SRI LANKA STANDARD 544 : 1981

UDC 631.812

CODE OF PRACTICE FOR HANDLING AND STORAGE OF BAGGED FERTILIZERS

BUREAU OF CEYLON STANDARDS

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SLS 544:1981

Gr. 5

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This Standard does not purport to include all the necessary provisions of a contract.

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FOREWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Bureau of Ceylon Standards on 1981-11-26, after the draft, finalized by the Drafting Committee on Fertilizers, had been approved by the Agricultural and Food Products Divisional Committee.

The storage of fertilizers becomes a problem due to their hygroscopic and/or corrosive nature. This code of practice is intended to provide guidance on the methods for such storage. While the exact practices adopted vary with the nature of fertilizer, the amount to be stored and the climatic conditions, this code of practice defines the factors to be kept in view. Therefore, this is not intended to be adopted *in toto* in all fertilizer godowns; only such considerations as are applicable in a given situation shall be acted upon. This code of practice does not give constructional details and other information for which normal civil engineering practices apply; only such aspects as are special to fertilizer storage are dealt with.

All values in this standard are in SI units.

In the preparation of this standard, valuable assistance derived from related publications of the Indian Standards Institution is gratefully acknowledged.

1 SCOPE

This standard lays down recommended practices to be followed for storage of fertilizers packed in plastic bags or jute bags, with or without a plastics liner.

2 WAREHOUSE STRUCTURE

The construction of the warehouse or storage godown shall be climatically suitable and damp-proof. In godowns having low plinth, mud walls and galvanized iron sheet roofs, the effects of

variation in temperature and humidity of atmosphere are pronounced. Fertilizers should be stored in godowns which can protect them from atmospheric deterioration. At the same time it should be noted that nitrate containing fertilizers when stored in an enclosed space without ventilation may give rise to hazards of explosion and fire if exposed to carbonaceous material. Such warehouses should, therefore, be well ventilated and away from places of fire hazards. Ventilators are also necessary in godowns used for storing fertilizers that give out volatile substances on storage. In view of the above considerations, fertilizer storage structures should be made of concrete, tile or steel. Where the level of sub-soil water is high or there is a chance of local flooding, a plinth of 1 m high shall be used. Decision on plinth height may be made keeping in view the convenience of loading and unloading of bags into trucks or railway wagons. The godowns shall have concrete flooring. Where it is intended to store fertilizers having a corrosive action on concrete, it is desirable to provide a protective coating to the floor with sodium silicate, or linseed oil, or bitumen or some other protective material. However, these protective coatings can be substituted by appropriate dunnage. In spite of all precautions, some of the fertilizer packed in bags bleeds out during handling and storage and this may damage the floor and adjacent portions of walls. It is, therefore, desirable that the floors, and walls up to a height of 0.5 m are coated with bitumen.

3 STORAGE OF HAZARDOUS FERTILIZERS

Fertilizers containing nitrate-nitrogen when stored at high temperatures are capable of decomposition with explosion and fire. It should therefore be ensured that they are stored either in a separate godown from other fertilizers or where it is not possible to do so, to store them in a separate area so that they are reasonably away from any combustible material.

4 MODE OF STACKING

4.1 All bags in a stack should be of uniform size and mass. The contents should be of the same type or grade. An ideal stack when built is stable, perfectly cuboid in shape, having all bags in one plane, with no face of the stack bulging outward or inward at any point.

4.2 Damaged bags

As soon as the bags are received for storage, the damaged bags shall be sorted out and kept separately from the undamaged bags. For this purpose, a damaged bag shall be one from which the contents are bleeding or which is wet or stained by oil, or the contents of which have either caked or are in a flowing condition.

4.3 Haulage alleyway

In arranging stacks of the fertilizer bags, a haulage alleyway of 1.0 m to 1.5 m shall be provided.

4.4 Dunnage

4.4.1 Proper dunnage is essential to protect the packed fertilizer from damage due to moisture and also to protect the floor of the godown from damage by fertilizer. In the absence of dunnage, the bottom layer of bags are subjected to moisture due to seepage from floor. Even if the floors are given damp-proofing treatment to prevent seepage of moisture, some water can condense on the floor from atmosphere on account of the diurnal variation in temperature.

4.4.2 An ideal dunnage is made from wooden crates since it keeps the bags about 100 mm above the floor level and also enables free circulation of air all round the stack. The crate, 1.5 m x 0.6 m is made out of four wooden batons, 1.5 m long, lengthwise and four batons, 0.6 m long, breadthwise, placed equi-distant and then nailed. The batons have a cross-section 60 mm x 60 mm. A layer of matting either above or below the crate is given so that the fertilizer droppings do not come in direct contact with the floor and could be collected appropriately for disposal. Dunnage can also be made of concrete bars with a protective coating of bitumen, so arranged that they provide the necessary support to the bags while leaving enough gap between them and the floor.

4.4.3 An alternative dunnage consists of a sheet of plastics (polyethylene, PVC, etc.) of thickness 75 µm sandwiched between two layers of hessian 305 g/m^2 to 427 g/m^2. The hessian-polythene laminate is prepared to the size of the godown in a single piece with minimum number of joints.

4.4.4 Where it is not found possible to adopt any of the dunnage given in **4.4.2** and **4.4.3**, a dunnage of some locally available material (bamboo matting, paddy husk, paddy straw, etc.) should be given. With these materials, one layer should be spread on the floor, then it shall be overlaid with a sheet of plastics material of 75 µm thickness and on it one more layer of the locally available material should be spread. It may however be noted that organic material like straw and paddy husk are dangerous if nitrate-containing fertilizers are stored; they may also lead to insect infestation.

4.5 Distance of stack from walls and distance between stacks

Both these distances should be not less than 0.6 m.

4.6 Size of stacks

Before the fertilizer stocks are received, a stack plan of the godown should be prepared, dividing the floor area into uniformly sized and serially numbered rectangular bases to build stacks.

Lines, 50 mm thick in white or black paint will serve to mark the boundry of the stack. The size of the stack is a matter of convenience depending upon the area of the godown. The three recommended sizes of stacks are 10 m x 6 m, 6.5 m x 5.5 m and 5.5 m x 4.5 m.

4.7 Arrangement of bags in stack

4.7.1 The stack shall be constructed by cross stacking of bags. That is, the bags in adjacent layers are kept at right angles. If in the first layer the bags are kept lengthwise, then in the layer above it all bags will be laid breadthwise, and so on. However, it should be kept in view that the mouth of all bags should be inside the stack and not the periphery. The cross stacking is advantageous in long term storage due to the marked stability of the stack.

4.7.2 Stack cards indicating the name of the fertilizer, date of receipt and issue when made, number of bags in the stack and other relevant information should be tagged to each stack at a convenient height. Further, each stack shall be provided with a receptacle capable of being closed in which the spillings and droppings may be collected everyday and disposed of suitably.

4.8 Height of stacks

4.8.1 For the purposes of height of stack, fertilizers may be divided into two broad categories. It is desirable hygroscopic or corrosive or explosive fertilizers be stacked to a height not exceeding 4 m while fertilizers other than those falling in this category be stacked to a height not exceeding 5 m.

4.8.2 A classification of the fertilizers based on their characteristics is as follows:

Hygroscopic or corrosive or explosive fertilizers	**Non- hygroscopic or non-corrosive or non-explosive fertilizers**
Ammonium chloride	Ammonium sulphate
	Basic slag
Ammonium phosphate sulphate	Bone meal
Ammonium sulphate nitrate	Diammonium phosphate
Ammonium nitrate	Dicalcium phosphate
Calcium ammonium nitrate	Dolomite
Calcium nitrate	Gypsum
Nitrophosphate	Magnesium sulphate
Potassium nitrate	Monoammonium phosphate
Superphosphate	Potassium chloride
Triple superphosphate	Potassium sulphate
Urea	Rock phosphate (ground)
Urea-diammonium sulphate	Sodium borate
	Thermal phosphate
	Zinc sulphate.

5 AERATION OF GODOWNS

5.1 During periods of high humidity, the ventilators and doors of the godown shall be kept closed. The stacks of hygroscopic fertilizers may also be covered with polythene sheets or tarpaulins or gunny sheets during such periods. But when the humidity of the atmosphere is not high, the doors and ventilators should be kept open and free aeration of the godown should be done.

6 HANDLING

6.1 The use of hooks on fertilizer bags should be avoided when fertilizer is handled.

6.2 The use of gloves and enlarged flap on bags can help labourers to handle fertilizer without hooks.

7 PRECAUTIONS WITH HAZARDOUS FERTILIZERS

7.1 Decomposition

Fertilizers based on ammonium nitrate may decompose slowly at temperature above 130 °C under the influence of fire or heat. In the case of some of these fertilizers, the decomposition stops when the heating stops, but in the case of some others, a slow decomposition reaction may propogate throughout the mass of fertilizer and temperatures between 300 °C and 500 °C may result (self-sustaining decomposition). This decomposition is accompanied with evolution of dense, yellowish-brown, pungent, toxic fumes. Therefore, when fertilizers of this type are stored, the recommendations given in 7.2 shall be observed. Further, if as a result of failure to observe these precautions, a zone of slow decomposition develops, emergency action laid down in 7.3 shall be taken immediately.

7.2 Handling recommendations

7.2.1 Storage buildings and ships holds shall be carefully cleaned before receiving the fertilizer. Coal dust, sulphur, oil, other combustible materials, acids and chemicals shall be kept away from the fertilizer.

7.2.2 In places where fertilizers are stored or handled, there shall be displayed in some conspicuous place a warning notice saying that smoking and the use of fire and naked flames are forbidden.

7.2.3 Care shall be taken not to expose fertilizers to external sources of heat. For example, the fertilizers shall not come into contact with steam pipes (even though insulated), heated oil tanks, hot bulkheads, electric cables, electric motors or lighting equipment, whether fixed or with trailing leads. Fertilizers shall not be exposed to frictional heat from the operation of mechanical equipment (for example, conveyers).

7.2.4 Due caution shall be taken in using vehicles powered by petrol or diesel oil, particularly in regard to spillages of the fuel.

7.2.5 In circumstances in which work may generate heat (for example, cutting, welding, brazing) the fertilizers shall either be removed or efficiently protected from heat (for example, by covering with damp sheets of canvas). Hot welding debris shall not fall into the fertilizers. Further, such work shall be carried out only under continuous expert supervision. After completion of the work, the work-place and its surroundings shall be kept under observation for several hours for development of fire or slow decomposition.

7.2.6 Caked masses shall be broken up by mechanical means only. The use of explosives in the stores shall be forbidden.

7.3 Emergency action

7.3.1 If the zone of decomposition is still small and easily accessible, an attempt may be made to remove it from the main body of the fertilizer by the use of picks and shovels, and to cool it down by localized quenching with water.

7.3.2 When it is impossible to remove the zone of decomposition, the fertilizer involved shall be soaked as rapidly as possible with a large quantity of water directed through high pressure jets against the centre of decomposition. To fight the decomposition by other means (for example, foam, carbon dioxide, steam, covering with sand or fertilizer) is useless, and may even encourage the decomposition.

7.3.3 If there is only a light evolution of fumes, the breathing apparatus used may be such as will give protection against nitrous gases. If fume evolution is heavy, independent breathing apparatus (for example, compressed air masks) shall be employed. Special care shall be taken when entering a ship's hold.

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Printed at SLSI (Printing Unit)

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