations inside the dam are given in Table 1. Special circumstances may require higher intensities than those normally encountered inside dams. The intensities given in Table 1 are the average illumination values maintained on the work plane.

The recommended level of illumination of emergency lighting required for various locations inside dams is of the order of 10 to 20 lux.

Table 1 Recommended Illumination Levels

(*Clause* 3.2)

Sl No.	Description of the Area	Recommended Illumination Level in Lux
(1)	(2)	(3)
i)	Corridors	70
ii)	Stairways	100
iii)	Inspection and drainage galleries, tunnels and shafts	70
iv)	Equipment galleries and operating chambers	150
v)	Substations	150
vi)	Toilets	80
vii)	Offices/laboratories	300
viii)	Lift car	100
ix)	Lift wells	70
x)	Adits	70
xi)	Instrumentation galleries	150
xii)	Sump wells, pump chambers	100

3.3 Lighting Fixtures

The illumination level is only one phase of the task of seeing. The source of the illumination flux is just as important as its density. The lighting fixtures to be provided at various locations inside the dam should be so chosen as to provide sufficient illumination on the working plane and to blend suitably with the environments. The choice of the luminaires should also be based on the total economics of the installation over a period of time including the annual costs of energy and maintenance. This means that in most cases lamps with higher luminaire efficiency and luminaire meeting equal quality standards as regards glare, etc, but with higher output ratio are more advantageous in the long run. In deciding upon the choice of the luminaire, the following points are recommended to be kept in view:

a) Discharge lamps are more efficient than incandescent lamps;
b) Lamps with reflectors are more efficient than those without reflectors;
c) The higher the wattage, the more efficient is the lamp;
d) Luminaires which are easily maintained provide better utilization of light output; and
e) LED lamps are more efficient, give more illumination, and have longer life.

3.3.1 The type of lighting fixtures generally recommended for different galleries in a dam are given in **3.3.2** to **3.3.5**.

3.3.2 The requirement of illumination in inspection galleries is more of a functional nature. These galleries generally have a very low ceiling height; consequently, recesses are formed in the ceiling to accommodate the lighting fixtures. The spacing recommended is between 5 m to 6.5 m depending upon the height of the galleries. In case sufficient headroom is not available, bulkhead fitting may be provided on the side walls.

3.3.3 In case of inspection and drainage galleries where the above types of recesses cannot be formed, incandescent bulkhead lighting fixtures are recommended. These are generally installed on the fillet of the galleries so that walls or ceilings do not remain dark.

3.3.4 In galleries which are frequently in use, such as visitors' galleries, fluorescent light fixtures in recesses are recommended. The lighting fixtures can be with either louver cover or with polystyrene louvers.

3.3.5 For equipment galleries, industrial type fluorescent lighting fixtures or bulkhead lighting fixtures are recommended. The fluorescent lighting fixtures are installed on the ceiling. The bulkhead lighting fixtures can also be installed on the walls.

3.4 Wiring

All wiring shall be in conduits. The joints shall be made in junction boxes provided for the purpose through porcelain connectors. Screws in the porcelain connectors shall be kept tight and smeared

with plastic compounds to prevent entry of moisture. Temporary connections, straps or wires shall be made good as far as possible. Untidy porcelain connectors with loose screwed connections are a potential source of trouble and should be avoided.

3.5 Additional plug points may be provided in the galleries for special lighting requirements.

4 VENTILATION

4.1 General

Galleries inside dams are not adequately connected to the outside atmosphere. It is, therefore, necessary to provide positive means of ventilation in the galleries. Ventilation is required for supplying fresh air, diluting inside air vitiated by body odours, relief of dampness, removing contaminants in the air, if any, and providing thermal environments for maintaining heat balance of the body for the comfort of working personnel in the galleries.

4.2 Recommended Values for Air Changes

The requirement of fresh air supply to the galleries may be very small as the number of occupants is usually very low. A minimum of two air changes per hour may be provided (a change per hour means that quantity of air equivalent to the total volume of galleries is supplied to and exhausted from the galleries each hour). However, for lavatories, a minimum of six air changes per hour should be provided.

4.3 Mechanical Ventilation

As the volume of air to be supplied to and exhausted from galleries is large, means of mechanical ventilation may be provided. Mechanical ventilation can be affected either by exhaust of air or by positive ventilation or a combination of the two. In case the exhaust method cannot be applied to the galleries, because of their layout the air should be supplied into the galleries by centrifugal or axial fans through ducting.

4.3.1 Selection of the fans shall be made after calculating the head required (in cm of water) to overcome the resistance in the duct system and by the characteristics of the fans. Air intake openings shall be provided with stormproof louvers and screens.

4.3.2 Where temperature and humidity control is required inside the galleries, air-conditioning/dehumidification may be resorted to.

5 WATER SUPPLY

5.1 General

An adequate water supply should be provided inside the dam for drinking purposes and for various service utilities such as cooling, flushing, fire-fighting, grouting, flushing of choked pipes, etc (*see* IS 1172). The water supply facility can be divided into two categories given in **5.2** and **5.3**.

5.2 Service (Raw) Water Supply

It is provided to meet the requirements of various equipment and for maintenance and cleanliness purposes inside the dam. For the supply, pipelines of at least 50 mm diameter should be provided. The location of pipelines should be such that there is no obstruction to normal working. Service water pipelines should have tapping with valve and suitable hose connections, normally spaced at 15 m. In case filtration/treatment arrangements are provided inside the dam, only one main line for raw and fresh water is recommended.

5.3 Drinking (Fresh/Treated) Water Supply

To cater to the requirements of drinking water for personnel working inside the dam, a supply line of at least 40 mm diameter should be provided. This pipeline shall be of heavy-duty PVC or similar material. It should run in the galleries along with the service water and compressed air pipelines. Drinking water connections are provided on this line at suitable locations.

5.4 Sanitary Arrangements

Toilet facilities including wash basins and urinals, where required, should be provided at suitable locations to serve the personnel working inside the dam. Sewerage and wastewater from all these facilities should be collected through a well-laid out system of sanitary drains and carried to a septic tank provided for the purpose. Digestive sludge should be disposed off by sludge pumps. Alternatively, chemical toilets with proper disposal of waste may be provided.

6 COMPRESSED AIR SUPPLY

6.1 Compressed air supply is required in dam galleries for maintenance work such as grouting, flushing of chocked pipes, etc. To meet these requirements, pipes at least 50 mm diameter should be provided. The layout of the pipelines should be such that they do not cause any obstruction to the

normal working inside the dam. Moisture traps should be provided at suitable locations for draining the condensed water.

6.2 Compressed air piping is usually left finished at the entrance of the gallery which is at ground level and has a connection with the approach road. In case of necessity, a portable compressor is brought there and hooked to the piping. Alternatively, compressed air piping may be connected to an independent compressed air system, capable of delivering a minimum pressure of 5.5 kg/cm^2 at the terminal point.

6.3 Compressed air piping should have tappings with valve and suitable hose connections in the galleries, normally spaced 15 m. The tappings on the compressed air and the raw water supply lines may be located side by side to facilitate certain operations.

7 DRAINAGE SYSTEM

For details of the drainage system, reference may be made to IS 10135.

8 FIRE FIGHTING SYSTEM

To meet any eventuality of fire breaking out inside the dam, provision of firefighting equipment should be made in the galleries. For this purpose, fire hose cabinets containing fire hoses, nozzles, and couplings should be provided at suitable places inside the dam. These may be connected to the hose connection point provided in the service water piping in case of need. Particular attention should be paid to this facility in equipment galleries where the chances of fire are relatively higher. In addition, portable fire extinguishers of requisite capacity shall also be provided at suitable places in the galleries.

9 COMMUNICATION SYSTEM

To provide local communication between various parts of the dam and outlying structures and for quick and reliable communication between various personnel working at key points in and around the dam to save considerable time and energy in the operation, maintenance, and repair of equipment installed inside the dam, a suitable communication system shall be provided.

10 ELEVATORS

Elevators of suitable capacities in dams having galleries at various elevations should be provided to cater for personnel and equipment in the dam. For dams below 30 m height, elevators may not be provided.

11 ENTRANCE DOORS

Suitable entrance doors where necessary should be provided at the entrance to the gallery and various other key points for security reasons.

12 FIRST AID

A first-aid facility should be available inside the dam.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Dams and Spillways Sectional Committee, WRD 09

Organization	*Representative(s)*
Central Water Commission, New Delhi	SHRI S. D. SHARMA **(*Chairperson*)**
Bhakra Beas Management Board, Chandigarh	SHRI ARUN KUMAR SIDANA SHRI J. P. SINGH (*Alternate*)
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Member Secretary
SHRI VAIBHAV JINDAL
SCIENTIST 'B'/ASSISTANT DIRECTOR/
(WATER RESOURCES), BIS

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