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Indian Standard

CODE OF PRACTICE FOR IMPROVEMENT OF EXISTING STRUCTURES USED OR INTENDED TO BE USED FOR FOOD GRAIN STORAGE

(Incorporating Amendment Nos.1 & 2)

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Indian Standard

CODE OF PRACTICE FOR IMPROVEMENT OF EXISTING STRUCTURES USED OR INTENDED TO BE USED FOR FOOD GRAIN STORAGE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 6 September 1955, the draft for which was finalized on 31 December 1954 by the Food Grain Storage Sectional Committee.

0.2 Owing to paucity of proper food grain storage structures, the Government and trade organizations store food grain, in an emergency, in any building which they can easily acquire. Such emergencies have frequently arisen in various parts of the country during the last decade, particularly because of the sudden heavy arrivals of food grain at places where it was not possible to construct storage structures at short notice. Furthermore, even if construction of storage structures was possible, it was not undertaken for the simple reason that they might not have permanent utility. Since structures, thus acquired, are not essentially built for the storage of food grain, they lack in many essential requirements for such storage, due to which the food grain stored in them is liable to suffer heavy losses. It is, therefore, obvious that in all acquired storage structures, which are not originally constructed for such purpose but utilized for it, either temporarily or on a long term basis, certain measures should be adopted in order that the desired level of proper conditions both in respect of the surroundings of such structures as well as in their constructional features may be maintained.

0.3 With a view to assisting in the improvement of existing defective food grain storage structures, the preparation of this standard code was taken up at the instance of the Government of India. It is hoped that by observing the various practices detailed in this code, the losses to stored food grain will be minimized to a large extent, which will finally result in not only saving to the storage organizations concerned but also in increasing the food grain supply of the country.

0.4 In addition to this aspect of improvement of existing defective food grain storage structures, the food grain itself has, during handling in transit or storage, to be looked after carefully and in a scientific manner. Likewise, the structures in which food grain is stored have to be of a desired standard. The Bureau of Indian Standards has brought out a series of standards for handling in transit and storage of food grain and also for the construction of food grain storage structure.

IS : 600-1955 CONSTRUCTION OF *Bukhari* TYPE RURAL FOOD GRAIN STORAGE STRUCTURE

IS : 601-1955 CONSTRUCTION OF *Kothar* TYPE RURAL FOOD GRAIN STORAGE STRUCTURE

IS : 602-1955 CONSTRUCTION OF *Morai* TYPE RURAL FOOD GRAIN STORAGE STRUCTURE

*IS : 603- CONSTRUCTION OF *Pev* TYPE RURAL FOOD GRAIN STORAGE STRUCTURE

*IS : 604- CONSTRUCTION OF FOOD GRAIN STORAGE STRUCTURES SUITABLE FOR TRADE AND GOVERNMENT PURPOSES FOR THE NORTHERN REGION

*IS : 605- CONSTRUCTION OF FOOD GRAIN STORAGE STRUCTURES SUITABLE FOR TRADE AND GOVERNMENT PURPOSES FOR THE CENTRAL REGION

IS : 606-1955 CONSTRUCTION OF FOOD GRAIN STORAGE STRUCTURES SUITABLE FOR TRADE AND GOVERNMENT PURPOSES FOR THE EASTERN REGION

IS : 607-1955 CONSTRUCTION OF FOOD GRAIN STORAGE STRUCTURES SUITABLE FOR TRADE AND GOVERNMENT PURPOSES FOR THE SOUTHERN REGION

IS : 608-1955 CONSTRUCTION OF FOOD GRAIN STORAGE STRUCTURES SUITABLE FOR TRADE AND GOVERNMENT PURPOSES FOR THE COASTAL REGION

IS : 609-1955 IMPROVEMENT OF EXISTING STRUCTURES USED OR INTENDED TO BE USED FOR FOOD GRAIN STORAGE

IS : 610-1955 STORAGE OF FOOD GRAIN AND ITS PROTECTION DURING STORAGE

IS : 611-1955 HANDLING OF FOOD GRAIN IN TRANSIT

*IS : 612- RE-CONDITIONING OF PARTIALLY DETERIORATED STORED FOOD GRAIN

*IS : 631- CONSTRUCTION OF PRE-FABRICATED ALUMINIUM FOOD GRAIN STORAGE BIN

0.5 This standard takes due account of the information collected from authoritative sources such as the Directorate of Storage and Inspection, Ministry of Food and Agriculture, and Civil Supplies Departments of various States which are custodians of food grain stored on behalf of the Government. Information has also been collected

*Under preparation.

from various trade agencies associated with the storage of food grain.

0.6 In this standard, particular attention has been paid to the fact that while suggesting methods for improvement of existing defective food grain storage structures, it is not either possible or economically feasible to re-build entirely the whole or part of the storage structure. The various practices given in this standard are, therefore, only of such a nature as could be easily adopted without bringing about any radical change in the storage structure itself. Nevertheless, it is considered that the changes suggested herein, would be adequate to provide sufficient protection to the stored food grain from ravages by insects, dampness or moisture and rats. It may also be mentioned that the intention in prescribing the various practices for improvement and maintenance of each part of the storage structure is to serve as a guide in the selection of such of the practices as may be applicable to the storage structure under consideration.

0.6.1 For easy reference, a classified index is provided at the end of this standard giving relevant clause references pertaining to the various practices embodied in this standard for safeguarding the various parts of the storage structure against the ingress of insects, rats, dampness or moisture and birds.

0.7 It may be added that this is the first co-operative attempt in India for the formulation of this standard, as well as other standards mentioned above, in the field of food grain storage. With the growing popularity of modern methods, it may be necessary to revise this as well as other standards in the series in the light of the experience and technique that may become available hereafter. The Indian Standards Institution will welcome any suggestions or comments as a result of such experience.

0.8 In this standard, it has been assumed that the work of improvement of the defective food grain storage structure, which will mainly be of the nature of repairs, cleaning, levelling of ground, etc, would be done according to the prevailing codes and, therefore, the various engineering practices connected with such work have not been given. However, wherever it has been considered desirable to elaborate any such practices, care has been taken to include such elaboration in this standard.

0.9 This code requires reference to the following Indian Standard Specifications:

IS : 277-1992 GALVANIZED STEEL SHEET (PLAIN AND CORRUGATED) (*Fifth Revision*)

IS : 280-1978 MILD STEEL WIRE FOR GENERAL ENGINEERING PURPOSES (*Third Revision*)

IS : 561-1978 BHC (HCH) DUSTING POWDERS (*Fourth Revision*)

IS : 634-1965 ETHYLENE DICHLORIDE CARBON TETRACHLORIDE MIXTURE (3 : 1 *v/v*) (*Revised*).

0.9.1 Wherever a reference to any Indian Standard Specification mentioned under **0.9** appears in this code of practice, it shall be taken as a reference to the latest version of the specification.

0.10 Metric systems has been adopted in India and all quantities and dimensions in this standard have been given in this system.

0.11 This edition 1.2 incorporates Amendment No. 1 (June 1964) and Amendment No. 2 (January 1996). Side bar indicates modification of the text as the result of incorporation of the amendments.

1. SCOPE

1.1 This standard prescribes the Methods for Improvement of Existing Structures Used or Intended to be Used for Food Grain Storage, both for bag and bulk storage type. It is intended to be chiefly adaptable for Government and trade storage of food grain.

2. ABBREVIATIONS

2.0 For the purpose of this standard, the following abbreviations shall apply.

2.1 BHC — Benzene hexachloride.

2.2 EDCT — Ethylene dichloride carbon tetrachloride mixture in the proportion of 3 : 1.

2.3 FGSS — Food grain storage structure(s), either for bagged food grain or in bulk.

3. GENERAL

3.1 Structures having mud floor or mud walls or thatched roof or those situated near river or sea bottom lands subject to flooding or inundations, shall not be used for the purpose of storage of food grain.

3.2 As far as possible, FGSS shall be at least 15 m (preferably 30 m) away from factories dairies, poultry runs, kilns, cattle pens, styes, slaughter houses, hide curing centres or tanneries, garbage dumping grounds, manure pits, sewage pits and disposal plants, and such other places, the close vicinity of which is deleterious to safe storage of food grain.

3.3 In case of inland FGSS, it shall be ascertained that, as far as possible, there is sufficient off-street parking and manoeuvring space for vehicles.

Likewise, for FGSS situated at ferry heads, docks, etc, care shall be taken to ascertain that sufficient berthing, loading and unloading facilities are available.

4. SITE

4.1 Drainage — The site shall be provided with proper drainage.

4.1.1 All existing pools, ponds and such other low level grounds within a radius of 15 m from the FGSS, where water is likely to accumulate or stagnate, shall be filled up and levelled.

4.1.2 *Drains* — The open drains within a radius of 6 m from the FGSS shall be made of brick or stone masonry or of cement concrete, and shall be plastered smooth. They shall slope towards the natural fall of the ground and shall be connected to an out-fall drain for the ultimate disposal of water.

4.2 Cleanliness — Any garbage, weeds, shrubs and other such things which are likely to have a deleterious effect on the stored food grain shall be removed, and such unhygienic places cleaned up and levelled.

4.2.1 All the branches of trees within a radius of 3 m of the FGSS shall be cut off.

4.2.2 Any lumber or such other articles which may provide either a path-way or jumping ground for the rats so as to enable them to reach the FGSS, shall be removed.

4.3 Rat Burrows — All rat burrows whether inhabited or not by rats in the vicinity of the FGSS or abutting the foundation of the FGSS shall be treated in the manner prescribed in Appendix A.

5. FOUNDATION

5.1 All pits in the ground abutting the foundation shall be levelled, watered, tamped and brought to the surrounding level of the ground.

6. PAVEMENT

6.1 All round the FGSS abutting the plinth, a pavement 150 cm wide and 15 cm thick of either bricks or stone slabs set in lime or cement mortar, or of lime or cement concrete shall be constructed, if such a pavement does not already exist. The bricks or stone slabs of the pavement shall be cement pointed.

6.1.1 The pavement shall slope outside at 1 in 10.

7. PLINTH

7.1 All cracks and crevices in the plinth shall be repaired.

7.2 All rat holes in the plinth shall be closed with cement concrete mixed with small broken glass pieces roughly 6 mm size (about 1.6 kg of glass pieces to 1 m^3 of cement concrete).

8. FLOOR

8.1 It shall be ascertained that the floor is strong and non-yielding and would not transmit dampness to stored food grain due to seepage of ground moisture.

8.1.1 All cracks and crevices in the floor shall be made up. If the floor has sagged at places, these places shall be dug up and re-built so as to bring them in level with the rest of the floor.

8.1.2 All rat holes in the floor shall be closed with cement concrete mixed with small broken glass pieces roughly 6 mm size (about 1.6 kg of glass pieces to 1 m^3 of cement concrete).

8.1.3 If the floor is either not strong and would yield to pressure of stored food grain, or is likely to transmit dampness to stored food grain due to seepage of ground moisture, it shall be re-made in the following manner:

Dig out the floor to a depth of 40 cm and level this dug out surface. Fill the bottom of this excavation with a 10 cm layer of earth consisting of gritty or gravelly soil, water and tamp it hard. Over this, spread a 10 cm thick layer of coarse sand, and again water and tamp it. Next, lay a layer of 15 cm thickness of lime concrete, then a 6 mm thick layer of bitumen, and finally, 44 mm thick layer of cement concrete. (This last layer of cement concrete forms the floor). Lay the floor in alternate panels, not exceeding 3 m × 3 m with their joints filled with mastic. Plaster the floor smooth.

9. WALLS

9.1 All cracks and crevices in the walls or in the plaster of the walls shall be made up.

9.2 The inside surface of the walls shall be plastered smooth with lime or cement plaster.

9.3 The inside edges of the walls and the corners where they meet the floor and the roof or the ceiling shall be rounded off to a radius of at least 50 mm.

9.4 If walls show signs of dampness, the plaster of inside surface of walls shall be removed and a coat of 6 mm thick bitumen applied. The inside surface shall then be re-plastered and the surface rendered smooth.

10. OPENINGS

10.1 Doors — The doors shall be repaired to the extent necessary so that there are no chinks, gaps or spaces in-between the door leaves and also that the leaves fit the frame closely.

10.1.1 If the door leaves are made of timber, their lower portions shall be provided with U shaped 0.63 mm thick, galvanized steel sheets (*see* IS : 277-1992), up to a height of 225 mm from bottom so as to cover both the inner and outer surfaces of door leaves. Also the two edges of the door leaves shall be covered by additional overlapping strips

of galvanized steel sheeting up to a height of 225 mm from the bottom (*see* Fig 1).

10.2 Windows — The windows shall be provided with shutters.

10.2.1 *Shutters* — The shutters for the windows shall be repaired to the extent necessary so as to fill up all chinks, gaps or spaces in them and fit closely.

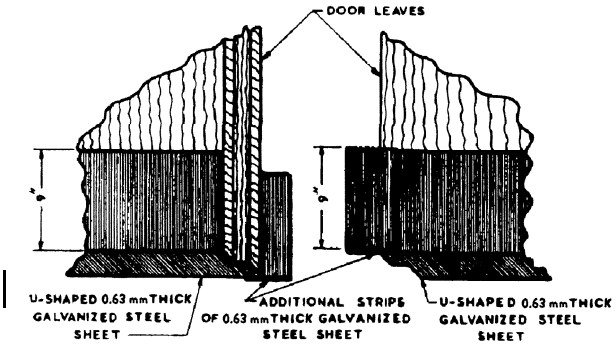

FIG. 1 BOTTOM PORTIONS OF TIMBER DOOR LEAVES

10.2.2 The windows, in addition to the shutters, shall be provided with wire netting of 6 mm mesh made of 0.560 mm thick galvanized mild steel wire (*see* IS : 280-1962).

10.2.3 In case there are no verandahs, the windows shall be provided with sun shades (*chajjas*) on the outer side of the FGSS.

10.2.4 The window sill shall slope outwards.

10.3 Ventilators — The ventilators shall be provided with sun shades (*chajjas*) on the outer side of the FGSS and their sills shall slope outwards.

10.3.1 If the ventilators have no shutters, wire netting of 6 mm mesh made of galvanized mild steel wire of 0.56 mm diameter shall be provided on all the ventilators. If there are shutters, they shall be repaired to the extent necessary, so as to fill up all chinks, gaps or spaces and also to fit closely.

10.4 Manhole — The manhole shall be provided with an iron cover of suitable dimensions so as to fit tightly with its frame and render the opening completely water-tight.

10.4.1 *Cover* — The cover shall be provided with a locking arrangement. The inside surface of the cover shall be provided with a wooden lining.

10.5 Spout — The spout shall be provided with a shutter.

10.5.1 *Shutter* — The shutter when closed, shall be close fitting so as to render the spout air-tight. It shall be provided with a locking arrangement.

11. ROOF

11.1 The roof shall be repaired to the extent necessary, so that there is no leakage or percolation of water through it.

11.1.1 *Gabled Roof* — In case of gabled roof, if there are spaces in between the walls and the roof sheeting, the spaces shall be fitted with wire netting of 6 mm mesh made of galvanized mild steel wire of 0.560 mm diameter. The roof shall project sufficiently outside the walls to prevent rain water coming into the structure.

12. DRAINAGE OF RAIN WATER FROM ROOF

12.1 Adequate provision for drainage of rain water from the roof shall be made. If drain pipes are already built, necessary repairs shall be done to them and they shall be properly secured at the off-take as well as to the walls. Their lower ends shall be cut 1.2 m short above the ground level and shoes for directing the water to fall away from the wall, provided to them. Below each drain pipe, a stone slab of suitable dimensions shall be provided on the ground so that the ground area is not scoured due to the water falling through the drain pipe.

13. DISINFESTATION OF VACANT FGSS

13.1 After the FGSS has been improved upon in the manner prescribed under **12.1** the floor, walls and the underside of the roof (or the ceiling) shall be swept thoroughly clean. It shall then be disinfested by one of the methods prescribed in Appendix B, before taking any food grain inside.

APPENDIX A

(*Clause* 4.3)

METHOD FOR TREATMENT OF RAT BURROWS

A-1. MATERIAL

A-1.1 There are a number of products marketed under different proprietary names which on exposure to atmosphere liberate hydrocyanic acid gas. These products are sealed in air-tight containers. Any one of these proprietary products could be utilized.

A-2. PRECAUTIONS FOR HANDLING THE MATERIAL

A-2.1 *Hydrocyanic acid gas is an extremely dangerous poison and so also the material evolving it. The material shall, therefore, be handled only by skilled hands. Anybody who is not trained or is not confident in handling the material shall not*

attempt to do so. The material shall not be touched with bare hands nor allowed to spill anywhere. When the material is not in use, the lid of the container shall be kept tightly closed and the edges of lid sealed with plasticine. The lid of the container shall never be opened inside a building. When not in use, the container shall be kept under lock and key in the custody of a responsible person. After the use of the material, the hands, spoons and any other article which may have been contaminated with the material shall be thoroughly washed and dried. If any article of food is suspected of having been contaminated with the material, the article shall be buried under the supervision of a responsible person.

A-3. PROCEDURE

A-3.0 Choose a fairly breezy day for the operation. Still days are dangerous and too much wind may interfere with smooth handling of the material.

A-3.1 Thoroughly wash hands and completely dry them. Take a clean dry piece of cloth and tie it round the face so as to cover the nostrils and the mouth but not the eyes. Place the container containing the material (*see* **A-1**), two table spoons and sufficient quantity of freshly prepared mud near the opening of the rat burrow on its leeward side. Sit near the opening of the rat burrow with the face turned towards the windward side. Open the lid of the container, quickly take out a table-spoonful of the material, close the lid of the tin, introduce the powder taken in the spoon into the rat burrow and close the opening of the rat burrow with mud and then plug with a piece of hard stone.

APPENDIX B

(*Clause* 13.1)

METHODS FOR DISINFESTATION OF VACANT FGSS

B-0. GENERAL

B-0.1 Disinfestation of vacant FGSS may be done by any one of the three methods, namely dusting, smoking or fumigation.

B-0.1.1 Dusting can be done of any FGSS, smoking only of those FGSS which can be made reasonably air-tight, while fumigation of only those which can be made perfectly air-tight.

B-0.2 During any one of these three operations, no spectator shall be allowed inside the FGSS.

B-1. DUSTING

B-1.1 Material — BHC dust containing 0.65 percent gamma isomer (*see* IS : 561-1955).

B-l.2 Equipment

B-1.2.1 *Duster* — According to the area to be dusted, a hand bellow duster, a rotary dust blower or a power duster may be used.

B-l.2.2 *Dust Respirator, Mask and an Overall* — Each operator shall be provided with a suitable dust respirator, a mask to protect his eyes from the dust and an overall.

B-1.3 Procedure — Calculate the quantity of the material required to be dusted at the rate of 25 g per 100 cm^2 surface area of the floor, walls and the ceiling and weigh out this quantity. Charge the chamber of the duster according to its capacity from time to time with quantities taken out of the weighed material and work the duster in a manner so that its nozzle is at a reasonable distance from the surface to be dusted and the deposit of the material on the surface is uniform. During the process of dusting of a bag storage structure, keep all the openings such as doors, windows, ventilators, etc, closed, while in case of a bulk storage structure, manhole may be kept open for permitting light.

B-1.4 Precautions — The operators shall wash and dry their hands, neck and other parts of the body likely to be exposed when wearing the over all and the mask, prior to starting the procedure for dusting (*see* **B-l.3**) as well as after it.

B-2. SMOKING

B-2.1 Material — A suitable formulation of BHC which on ignition gives out smoke charged with BHC fumes, may be used. (A number of such formulations are available in the market and contain instructions for their dosage, method of ignition, etc).

B-2.2 Procedure — Close all the openings of the FGSS leaving one open for the operator to come out. Paste strips of gummed paper on, or mud plaster, all the points in the openings from which smoke is likely to escape. Ascertain that barring the one opening left open for the operator to walk out, the FGSS has been made reasonably, air-tight. Take the requisite quantity of the material (*see* **B-2.1**) and put it on a piece of galvanized steel sheet. Place this steel sheet together with the material in the centre of the FGSS. Ignite the material. Wait and ascertain that the material has been well-ignited so that it would not later remain half-burnt, and also that the smoke has started to evolve in copious quantities. After ascertaining these points, leave the FGSS through

the one opening left for the purpose. Close and lock the opening and then mud plaster the chinks in this opening also, ensuring that the smoke may not escape from any point in the structure. Keep the FGSS closed till the following morning.

B-3. FUMIGATION

B-3.1 Fumigant — EDCT (*see* *IS : 634).

B-3.2 Equipment

B-3.2.1 *Gas Mask* (*Canister Respirator*) — Each operator shall be provided with a suitable gas mask. A gas mask of the type given below is considered suitable:

> A face-piece covering the eyes, nose and mouth, connected to a canister containing absorbent material for the vapours of EDCT, by means of a flexible non-kinking breathing tube and arranged with valves so that all air inhaled by the wearer passes through the canister and the exhausted air passes direct to the surrounding atmosphere through a non-return valve. The canister containing the absorbent material should have a warning indicating the number of hours for which it could be used effectively in an atmosphere charged with EDCT vapour.

B-3.2.2 *Buckets* — sufficient number depending upon the quantity of the fumigant to be used (*see* **B-3.4**).

B-3.3 Precautions — Fumigation shall be done under the supervision of an experienced and responsible person and the operators shall be well trained. The operators shall wear gas masks when handling the fumigant (*see* **B-3.1**).

B-3.4 Procedure — Close all the openings of the FGSS, leaving one open for the operators to come out. Paste strips of gummed paper on, or mud plaster, all the points in the openings and in the FGSS from which vapours of the fumigant are likely to escape. Calculate the quantity of the fumigant required for the inside space of the FGSS at the rate of 325 g per 1 m^3. Take out this calculated quantity in suitable number of buckets. Give one bucket to each operator and ask the operators to quickly throw the fumigant on the floor, all the operators working simultaneously. After all the quantity of the fumigant has been thrown on the floor, the operators shall immediately leave the FGSS through the one opening left open for this purpose. Close and lock this opening. *Before locking the opening, ensure that no operator has been left inside the FGSS*. Mud plaster all the possible points of leakage of fumigant vapours in this opening. Put danger labels on the structure at various points with the following minimum cautionary words:

"DANGER — UNDER FUMIGATION"

Ascertain after an hour that no fumigant vapour leaks from any of the points in the FGSS. (If there is leakage from a point, odour like that of chloroform would be perceptible there.) Seal such points with strips of gummed paper or mud plaster. Keep the structure closed for at least 48 hours. After the expiry of this period, unlock the opening by which the operators had left the FGSS after spreading the fumigant, and push or pull it wide open and run away to a distance not less than 15 m from the opening. Keep it open for at least 4 hours. During this 4 hours' period maintain a watch so that nobody is allowed to come within a radius of 15 m from the opening. After the expiry of these 4 hours, let two operators (wearing gas masks) enter the FGSS. They should then open all the other openings. The operators should then leave the FGSS. Keep the FGSS open for a period of another 6 hours. Do not allow any person to enter the FGSS during these 6 hours.

*Under preparation.

CLASSIFIED INDEX FOR CLAUSE REFERENCE

(*Clause* 0.6.1)