





SOLKANE® Foaming Agents IXOL® Polyols

Transport – Packaging – Storage

Content

1.	General information	3
1.1.	General safety aspects	3
1.2.	Product characteristics	4
2.	Bulk and packaged goods	5
2.1.	Packaged goods	5
2.2.	Characteristics	6
2.3.	Bulk goods	7
3.	Connections	7
4.	Handling of packed goods	8
4.1.	Storage	8
4.2.	Overheating	8
4.3.	Corrosion protection	8
4.4.	Handling instructions	8
4.5.	Moving and lifting	8
5.	Guidelines for bulk storage of SOLKANE® foaming agent	9
5.1.	Storage tank	9
5.2.	Equipment	9
5.3.	Examples of storage facilities and unloading operations	. 10
6.	Unloading procedure for bulk deliveries	. 12
6.1.	Responsibilities and safety precautions	. 12
6.2.	Unloading operation	. 13

1. General Information

This brochure provides information on the characteristics, the handling and the transport of SOLKANE® foaming agents and IXOL® Polyols. Furthermore it provides information with respect to emission free bulk supply in ISO Tank Containers (ITC) and road tankers for SOLKANE® 365mfc and blends.

This information provided is not intended to replace existing standard operating procedures and can not cover every scenario. We would like to advise you to contact our technical service team in case of any additional questions.

SOLKANE[®] foam agents and IXOL[®] Polyols must be stored and disposed of in compliance with relevant laws and regulations.

Please consult our safety data sheet (SDS) for detailed information on the chemical. Specific chemical handling and storage precautions will be outlined in the SDS. The SDS will also have specifications for appropriate personal protective equipment for worker protection.

1.1. General safety aspects

Handling - Safety equipment:

The contents of opened vessels may escape in a liquid or gaseous form. The higher the vessel pressure, the more violent this process becomes.

Eye protection

Chemical resistant goggles must be worn when handling SOLKANE[®] foaming agents and IXOL[®] polyols.

Hand protection

SOLKANE[®] foaming agents and IXOL[®] polyols dissolve grease and oil. If they come into contact with the skin, they make the contact area sensitive to cold and infection. Suitable safety gloves such as those made from PVA (poly-vinyl alcohol) will provide adequate protection.

Skin protection

Heat is extracted from the environment in order to evaporate the liquid material. If the Foaming Agent comes into contact with skin, this process can cause local freezing such as frostbite. This is particularly critical when handling SOLKANE® foaming agents with low evaporation temperatures. Skin contact with pressurized liquids material must therefore be avoided.

Breathing protection

Appropriate exhaust ventilation systems must be in place to comply with the occupational exposure limits. When workers are exposed to concentrations above the exposure limit they must use appropriate certified respirators.

1.2. Product characteristics

1.2.1. SOLKANE® foaming blowing agents

SOLKANE® foaming agents consist of SOLKANE® 365mfc and blends, i.e. with SOLKANE® 227ea. Please consult our documentation "SOLKANE® 365mfc and SOLKANE® 365/227: Flammability characteristics and handling".

1.2.2. SOLKANE® 365

SOLKANE® 365mfc is a hydrofluorocarbon. It is a colorless, volatile liquid with faintly etherlike odor. SOLKANE® 365mfc is a highly flammable liquid and vapor with a flash point below -27 °C. (DIN 51755 Part 2). The flammability limits at room temperature and at atmospheric pressure are:

Lower flammability limit (LFL) 3.6 % by volume in dry air Upper flammability limit (UFL) 13.3 % by volume in dry air

Although SOLKANE[®] 365mfc is flammable, the minimum required ignition energy is quite high. Low energy ignition sources such as electrostatic charge could not ignite the material.

It is easy to eliminate the flammability properties by blending with non flammables com-pounds such as SOLKANE[®] 134a, SOLKANE[®] 227ea and also HFC 245fa.

Transport Information

UN number	1993
Class	3
Packing group	II

1.2.3. SOLKANE® 365/227 93/7 and SOLKANE® 365/227 87/13

SOLKANE[®] 365/227 93/7 and SOLKANE[®] 365mfc/227 87/13 are colorless, volatile and non-flammable liquids with faintly etherlike odor. Although the blend SOLKANE[®] 365/227 has no flash point, it has flammability limits in air. The flammability limits at room temperature and at atmospheric pressure are:

Lower flammability limit (LFL) 3.6 % by volume in dry air Upper flammability limit (UFL) 13.3 % by volume in dry air

Due to its non azeotropic character, the difference in boiling points and the non-flammable component i.e. SOLKANE[®] 227 is highly volatile, the blend might become flammable if significant fractionation is allowed to take place.

Transport Information

UN number	Not regulated
Class	Not regulated
Packing group	Not regulated

1.2.4. IXOL® M125 and IXOL® B251 polyols

IXOL[®] products are viscous liquids. Chemically they belong to halogenated polyether polyols. They are non corrosive under normal conditions up to 50°C. Due to their hygroscopic charac-ter the containers should be kept closed when not in use.

Transport Information

UN number	Not regulated
Class	Not regulated
Packing group	Not regulated

2. Bulk and Packaged Goods

SOLKANE[®] foaming agents and IXOL[®] Polyols are transported in approved and marked vessels such as drums, IBC's, road tankers (RTC) and ISO tank containers (ITC).

2.1. Packaged goods

2.1.1. One way drums

Our products are transported in approved and marked drums. The drums have two screwed openings of 2" for the liquid phase and ¾" for the gas phase taps. The customer is responsible for the disposal of the used drums.

2.1.2. Intermediate Bulk Container (IBC)

IBC's are used for IXOL[®] polyols only. These standard containers have a top opening DN 225 and a bottom valve DN 80. The customer is responsible for the disposal of the used Intermediate Bulk Container (IBC).

2.1.3 Pallets

The maximum recommended strength for the pallets is 1,200 kg. One way drums are strapped on heat treated CP3 pallets (I x w x h) 114 x 114 x 15 cm with a weight of 23 kg.

2.2. Characteristics

Maximum weights, approx. [kg]

Product	Drums in Full Container Load (palletized)	Drums in Truck (palletized)	IBC in Free Con- tainer Load (palletized)	IBC in Truck (palletized)	RTC	ІТС
SOLKANE [®] 365mfc	80 x 240	80 x 240	-	-	24,000	20,000
SOLKANE [®] 365/227	80 x 240	80 x 240	-	-	24,000	23,000
IXOL [®] B251	80 x 300	80 x 300	13 x 1,500	15 x 1,500	24,000	-
IXOL [®] M125	80 x 300	80 x 300	13 x 1,500	15 x 1,500	24,000	-

Tare weights, circa [kg]

Product	Drum	IBC	ІТС
SOLKANE [®] 365mfc	25.5	-	3,600-4,500
SOLKANE [®] 365/227	25.5	-	3,600-4,500
IXOL [®] B251	18.5	60	-
IXOL [®] M125	18.5	60	_

Packaging size [mm]

Product	Drum	IBC	ПС
Height	895	1,160	2,591
Length	-	1,200	6,058
Diameter	587	1,000	-

2.3. Bulk goods

2.3.1. ISO-Tank Containers (ITC)

All ITC for transportation of SOLKANE® foaming agents are equipped with Dry Disconnect Coupling DN 50 (male connector) for the liquid filling line and DN 40 (male connector) for the gas phase line. The discharging unit of ITC does not contain any offloading pump or connecting hoses.

2.3.2. Road Tankers

There are two types of road tankers transporting SOLKANE® foam blowing agents and IXOL® Polyols with different connections.

Road tankers for SOLKANE[®] 365mfc and blends are equipped with a hydraulic pump. Road tank cars are equipped with hoses with Dry Disconnect Coupling DN 50 (male connector) for the filling line and DN 40 (male connector) for the gas phase line.



3. Connections

Besides the liquid filling line, a gas phase line is needed to avoid emissions and changes in composition of our product during unloading. This gas phase line is equipped with a dry coupling device to limit any mishandling. During filling operation vapors are taken over from the customer's tank and will be fed back to the transport tank. The open ends of the connections are closed with dry coupling devices (female connector). Dust covers are provided to protect the fittings from dust, dirt etc.



*ISO-Container on trailer can be supplied on a chassis equipped with unloading pump.

4. Handling of Packed Goods

We recommend the following guidelines for SOLKANE[®] foaming agents and IXOL[®] Polyols supplied in marked drums and IBC's.

4.1. Storage

Containers should be properly secured at all times to prevent tipping, falling or rolling. The goods should be located in a storage area, where the containers will not be knocked over or damaged by falling objects.

Store SOLKANE[®] containers in a cool, dry, well-ventilated, fire-resistant area, in accordance with government and company regulations. Store IXOL[®] containers in well-ventilated place, in accordance with government and company regulations.

4.2. Overheating

In order to prevent potential hazards, the pressure vessel legislation stipulates that vessels must not be heated to a temperature of above 50°C (25°C for SOLKANE® 365-blends). Before opening a drum with SOLKANE® 365mfc or its blends the drum must be cooled down to belowboiling temperature to avoid over boiling.

Heating of vessels using a naked flame is not permitted. Local overheating can cause micro structural changes in the vessel material and may also cause the material to decompose. Even if there are no signs of external damage to the vessel when this has occurred, the vessel must not be refilled.

4.3. Corrosion protection

Empty vessels must be sealed in order to prevent moisture and dirt from entering. Moisture causes corrosion in containers. The resulting rust may weaken the walls of the container. Corrosion and dirt particles from the vessels can also cause faults in succeeding use.

4.4. Handling instructions

- 1. Carry out industrial operations in closed piping circuits and equipment.
- 2. Operate in a well-ventilated area.
- 3. Prevent product from contacting hot spots (shower of sparks from gem cutters, sparks from welding, naked flames or hot surfaces and electrical arcs). We strongly recommend nitrogen padding for tanks, vessels etc. Pump unloading is a common used unloading method for drums (ex-proof drum pump). Rigid piping may be used. It is recommended to use fixed dry connections where ever possible to eliminate/minimize the risk of spills/exposure.

4.5. Moving and lifting

- 1. Be sure to close all valves and connections when not in use.
- 2. Ensure that all containers are transported in that way, that they do not tip, fall or roll.
- 3. All connections should be removed and valve protection caps should be secured in place before moving containers.
- 4. Appropriate lifting devices, such as cradles or forklift, must be used.

5.1. Storage tank

5.1.1. Capacity

The tank capacity should be adequate to carry a sufficiently large stock and be able to receive the total amount of volume from the road tanker. If the consumption is less than 50 tons per month, the ideal storage capacity should be at least 1.5 x the volume of the road tanker. This should be suitably adapted if the consumption is higher than 50 tons per month.

5.1.2. Storage tank labeling

The storage tank should be labeled with the product name, the safety symbols, and the tank identification.

5.1.3. Materials

We recommend using a steel storage tank. However in some cases (extreme cold or hot climate) other adapted materials should be used. The tank must tolerate 100% vacuum when it is commissioned and pressure when the tank is filled with product. The following list shows pressure values at 20 and 50 °C.

Parameter	Unit		SOLKANE® 365/227 93/07	SOLKANE® 365/227 87/13
Specific gravity (at 20 °C)	kg / dm³	1.27	1.28	1.29
Pressure (at 20 °C)	bar	0.43	0.69	0.88
Pressure (at 50 °C)	bar	1.38	1.91	2.32

The tank and all other equipment must be in compliance with relevant laws and regulations. If storage tank was previously used for SOLKANE[®] 141b, it should be adequate to receive SOLKANE[®] 365mfc or blends. Please check the tank supplier specifications beforehand.

5.2. Equipment

5.2.1 Valves

Ball valves doubled sealed or valves with bellows are suitable. Valves should be designed fire safe and support pressure.

5.2.2. Pumps

Side channel pumps with NPSH suction stage, with magnetic coupling, Rotary Vane Pump, Membrane Pump or Canned-motor pump or comparable Note: our road tankers are equipped with hydraulic pump for unloading operation.

5.2.3. Gaskets

All equipment should be sealed by using double gaskets. We recommend the following materials: Polytetrafluoroethylene (PTFE).

5.2.4 Hoses

Unloading hoses should be equipped with dry coupling. The connector of the customer's filling line should be equipped with Dry Disconnect Coupling DN 50 (female connector).

5.2.5 Electrical installation

Ex-proof condition should be applied around the entire storage facility.

5.2.5 Vapor return line

The vapor return line ensures a closed system for emptying road tankers or ISO Containers.

5.3. Examples of storage facilities and unloading operations for ITC and for Road Tanker

5.3.1. Storage and unloading of SOLKANE® 365/227 by road tanker



5.3.2. Storage and unloading of SOLKANE® 365/227 by ITC



5.3.3. Storage and unloading of SOLKANE® 365mfc by ITC



Description

- 1. Flexible hose, filling line
- 2. Flexible hose, gas phase
- 3. Transfer pump (to end use)
- 4. Unloading pump from customer (ITC delivery)
- 5. Level indicator
- 6. High level alarm: to avoid overflow and in the case of unloading with pump to switch off.
- 7. Low level alarm: to avoid cavitations and to switch off pump to the end-use.
- 8. Inspection glass: to witness the unloading process and the moment the container is fully emptied.
- 9. Dirt trap: to enhance the safety and the lifetime of the transfer pump in case of solid particles would be released from the storage tank or other equipment.
- 10. Safety valve
- 11. Manometer
- 12. Shuttle valve: to switch of safety valve if one of both should be removed for maintenance. By doing so, the storage tank could be kept in operation.
- 13. Bund or collecting basin should be designed for at least 110% of the volume of the storage tank.

- 14. Ex-proof motor
- 15. Gas warning system
- 16. To the end use
- 17. Overflow line: loop line back to the storage tank with a overflow valve if flow exceeds to the end use
- 18. Spring-loaded valve.
- 19. Non-return valve.
- 20. Excess flow valves are integrated in the bottom valve of the tanker or ITC. The primry purpose of an excess flow valve is to protect against excessive flow in case of a rupture, of hose or pipe. When we refer to breakage or rupture, a clean and complete separation is assumed. If the damage is only a crack or if the piping is crushed at the point of failure, the escaping flow will be restricted and may or many not pass sufficient vapour or liquid to cause the excess flow valve to close. An excess flow valve, while in its normal open position, permits the flow of liquid or gas in either direction. The flow is controlled in one direction only. If the flow in that direction exceeds a predetermined rate, the vale automatically closes. The flow rate should be ranging from 5 to 7 m3/h.

6. Unloading procedure for bulk deliveries

6.1 Responsibilities and safety precautions

6.1.1. Responsibility

- The carrier is responsible for ensuring that the tanker and discharge pump are in perfect condition. All work on the road tanker (fitting of hoses, operation of the discharge pump) is carried out by the tanker driver as his responsibility.
- The tank operator is responsible for ensuring that the storage tank is in proper condition. All work on the storage tank, including operation of the valves and level monitoring, is carried out by the tank operator or by his authorized representative.
- The unloading operations are followed by the customer representative.
- Work of any kind carried out by tanker personnel on the tank installation is at the responsibility of the tank operator.

6.1.2. Safety Precautions

- All personnel engaged in road tanker emptying operations should wear safety helmet, protective goggles and gloves.
- The tank operator or his authorized representative should check whether the tanker has been filled with the correct SOLKANE[®] foaming agent or IXOL[®] polyol type and whether there is sufficient space in the storage tank to accommodate the amount being supplied.
- Once completed the representative should show the tanker driver the connections for the liquid and vapor balance lines. If several tanks are grouped together, the connections must be clearly marked. When fitting on the hoses, special care must be taken to ensure that they are connected to the right storage tank.
- The product should only be filled into pressure vessels which are of approved design for the officially specified operating pressure and have been inspected for this purpose by the relevant supervising authority.
- The level indicator system must be observed by the tank operator, during the whole discharging process. The driver must follow the orders of the tank operator concerning the level indicator system.
- The load-bearing capacity of the access road to the storage tank must correspond to the total weight and maximum axle loading.
- Unloading site should be adequately lit and easily accessible.

Solvay offers and recommends an optimized and environmentally friendly delivery system ("FRED") which was developed to help eliminating SOLKANE® foaming agent losses during discharging operations. The general description of this new system, which avoids emitting SOLKANE® foaming agent, is given by figure 6 A,B,C. Main difference of "FRED" come from replacing former flange couplings with emission free dry couplings. This system offers economic and ecologic benefits as no product is lost and fast unloading with maximum quality standard is guaranteed.

Please check the "Guidelines for the safe loading & unloading of road freight vehicles" document issued by CEFIC http://www.cefic.org/ – Publications – Transport and Logistics.

6.2. Unloading operation

Figure A: Normal tank operation

The open ends of the connection of the filling line are closed with one part of the couplings (the female half – inline with handle or a hand wheel), which are protected with dust caps. Vapor phase (1) and liquid filling (2) valves are closed; the manual bypass valve (3) is opened. The self sealing couplings are stored orderly (e.g. on a rack).



Customers storage tank - equipped with the female part of the dry couplings

Figure B: Delivery system

On road tanker arrival, parking brakes should be set and wheels should be blocked. The delivery system (as shown for a Solvay road tank car in figure B) is equipped with the male half (adapter) with a crown. Also this part of the coupling is protected with dust caps. Liquid (4) and vapor (5) valves of the Solvay road tank car are closed.



Figure C: Procedure during foaming agent delivery

The dust caps are removed from all parts of the couplings. The female parts of the couplings on the liquid filling and the vapor phase are threaded to the appropriate male parts on the hose of the road tanker. The driver shall ensure that the tanker-coupling connections have been properly made.

The tank operator closes the manual bypass valve (3). The tank operator slowly opens the vapor phase line valve 1 and liquid fill line valve 2 on the storage tank. The operator instructs the driver to begin discharge. The road tanker driver checks the pressure of the transport tank (should be less than 1 bar above atmosphere). The driver should observe the connections.

The road tanker driver slowly opens the liquid filling and vapours phase line valves 4 and 5. The SOLKANE[®] foaming agent is now pumped into the storage tank. If, for any reason, it is necessary to suspend the discharge, the operator must clearly instruct the driver when he can restart the pumping process.



Finishing unloading:

When the delivery is finished, the pump is turned off. The vapor phase and liquid filling valves 4 and 5 on the road tank car are closed. The vapor balance line valve 1 and liquid fill line valve 2 on the storage tank are closed, the manual bypass is opened.

The female parts of the couplings on the liquid and the vapor are disconnected from the male parts on the hose of the road tanker, are protected again with the dust caps, and are stored orderly.

The customer should sign the delivery note upon completion of delivery. In some countries (e.g. Spain), the customer is responsible to give an empty outbound when the road tanker is leav-ing without being cleaned.



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