



# FERTILIZER PRODUCTS STORAGE INSTRUCTION



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## INTRODUCTION

The storage instruction includes principles on retention and storage of nitrogen fertilizers, which arise from national, European legislation, guidelines of the European Fertilizer Manufacturers Association - Fertilizers Europe and recommendations of the manufacturer. Observance of the principles contained in it and compliance with the guidelines aim at minimizing the risk related to storage of fertilizers with simultaneous maintenance of high quality as well as performance properties (looseness) of products delivered by ANWIL S.A. Detailed data is available at the websites - <http://www.productstewardship.eu/the-program/sales-storage-and-transportation/storage/> and in this instruction, made accessible at the Seller's website: [www.anwil.pl](http://www.anwil.pl) - "Distributor's Zone".

In order to satisfy growing requirements within the scope of offering safe nitrogen products to customers, which at the same time are of the highest quality and effective in use, ANWIL S.A., as a member of Fertilizers Europe, has undertaken to propagate the association's recommendations. The recommendations contained herein aim at providing information the observance of which contributes to minimization of the risk of deterioration of quality and minimization of the risk of fire and decomposition of fertilizers.

The nitrogen fertilizers storage instruction includes obligatory guidelines the non-observance of which results, inter alia, in a loss of the right to guarantee or warranty.

This storage instruction pertains to the principles of storage of the following products:

- **Ammonium nitrate,**
- **CANWIL with magnesium,**
- **CANWIL S with sulphur,**
- **CANWIL Mg-S.**

The major objective of storage of nitrogen fertilizers is to protect products against variable ambient conditions, in particular against changes of temperature and humidity. These conditions are a result of an explicit impact of ambient conditions on the change of qualitative parameters of the product, mainly reflected in a strong tendency of fertilizers to absorb humidity from air (hygroscopicity), which in consequence may lead to a natural phenomenon of granule getting stuck together in bigger agglomerates, so-called natural product wedging. Therefore, compliance with the principles on storage of nitrogen fertilizers is so significant.

# 1. Structure and location of warehouse

- 1.1.** Selection of warehouse location should take account of the following aspects:
- 1.1.1.** An impact of the hazard posed by stored fertilizers on adjacent population centres. Fertilizer warehouses should not be in the vicinity of public utility buildings for which there is a suspicion that it may be considerably difficult to carry out an evacuation and rescue action (e.g. hospitals, schools, kindergartens, nursery schools, etc.)
  - 1.1.2.** Improperly stored fertilizers may be a source of serious contamination of ground and surface waters. As far as possible, fertilizers must be stored at least 10 metres from water channels or drainage ditches and at a considerable distance (e.g. 50 metres) from boreholes, wells, etc. to avoid contamination.
  - 1.1.3.** Protection of a fertilizer against theft and improper use of nitrogen fertilizers.
- 1.2** Structure of a warehouse should ensure free entry to and exit from the warehouse and in case of fire – easy access to emergency and fire-fighting equipment.
- 1.3** In the vicinity of the building there should be a hydrant with fire-fighting water. It is also advisable to have fire extinguishers on the spot, with the reservation that it is necessary to remember that fire extinguishers with chemical agents are ineffective for extinguishing nitrogen fertilizers.
- 1.4** In warehouses where nitrogen fertilizers are stored there is a total ban on smoking, using naked flame. Moreover, it is absolutely necessary to comply with generally binding OHS and fire prevention provisions. In visible places it is necessary to display boards with the inscription: “No smoking”.
- 1.5** A warehouse should properly be ventilated in case of fire or decomposition of fertilizers in order to release heat and smoke .
- 1.6** It is necessary to consider equipping a warehouse with appropriate and solid fire detection systems. They should be chosen based on such factors as quality and type of stored fertilizer, structure of the building and its location, submission to national provisions. Exemplary fire detection systems may include detection of smoke, measurement of temperature, detection of gases (e.g. N<sub>2</sub>O, NO<sub>x</sub> and NH<sub>3</sub>).
- 1.7** It is advisable for fertilizers to be stored on a bed without a basement, located at the ground level .
- 1.8** Construction materials used for building the warehouse should not be flammable. Toxic smokes might be generated from such materials during fire. Wood and other flammable materials should also be avoided too. Laminated wood or wood protected with another fireproof agent may be used in the form of beams provided that there is no direct contact between wooden construction elements of the warehouse and the fertilizer. Additionally, safe storage of fertilizers in warehouses with wooden

construction elements should be confirmed by way of a positive assessment of a fire risk in a given facility. Brick, concrete and steel, properly protected against corrosion, are the best non-flammable materials applicable as construction materials for building the warehouse. A substrate of the warehouse should not be made of flammable materials either. Concrete (preferably without joints or bituminous coating) and highly hardened asphalt (typical class from 6 - 12% of bitumen) are the best materials applicable as a bed of the warehouse

- 1.9** Due to possible reactions of zinc and copper with fertilizers, zinc-plated elements such as: metal sheets, grids or components of ventilation system should be avoided in warehouses .
- 1.10** To avoid accumulation of fertilizer in uncontrolled places and mixing of such a fertilizer with other materials, warehouses should not have an internal sewage system, drainage holes or channels. Any possible sewage system installation must be plugged.
- 1.11** It is advisable to equip the warehouse with sensors for measurement of temperature and air humidity.
- 1.12** It is necessary to take an extremely cautious attitude to equipping warehouses with fixed heating installations. Power supply and electric network (which release heat) should be designed in such a way so that the fertilizer will not be in contact with its elements under any circumstances (especially when the warehouse is full). This also applies to steam networks, pipes with hot water and heaters as well as other sources of heat. The above is also applicable to electric cables which release heat and lighting. Electric heaters cannot be used with bare heating elements. The electric installation must be consistent with provisions and must undergo periodic inspections in accordance with regulations.
- 1.13** The main electric off switches and fuses should be placed outside the warehouse area. Any and all local off switches and cabling inside the warehouse area must be placed in such a way so that they will have no contact with the fertilizer stored.
- 1.14** Due to the fact that particular elements of electric installation generate heat, it is necessary to avoid dust depositing on elements of the electric installation. In particular, it is necessary to pay attention to:
  - 1.14.1** protection of electric devices against corrosion through separation of the electric installation from direct contact with fertilizers;
  - 1.14.2** minimization of use of metal parts, e.g. by using polycarbonates for such devices as: connecting boxes, connecting switches, indicator stations, etc. due to corrosive properties and hygroscopicity of fertilizers;
  - 1.14.3** use of high-class insulations, at least in IP54 standard ;
  - 1.14.4** use of plastic fittings fully closed for lighting, in particular in dusty areas.

- 1.15** Any and all electrical repairs must be carried out immediately .
- 1.16** To avoid contact between the fertilizer and any source of heat, the upper layer of stored fertilizer both placed in piles in packaging and stored in bulk should be at least at a distance of 1 metre from roof, exhaust hood, load-bearing beams, ceiling conveyor (and its load-bearing elements) as well as lighting fittings. Therefore, LED lighting is preferred in warehouses in place of lighting such as traditional bulbs due to lower temperature. All elements of mounted lighting should be made of non-flammable materials. While placing and securing lamps, it is necessary to take into consideration reduced accumulation of dusts. Fulfilment of this condition aims at avoiding contact between the product and e.g. sources of heat (warm room, heat generated as a result of friction) and unintended contamination of fertilizer.
- 1.17** Electric motors, transformers and other electric equipment, both inside the warehouse and any electric equipment linked with the warehouse must have protections against overloading.
- 1.18** If the warehouse is intended for storage of different fertilizers in bulk, it should have partitions.
- 1.19** If there are skylights or windows in the warehouse, they must be covered to avoid a continuous impact of sunlight on the product .
- 1.20** Warehouses should be equipped with a lightning protection system .
- 1.21** With regard to nitrogen fertilizers stored in bulk, also walls to which the fertilizer adheres should be protected against penetration of moisture to the product in a pile.
- 1.22** Access to all warehouse areas, both inside the warehouse and outside, should be permitted solely for authorized persons.
- 1.23** Warehouses where in a given moment loading or unloading is not carried out should be protected and closed.
- 1.24** The while warehouse area should have an identifier of stored materials.
- 1.25** A valid list of stored materials, including the type of fertilizer, its quantity and arrangement in the warehouse, should be available in the warehouse. In each and every case, the foregoing information should be available. Such information may be needed for safety reasons in emergency and in case of fire.
- 1.26** It is necessary to conduct a regular control of the condition of the warehouse and keep order in the warehouse. Any and all waste must be removed quickly, safely and in accordance with applicable provisions.

## 2. Equipment and vehicles used in warehouses

- 2.1 Any and all devices which are in contact with nitrogen fertilizers in the warehouse should not be made of flammable materials.
- 2.2 Special attention must be paid to belt conveyors (type of rubber, oil-resistant properties and their resistance to sustained combustibility) and related protection systems such as: overloading blockade, antistatic protections, alarm, high temperature blockade and drive drum and tightening drum damage blockade.
- 2.3 All machines and devices used warehouses, in particular: intake hoppers, conveyors (belt, bucket, worm, etc.), scoopers, charging hoppers, discharge systems, loaders, containers and other, forming part of the warehouse equipment, cannot have an influence on the change of physical and chemical parameters of the product.
- 2.4 Nitrogen fertilizers should be stored far from any sources of heat, e.g. heating installations, collectors with steam or hot water as well as electric network which emits heat. To avoid potential sources of heat, any and all movable elements of belt conveyor should be cleaned and kept in good condition. Any and all equipment must be protected in particular against leakage of oil which might contaminate the fertilizer.
- 2.5 Equipment and devices in the warehouse should be technically operational. Damaged vehicles, such as e.g. forklift trucks and loaders, with a visible leakage of oil or fuel should not be admitted to work with the fertilizer - such vehicles should be repaired. After the end of loading processes, vehicles must be cleaned, preferably in places that are especially intended for this purpose. Such procedures will allow to protect the product against contact with petrol, oils and lubricants. It is prohibited to park vehicles without supervision of an operator in places of storage.
- 2.6 To ensure cleanness and cleanliness of the warehouse area, vehicles such as forklift trucks and loaders which are not used for loading or unloading fertilizers should be parked outside the warehouse or in its specially separated part, isolated from the fertilizer with a fireproof barrier (e.g. wall).
- 2.7 Vehicles must not be left unattended with their engines running.
- 2.8 It is necessary to pay attention to fumes so that they will not heat fertilizers.
- 2.9 LPG, CNG propelled vehicles or vehicles with electric drive are the preferred type of vehicles. Vehicles cannot be refuelled in the warehouse. Discharged batteries should be charged in a separate place as well.
- 2.10 It is advisable to mark out passageways for vehicles and pedestrians.
- 2.11 Any and all vehicles, forklift trucks, loaders should be equipped with fire extinguishers.

**2.12** If equipment made of plastics is used, such as pipes or containers, it is necessary to take into consideration and protect them against effects of static electricity.



### 3. General principles for storage

- 3.1 Due to low resistance of nitrogen fertilizers to direct impact of weather conditions, in particular to solar radiation, precipitation and changes of temperature, fertilizers should not be stored under shelters, on open storage sites, on open storage sites under canvass hoods or other temporary protections.
- 3.2 Goods cannot be exposed to solar radiation even if they are in the warehouse. The product must be isolated from direct impact of solar radiation in warehouses equipped with windows or having other places through which light falls inside on a permanent basis.
- 3.3 Storage of fertilizers at a temperature below 30°C and air humidity: maximum up to 60% is a warranty of maintenance of high quality of fertilizers, with preservation of their performance properties (looseness).
- 3.4 Loading machines cannot run down the product. This refers both to goods stored in bulk and to goods spilled during handling operations of packed goods. It is also necessary to avoid formation of layers of compact fertilizer on the warehouse floor. With regard to spilled fertilizer or in case of formation of a compact layer of fertilizer on the substrate, it must be definitely separated and removed.
- 3.5 The oldest fertilizer should be given first from the warehouse, in accordance with the FIFO principle (First In, First Out).
- 3.6 In the case of storing goods in bulk, prior to commencement of storage, it is absolutely necessary to clean the surface on which the goods will be stored.
- 3.7 In the case of storing two or more product ranges, goods must be protected against mixing in a durable way. It is always necessary to clean the warehouse surface before filling with fertilizers, in particular during changes in product range of the stored fertilizer.
- 3.8 Prevent fouling of walls, bed and equipment in the warehouse.
- 3.9 It is necessary to avoid fouling of pallets, strings, canvass hoods.

## 4. Storage of fertilizers with other products

- 4.1** In the case of storing nitrogen fertilizers with other materials which are not fertilizers and which are flammable and chemically reactive, it is necessary to take special care. Such materials should be separated from each other by means of a fireproof barrier, appropriately adapted to the quantity and nature of stored substances.
- 4.2** Examples of the aforementioned substances are:
- 4.2.1** Solid and liquid materials (organic suboxides) sensitive to explosive decomposition).
  - 4.2.2** Flammable liquids such as: petrol, fuel oil and other oils and lubricants.
  - 4.2.3** Gas bottles (including those used while welding).
  - 4.2.4** Pesticides based on oils .
  - 4.2.5** Caustic liquids, acids and other reactive substances, such as: chlorides, hypochlorites, chlorinated organic compounds, bleaches, chromates, nitrates, copper and zing salts, permanganates.
  - 4.2.6** Flammable liquid and solid products, such as: sulphur, powdered metals and substances of organic origin, such as: hay, straw, sawdust, crops and animal fodders.
  - 4.2.7** Products, such as: burnt lime and calcium cyanamide which generate heat in the presence of humidity .
  - 4.2.8** Products, such as: cement, lime and other alkaline substances which contribute to generation of ammonia gas from nitrogen fertilizers.
  - 4.2.9** Other products used in agriculture, which in the presence of ammonium nitrate may behave in unpredicted manner, e.g. pesticides, disinfection agents, herbicide agents.
  - 4.2.10** Other fertilizers, in particular non-specified.
- 4.3** Materials which are thermally stable and which do not react with ammonium nitrate may be stored in the same place in which there are nitrogen fertilizers (i.e. DAP, sodium nitrate, limestone flour, nitro-chalk) provided that precautions are taken, allowing to avoid contamination of these products.
- 4.4** Prevent mixing and direct contact of various type of fertilizers.
- 4.5** Prevent mixing and direct contact of the same type of fertilizers coming from different manufacturers.

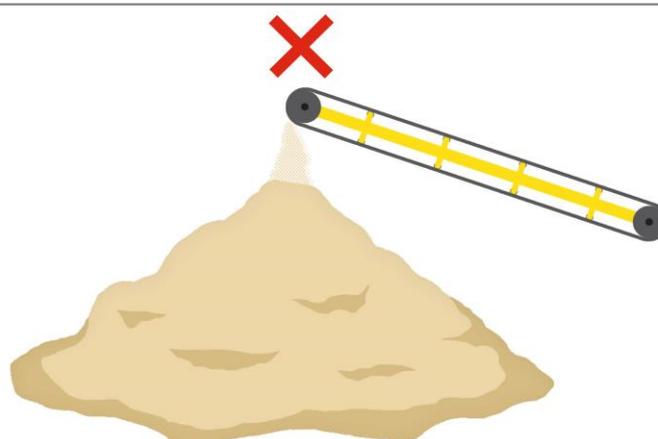
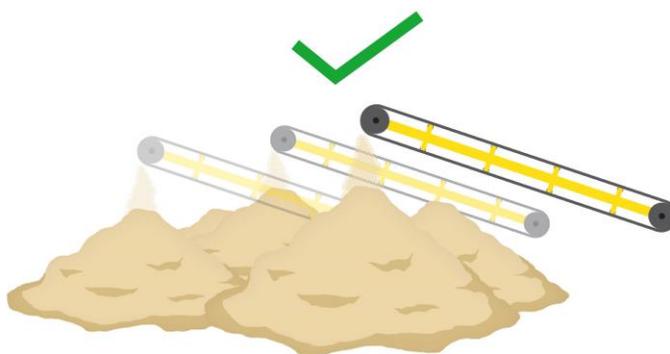
## 5. Storage of fertilizers in packaging: 25 kg, 50 kg and big-bag type

- 5.1** To ensure stability of stored pile, any and all damaged and broken bags must be removed. Fertilizer spilled during these and other similar operations should be immediately swept and safely removed.
- 5.2** Small quantities of spilled fertilizer should be swept and properly marked. Do not mix spills with other fertilizers, in particular with other substances and chemicals used in agriculture.
- 5.3** During transportation of stored pile of fertilizer, e.g. by forklift truck, it is necessary to pay attention to the fact whether the transported pile of fertilizers will not catch against equipment and construction elements of the warehouse, such as lighting or upper door beam.
- 5.4** A pile of packed fertilizers should be laid in such a way so that there will be a passage along one side of each pile. This passage should be wide enough to enable access for unloading vehicles, in particular in case of emergency.
- 5.5** Different types of fertilizer should not be stored in one pile. A fortiori, fertilizers should not be stored with other materials which are not fertilizers in the same pile.
- 5.6** During storage of different types of fertilizers with other materials which are not fertilizers in adjacent piles, it is necessary to check whether there will be a reaction between the stored materials.
- 5.7** To avoid damaging bags during any and all operations carried out in the warehouse, it is necessary to ensure an appropriate distance between the stored piles or to adapt length of forklift truck's forks in such a way as not to damage the bags in adjacent rows of piles with the fertilizer.
- 5.8** Pallets made of wood, plastic or steel are appropriate provided that they are sufficiently resistant to predicted loading. Empty pallets and plastic packaging should be stored in a place that is appropriately intended for this purpose, far from fertilizers. Damaged pallets should not be used. Pallets used for fertilizers should be checked in terms of cleanness and cleanliness and, if necessary, they should be cleaned before use.
- 5.9** In particular, you must not do the following in the warehouse:
- 5.9.1** Use hooks for carriage of bags unless they have been designed especially for this purpose.
- 5.9.2** Use ropes for carriage of bags.

- 5.9.3** Drop unit packaging with fertilizer from big heights (bigger than 1 metre).
- 5.9.4** Carry bags if not necessary.
- 5.10** Do not store fertilizers with oxidizing properties (UN2067) with fertilizers which sustain combustion (UN2071) in the same warehouse. If they are stored after all in the same warehouse, it is necessary to determine strict procedures the observance of which will ensure their effective separation, in particular in case of fire or decomposition.
- 5.11** Fertilizer in 25 kg packaging must be stored in piles composed of maximum 16 layers of bags.
- 5.12** Fertilizer in 50 kg packaging must be stored in piles composed of maximum 12 layers of bags.
- 5.13** Big-bags with fertilizer with weight of up to 500 kg and products in 25 and 50 kg bags stored on pallets must be stored in maximum 2 layers of loading units. Big-bags with weight of above 500 kg must be stored in one layer.
- 5.14** The distance from warehouse walls should be at least 0.2 metre and from heating devices - at least 1.5 metres.
- 5.15** Gaps between piles of ammonium nitrate must be at least one metre.
- 5.16** Fertilizer stored in a pile should be placed in a stable way (it should not slope or fall over).
- 5.17** Damaged bags must be protected against spillage of goods and must be stored separately.
- 5.18** With regard to ammonium nitrate in one pile, do not store more than 300 tons. In rooms where a bigger quantity of saltpetre is stored, piles of packaging must be separated at least by one-metre corridors. The pile is understood as loading units (big-bags or bags on pallets) adhering to each other.
- 5.19** **NOTE!** Ammonium nitrate is a non-flammable product, whereas it has strong explosive properties. The temperature at which an explosive reaction starts is 180 °C. This product must be definitely isolated from sources of fire.
- 5.20** Ammonium nitrate is a hazardous product within the meaning of the Act on the carriage of hazardous goods. This product can be transported, handled and stored solely under the principles specified in the Act on fertilizers and fertilization of 10 July 2007 (OJ 2020.796 consolidated text) and the Act of 19 August 2011 on the carriage of hazardous goods (OJ 2011 No 227 item 1367).

## 6. Storage of fertilizers in bulk

- 6.1** Nitrogen fertilizers, except ammonium nitrate, can be stored in bulk in piles and open boxes. Due to the fact that the products are hygroscopic, they must be absolutely protected against absorption of moisture from the environs, e.g. by covering the fertilizer with a waterproof material (e.g. polyethylene foil or canvass hood). Fertilizers should be covered immediately after heaping up a pile. Protection against absorption of humidity from the environs can be ensured also by applying the air conditioning system. Doors in the warehouse in which the material is stored in bulk should be closed as often as possible.
- 6.2** Fertilizers consist of particles of various size. Smaller and bigger particles have the tendency to split during motion or shakes. This phenomenon may take place at several stages of distribution, especially when the material is laid in large piles. Smaller particles will concentrate inside the pile. Granules of the fertilizer which undergo long-lasting pressure are glued into bigger agglomerates. It is advisable to heap bigger quantities of smaller heaps, thanks to which they will be mixed well afterwards during the loading process. Recommended prism height up to a maximum of 3 meters.



- 6.3** During storage of fertilizers in bulk in piles or in open boxes:

- 6.3.1 warehouse area may be divided into smaller boxes in suitable shape and dimension.
- 6.3.2 It is necessary to avoid contamination of fertilizer stored in bulk with other type of fertilizer. Any and all spillages must be immediately separated.
- 6.3.3 Reduce the use of lamps with mains power. Any and all portable lamps should be in a glass shield and a wire frame and should not be covered with a layer of fertilizer. Lamps with battery power are the preferred type of lamps.
- 6.3.4 Any and all spillages made as a result of operations in the warehouse should be swept and safely removed. It is significant for main and side passageways to adjacent piles of fertilizers to be clean.
- 6.4 Loaders and other self-propelled equipment must be stored outside the warehouse or in such a place so that fire will not be carried to piles of stored fertilizer during fire of such a device.
- 6.5 During storage of different types of fertilizers and other products, not being fertilizers, in the same warehouse, they should be separated well to avoid mutual contamination.
- 6.6 **DO NOT USE ANY EXPLOSIVE MATERIALS** to restore looseness of fertilizer (in particular stored in bulk)!

## 7. Storage of fertilizers in closed containers of silo type

- 7.1 Silos should be made of plastics resistant to UV radiation (e.g. polyesters), steel or other proper materials. In the case of using plastics, it is necessary to pay attention to consequences of static electricity.
- 7.2 Silos should be appropriately selected for predicted loading and installed at the ground level in such a way as to ensure free access for vehicles while loading and unloading.
- 7.3 Structure of silos should make it possible to empty it completely before loading a new batch of fertilizer as well as it should ensure that stored fertilizer will not absorb moisture from outside and will make it impossible to contaminate it with other materials.
- 7.4 Silos should be outside buildings, at a safe distance from any flammable materials.
- 7.5 A silo should be additionally equipped with ventilation to avoid crushing due to underpressure formed inside it while unloading (implosion) as well as to discharge excess air accumulated in it while filling. Moreover, ventilation is used for discharging gases generated during fire.
- 7.6 More than one fertilizer cannot be in a silo at the same time. A silo may be used for storage of other products only after being cleaned beforehand.

## 8. Final remarks

- 8.1** The warehouses which are suitable to store nitrogen fertilizers, including to conduct unloading processes of fertilizers delivered by rail or by car, storage and loading processes are considered those which correspond with the aforementioned conditions and have an appropriate set of machinery and equipment for receiving and giving fertilizers.
- 8.2** Storage of fertilizers inconsistently with the conditions indicated above in particular pertaining to temperature, humidity and height of piles and heaps gives rise to the risk of change of properties of granules, which in consequence may lead to loss of looseness and to the necessity to use mechanical procedures aimed at restoring looseness of fertilizer.
- 8.3** If despite observance of the foregoing instructions the product has been degraded, which resulted in formation of excessive amount of dust or durable, irreversible lumpiness, such a product must be immediately separated and the supplier must be immediately informed about this fact.