SEKISUI

Bulk Handling Guidelines

SELVOL™
POLYVINYL ALCOHOL

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About the Company

The Sekisui Chemical Group is a global company that operates in three major businesses: High Performance Plastics, Urban Infrastructure and Environmental Products, and Housing. Founded in 1947 and currently headquartered in Osaka and Tokyo, Japan, Sekisui strives to deliver a wide range of products and services to enrich people's lives and the social infrastructure.


Architectural Glass


Urban Intrastructure and Environmental Product

Our Promise

Through prominence in technology and quality, Sekisui Chemical Group will contribute to improving the lives of the people of the world and the Earth's environment, by continuing to open up new frontiers in residential and social infrastructure creation and chemical solutions.


Housing

Sekisui Specialty Chemicals

Sekisui produces and sells one of the most complete lines of polyvinyl alcohol in the world. Since the introduction of Selvol Polyvinyl Alcohol, we have developed a high level of expertise in both the production and use of PVOH.

Based in Dallas, Texas, Sekisui Specialty Chemicals is a leading polyvinyl alcohol supplier with manufacturing facilities in Calvert City, Kentucky, Pasadena, Texas and Tarragona, Spain. The combined capacity of the three plants makes Sekisui a leading global merchant supplier of polyvinyl alcohol.

Sekisui's commitment to polyvinyl alcohol is especially evident in our research and applications support activities. We have one of the largest technical services, product application, and analytical services groups in the world. Research and application development is carried out at our facilities in Houston, Texas. Sekisui also has a global sales force located in offices worldwide to respond more quickly to the needs of our customers.

SELVOL™ POLYVINYL ALCOHOL

Introduction

This brochure will give customers an introduction to unloading methods, product storage and safety considerations for railcar and trucks. This brochure is specifically designed for materials managers, safety engineers, plant managers, loading dock personnel and individuals involved in handling Selvol Polyvinyl Alcohol in bulk. It should be noted that the instructions that follow are provided as guidelines only. Specific unloading and storage situations will differ from customer to customer. For more detailed information on specific applications, the preparation of polyvinyl alcohol solutions, please refer to our other brochures, visit our website at www.selvol.com, or call our Product Information Center at +1-281-280-3460.

Environmental, Health, and Safety

Please refer to our Material Safety Data Sheets (MSDSs) or Safety Data Sheets (SDSs) for information on the safe use and handling of Selvol Polyvinyl Alcohol, including toxicity, fire, and explosion hazards, as well as environmental effects. An MSDS can be obtained online at www.selvol.com.

FDA Compliance

Polyvinyl alcohol is used in many food contact applications, including food packaging adhesives and coatings for paper and paperboard. For more specific information on the FDA status of any of our grades, please contact our Product Information Center at +1-281-280-3460.

TABLE 1:
Selvol Polyvinyl Alcohol Right-to-Know Information

Ingredient	CAS Number
Selvol Polyvinyl Alcohol • Super and Fully Hydrolyzed • Partially and Intermediate Hydrolyzed	 9002-89-5 25213-24-5
Water	7732-18-5
Methanol	67-56-1
Sodium Acetate	127-09-3

Selvol Polyvinyl Alcohol

Selvol Polyvinyl Alcohol is a white, granular, water-soluble resin manufactured by polymerizing vinyl acetate and hydrolyzing the resultant polymer to produce the alcohol (Figure 1).

Because PVOH is synthesized from polyvinyl acetate, a variety of different grades of Selvol Polyvinyl Alcohol is available that varies in molecular weight and hydrolysis level. These two factors are the major determinants of the performance properties of PVOH.

FIGURE 1:
General Structure of Polyvinyl Alcohol

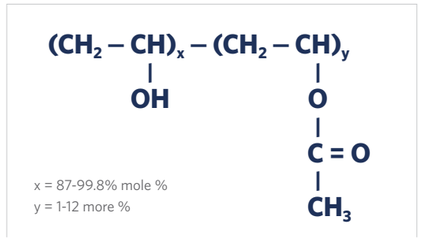


TABLE 2:
Selvol Polyvinyl Alcohol Molecular Weight

Viscosity[1] (cP)	Viscosity Type	Degree of Polymerization	Average Weight Molecular Weight Range	Number Average Molecular Weight Range
3-6	Low	150 - 650	13,000 - 50,000	7,000 - 23,000
22-30	Medium	1000 - 1500	85,000 - 124,000	44,000 - 65,000
45-72	High	1600 - 2200	146,000 - 186,000	70,000 - 101,000

1 4% aqueous solution viscosity.

Molecular weight is a measure of polymer chain length and is typically reported as a 4% aqueous solution viscosity (Table 2).

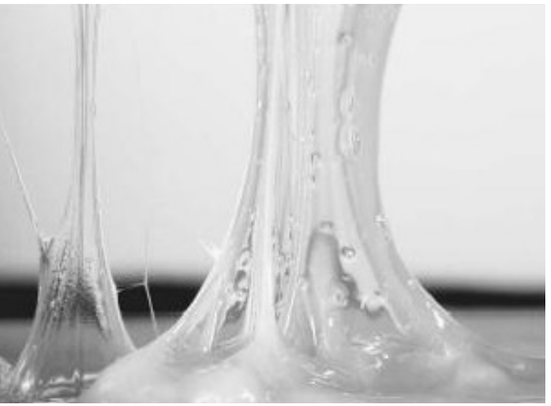
Molecular Structure PVOH

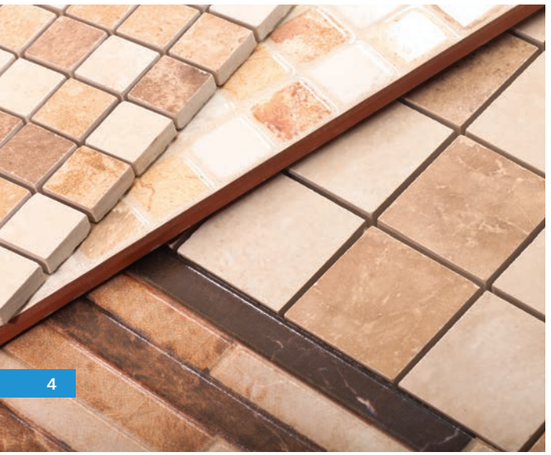
TABLE 3:
Description of the Different Hydrolysis Levels for PVOH

Grade	Hydrolysis Mole %
Super	99.3+
Fully	98.0-98.8
Intermediate	90.0-97.0
Partially	87.0-89.0

Hydrolysis level is a measure of the mole % hydroxyl functionality on the polymer. The hydrolysis level of PVOH is typically categorized as shown in Table 3.

SELVOL™ POLYVINYL ALCOHOL

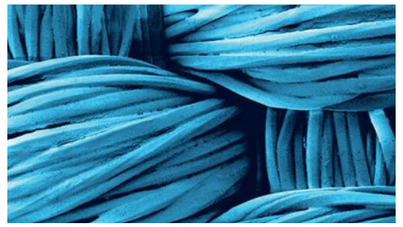




Polyvinyl Alcohol Business

Important end-use markets for these polymer products include textiles, paper, adhesives, building products, and specialty applications.

Selvol Polyvinyl Alcohol resins perform well as textile sizing agents, pigment binders, emulsifying agents, and in adhesive and protective film applications. Special properties may be imparted by blending grades or compounding with other ingredients.



Safety Considerations for Handling Selvol Polyvinyl Alcohol

ORGANIC VAPOR HAZARD

The primary hazard associated with bulk handling of polyvinyl alcohol resins is the organic vapors that can build up in the headspace of transport vehicles or storage silos over time. These organic vapors (primarily methanol) slowly diffuse out of the polyvinyl alcohol. This situation is aggravated if the bulk container is sealed and exposed to the hot sun. Organic levels that exceed the lower flammable limit of the vapor can be reached.

DUST HAZARD

The other potential hazard is associated with handling dust. Like almost all organic powders, polyvinyl alcohol dust can form an explosive mixture in air. Standard testing of Selvol Polyvinyl Alcohol dust (material below 200 mesh), according to procedures in NFPA 68, has indicated that our powders typically exhibit an ST-1 hazard class, which is the weakest of three explosibility classes for dusts. The bulk of the product has a particle size much greater than that used for explosion testing and hence is less of an explosion threat. However, fines are always present, particularly in bag collectors and during transfer operations, and this material is a dust explosion threat.

TABLE 4:

Polyvinyl Alcohol Properties/Safety Considerations

- Generally non-hazardous
- Explosive dust, particularly fines
- Residual methanol and methyl acetate will diffuse from product and can accumulate in closed silos, trucks, railcars, containers
- Potentially explosive methanol and methyl acetate vapor given sufficient diffusion time and temperature
- Methanol and methyl acetate have 8-hour exposure limits of 200 ppm—industrial hygiene level
- Nuisance dust with 8-hour exposure limits of 5 mg/M^3
- Slippery when wet

TABLE 5:

Control Methods

- Minimize ignition sources
  - grounding
  - bonding
  - no smoking
  - no hot work
  - explosion-proof electricals
  - external bearings
- Minimize flammables
  - remove organics from product
  - air dilution
  - good housekeeping; clean up dust

GENERAL COMMENTS

For combustion to occur, fuel, air and an ignition source must be present and must combine in the proper amounts. Air is always present in normal powder operations. The fuel is the powder and organic vapor. Suspension of the powder in air will normally occur during powder conveying operations. With two of the three legs of the fire triangle present in normal operations, ignition sources must therefore be controlled as much as humanly possible. The ignition of Sekisui's polyvinyl alcohol powder requires a significant amount of spark energy, on the order of 150 millijoules. (Touching a metal door knob when humidity is low after walking a nonconductive rug will result in a static spark discharge of approximately 25 millijoules.) A flammable vapor would require less than 1 millijoule. A primary source of spark is from static discharge.

The potential for most static discharges which might occur in air conveying systems can be controlled to levels well below those necessary for ignition of powder using proper grounding and bonding of the powder transfer and storage systems. Prevention of vapor explosion is controlled by sufficient air dilution prior to or during transfer from the transport vehicle and ventilation of the vapor spaces of receiving storage silo before transfer begins. However, although we work very hard to make sure ignition sources and any flammable vapor are eliminated, we can never be sure that they are totally eliminated. For that reason, powder conveying and storage equipment is provided with explosion vents and/or weak seam roofs. These features will allow an explosion which might occur to vent in a direction away from personnel and other equipment resulting in a lack of injuries and minimal damage and disruption.

These types of incidents have occurred, although very infrequently, and it is important to pay attention to maintaining both the grounding and bonding systems, as well as any explosion vent panels. Table 5 outlines recommended control methods; Sekisui can assist you in evaluating your equipment to minimize the chance of explosion.

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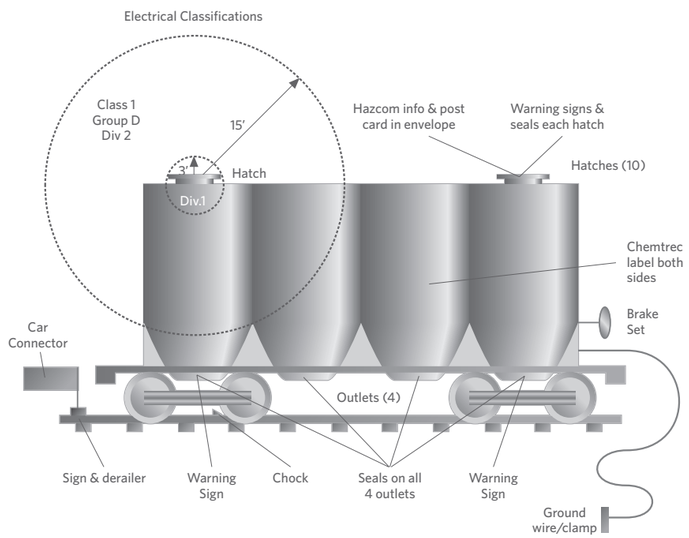
Covered Hopper Railcars

To assure the highest quality bulk delivery service possible, Sekisui maintains a permanent fleet of covered hopper, dry bulk vacuum discharge railcars. These railcars typically hold 180,000 pounds of Selvol Polyvinyl Alcohol.

They have four separate compartments lettered A-AC-BC-B on the outside of each car. Compartment numbering starts with the brake-end, which is designated compartment B.

Our bulk distribution staff completes all necessary railroad routing and scheduling arrangements to ensure that our shipments consistently meet customer requirements.

FIGURE 2: Covered Hopper Railcar



LININGS

Covered hopper railcars have a thin Placite #7122 epoxy coating which acts as a barrier between the product and the car to maintain product quality. This coating is applied to all interior surfaces which are not stainless steel or aluminum. Care should be taken to keep the lining intact. Hard objects such as shovels, poles or ladders should not come in contact with the lining. Hammers, vibrators, etc., which are used on the outside of the car to assist unloading, can also damage both the car and the lining and should be used with care. In general, Selvol polyvinyl alcohol unloads well without the need for flow aiding devices.

CONNECTIONS

Covered hopper railcars have a 61/4" o.d. quick coupler connection on the product discharge outlet, and they are vacuum unloaded.

Due to the numerous combinations possible, adapters or reducers for connecting the covered hopper cars to customer transfer lines must be supplied by the customer.

INSPECTION PRIOR TO UNLOADING

Prior to loading railcars, Sekisui thoroughly inspects to ensure the car is clean and that it operates properly. Customers should inspect storage silos, transfer equipment and lines before unloading. Recommended procedures include the following:

Inspect the Railcar

The railcar should be inspected for physical damage and missing parts. Any defects should be reported to Sekisui at once. All railcars will have a postcard and OSHA information attached to the top dome. The postcard should be returned indicating any railcar deficiencies.

Check Seals

The seals on the outlets and roof hatches should be inspected to make sure that they are intact. If they are not, the railcar should be inspected to determine if there has been any damage or contamination.

Inspect for Cleanliness or Contaminants

Before transferring any product, the air conveying system should be checked to make sure that it is clean.

Compare Products

Before transferring any product, the storage silos, transfer lines and equipment should also be checked to make sure that the product being transferred is the same as the residual product.

Check Your Equipment

The transfer equipment should be checked to make sure that it is operating properly before starting to transfer any product.

Should you require assistance or have a question, contact your Sekisui service representative.

RAILCAR UNLOADING PROCEDURES

Customers must ensure that all applicable regulations are satisfied and all safety precautions are followed.

Covered hopper railcars require a vacuum system for unloading. The following are typical unloading steps.

1. The car, transfer systems and storage silos must be bonded and grounded to prevent buildup of static electricity. The grounding clip location should be checked yearly with a "meggar" to be certain it is adequate.
2. To avoid the risk of collapsing the bulkheads, at least one hatch on the compartment being unloaded should be opened. Filters should be attached to the open hatches and rain should be prevented from entering the open hatchway. Sekisui recommends the use of removable hatch covers such as the one shown in Figure 3. This cover will permit adequate airflow but prevents water, or other contamination, from entering the car. Contact your Sekisui service representative for filter or cap information if necessary.
3. The caps should be removed from both sides of the outlet. The flow control tube cannot be rotated unless both caps have been removed. A 30 micron cone inlet filter should be attached to the nozzle opposite the one used for the vacuum connection.
4. The pneumatic line should be connected to the outlet nozzle using a sliding joint which will allow rotation of the control valve during unloading.
5. The pneumatic line adjacent to the nozzle connection should be supported above ground to prevent moisture pickup and to avoid excess friction when the control valve is rotated. If a heavy air filter is used on the other side, it should also be supported.
6. The pneumatic system should be started up.
7. The control valve should be opened to achieve the desired flow rate. If the control valve is difficult to operate, you should check to make sure that the adapter retaining screws are tight.
8. The control handle should be rotated in a counterclockwise direction until the desired flow rate is achieved. Most of the compartment will be unloaded with the valve in this position.
9. When the product flow has ceased, the control handle should be rotated in a clockwise direction until the desired flow rate is again achieved.
10. To complete the compartment cleanout, the control handle should be rotated several times in alternately clockwise and counterclockwise directions, with a pause for several seconds in the closed position so the vacuum can clear the tube of residual product.
11. The control handle should be returned to the closed position.
12. With the pressure fully relieved, each top hatch cover should be opened and the hoppers should be inspected to make sure that all the product has been removed.
13. The car should be prepared for the return trip as detailed in the next section.

INSTRUCTIONS FOR RETURNING EMPTY HOPPER CARS

After unloading, the instructions below should be followed to prepare the car for the return trip. This will help ensure that the empty cars remain clean.

Make Sure the Car is Empty

Customers are encouraged to empty all compartments completely as credit will not be issued for a returned heel.

Remove Dust Caps

All disposable dust caps should be removed from the hatches and outlets.

Close and Secure All Hatches

All hatches should be closed and secured to help prevent contamination and to protect the car interior from the weather. Remove filters or temporary hatch covers.

Replace and Secure Outlet and Air Line Caps

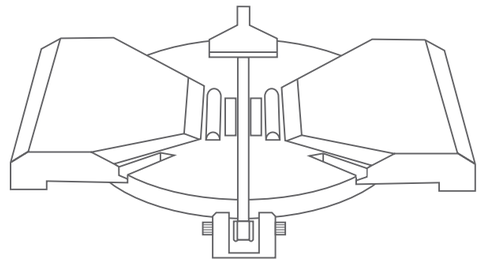
Damage in this area is the largest single maintenance expense which eventually finds its way back to the customer. Replacing caps reduces the chance of damage to the outlets, and helps prevent contamination.

Follow Return Routing Instructions

Unless other instructions are provided, the empty cars should be returned to the shipping point via reverse routing.

If special instructions accompany the shipment, they should be relayed to the railroad. Should you require assistance or have a question, contact your Sekisui service representative.

FIGURE 3:
Removable, Vented Hatch Cover



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Pneumatic Bulk Trucks

The pneumatic bulk trucks used for the shipment of Selvol polyvinyl alcohol are self-contained units that hold 46,000 pounds of product. They are capable of being unloaded without additional equipment. However, customers are responsible for:

1. Defining their unloading equipment requirements (discharge hose length, special fittings, filters, etc.);

2. Supplying transfer lines from the truck unloading station to the storage silos;

3. Supplying an air-return line from the silo to the truck; and

4. Ensuring that the systems are bonded and grounded. Four-inch quick-connect fittings (female connection at end of hose) are standard, and customer transfer lines must have appropriate connections, adapters or reducers.

INSPECTION PRIOR TO UNLOADING

Prior to loading a bulk truck, Sekisui thoroughly inspects each trailer to ensure that it is clean and operating properly. Customers should inspect their storage silos, transfer equipment and lines before unloading. Recommended inspection procedures include the following:

Inspect for Cleanliness or Contaminants

Before transferring any product, the entire system should be checked to make sure that it is clean.

Compare Products

Before transferring any product, the storage silos, transfer lines and equipment should be checked to make sure that the product being transferred is the same as the residual product.

Check Your Equipment

The transfer equipment should be checked to make sure that it is operating properly before starting to transfer any product.

Product Sample

The driver of the truck will provide a sample of the product.

UNLOADING PROCEDURES

Customers must ensure that all applicable regulations are satisfied and all safety precautions are followed. They must identify the correct storage line and prepare their system to accept the entire load. The truck, transfer system and storage silo must also be bonded and grounded to prevent build-up of static electricity. The grounding clip location should be checked yearly with a "meggar" to be certain that it is adequate.

In the presence of the customer's designated representative, the truck driver will connect the ground cable, then the unloading hose (and the air-return line, if so equipped) to the truck transfer lines. The driver will also operate the blower, which is mounted on the truck.

Because of the potential organic vapor buildup, do not open the top hatch of the truck. If you would like a sample of the material, Sekisui can provide one with the driver of the truck.

Should you require assistance or have a question, contact your Sekisui Service Representative.

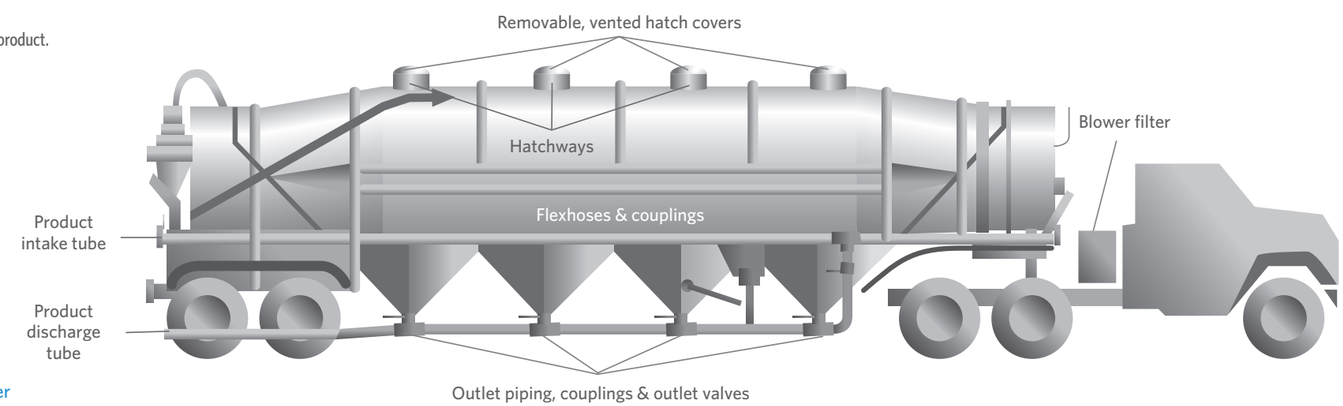


FIGURE 4:
Hopper truck with self-loader

Storage Silos

A bulk storage silo system for polyvinyl alcohol must be designed properly for safety and consistent performance (Figure 4). Sekisui will be more than happy to assist you in evaluating your system so that existing equipment can be adapted to Selvol Polyvinyl Alcohol.

SILO CAPACITY

A minimum silo capacity of 1,500 cubic feet is recommended in order to hold a full truckload of polyvinyl alcohol(45,000 pounds). Excess volume allows the silo to be refilled before it is completely empty.

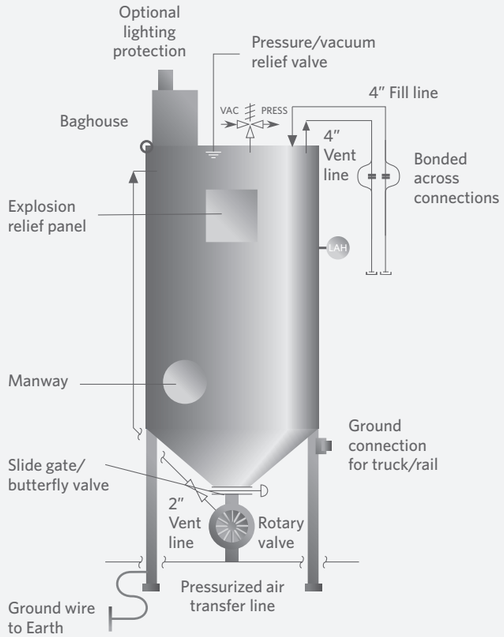
MATERIAL OF CONSTRUCTION

It is recommended that the silo be made of aluminum, stainless steel or carbon steel. A carbon steel silo should be primed to prevent rust and then covered with a solvent resistant epoxy coating. Paint baked on at the factory, often found in bolted silos, is also acceptable.

SILO GEOMETRY

The ideal silo for polyvinyl alcohol has a cone bottom with an angle of 60 degrees from the horizontal. This arrangement allows for uniform flow of polyvinyl alcohol from the silo. Other cone angles or outlet designs may contribute to bridging or "rat holing."

FIGURE 5: Storage Silo



Alternatives to Explosion Relief

- Weak seam roof with restraining cable/chain
- Contain explosion
- Explosion suppression/
- Inert purging with instruments

Silo

Materials of construction

- Stainless steel
- Aluminum
- Coated carbon steel

Other considerations

- No smoking
- No hot work
- Electrical class
- Confined space
- Housekeeping

Piping

Materials of construction

- Stainless steel
- Aluminum with stainless elbows

SELVOL™ POLYVINYL ALCOHOL

Storage Silos

FEEDING SYSTEM

The feeder from the silo to the pneumatic conveying line is a very important part of the bulk handling system. The feeder allows for the transfer of solids at a controlled feed rate from storage into the process. A rotary or star valve is recommended for polyvinyl alcohol. An open rotor design is necessary, as polyvinyl alcohol will lock up a closed rotor design. It is important to size the opening to the rotary valve correctly. Too small an opening could also result in bridging or rat holing. An eight-inch diameter opening is reasonable.

The rotary feeder should have external bearings to prevent damage to the bearings and seals, as well as product degradation. If the bearings are internal, they should be purged with 2 cfm of plant air.

When used in a positive pressure system, the rotary valve will leak high pressure pneumatic conveying air into the silo. This air often impedes solids flow and must be vented. The air can be vented off the valve itself, or off the bottom of the silo just above the valve. The vent must be routed back to the top of the silo. To keep this vent line from plugging, supplying additional conveying air to the vent line is recommended.

TABLE 6:

Explosion Relief Consideration

- Sized for ST-1 dust
- May be door, panel, diaphragm
- Vent to outside
- < 10-ft duct
- Vent to safe place
- Inspect routinely for paint, ice, sticking, corrosion
- Restraining chains or springs

Alternative Designs:

- Weak seam roof with restraining cables/chains
- Explosion suppression system
- Constructed to contain explosion (125 psig)
- Inert atmosphere

TABLE 7:

Transfer Piping Considerations

- 4" stainless steel or aluminum with stainless steel elbows (no plastic)
- Vent (vapor return) line to truck if no dust collector on silo discharge (truck has bag house)
- Capped to keep clean
- Connectors, except welded joints, provided with jumper wires/cables to provide electrical continuity
- Test electrical continuity once a year

Hose Considerations

- Stainless steel spiral construction
- Or plastic/elastomer with spiral wire connected to fitting at both ends
- Continuity across flange or fitting

GENERAL GUIDELINES

Silo Construction:

1. All new silos should be designed in accordance with NFPA 68 requirements for explosion relief protection. See Table 6 for guidelines.
2. If a bolted silo is chosen, care should be taken to prevent water leaks at the multitude of joints.
3. Aluminum and stainless steel are the preferred materials of construction. If an interior coating is used on other materials, the coating should be resistant to methanol, methyl acetate and water.
4. Transfer pipes should be of stainless steel or aluminum and capped to keep clean. Other considerations are listed in Table 7.
5. A vacuum/pressure relief vent should be used on all silos. This relief device should be checked regularly as part of your facility's routine maintenance program.
6. "Popper"-type baghouses that use dry compressed air to blow the bags clean are preferred over shaker types. The baghouse assemblies must be properly grounded since loose bag clamps are a potential source for static discharge. Table 8 lists baghouse considerations.
7. Polyvinyl alcohol silos should be equipped with a purge system to prevent a buildup of volatile substances which may present a health and/or flammability hazard. One method to do this is to equip the vent filter baghouse with a small fan. A 2-hp, explosion-proof 800 CFM fan is usually adequate to purge an 8000 cubic foot silo. (Most manufacturers of vent filters offer purge fans as an option.) A simpler method is to use a dust return type air conveying system to convey the polyvinyl alcohol from the silo to its destination. This arrangement will provide a substantial purge of the silo each time it operates. All silos should also use a "blowoff" or weak seam roof with four restraining chains, to provide explosion relief protection.
8. The silo must be provided with proper grounding. See Table 9 for guidelines.
9. If certain conditions are not met, separate lightning protection may be needed. Table 10 lists these conditions.

TABLE 8:

Baghouse Considerations

- Reverse air cleaning
- Electrically conductive bag
- Procedurally tighten clamps
- Access door/explosion relief vents
- Electrically classified
  - Class I, Group D
  - Div 1—5 ft
  - Div 2—10 ft
- All vents outside
  - >12 ft above grading
  - <5 ft from building opening

TABLE 9:

Grounding Considerations

- All equipment provided with ground to earth (firmly attached cable between equipment/support steel to buried rods)
- Ground wire between silo and vehicle during unloading
  - unpainted brass or stainless steel
  - reel clamp
  - reel with continuity test, alarm or interface
- Test electrical continuity once a year

TABLE 10:

Lightning Considerations

Separate lightning protection needed if all the following are not met:

- Electrically continuous metal construction
- > 3/16" thick
- Roof bound to sides
- Piping metallurgically sealed to tank
- Vapor openings sealed or protected

Silo Discharge Arrangement:

1. An airlock should be used to discharge and meter the silo outflow. A manually operated butterfly shutoff valve should also be installed above the airlock to allow airlock removal beneath a loaded silo. "Air pad"-type devices that rely on fluidizing membranes should not be used because they tend to skin over from moisture in the air.
2. Instead of "air pads," two or three "air cannons" should be used, as necessary, to minimize discharging problems. Only clean, dry compressed air should be used to operate the cannons.
3. A 60° angle hopper bottom should be used.
4. A dust return loop type air conveying system is recommended. The airveying line should be piped back to the silo to prevent product dust losses, and to provide a purging effect.
5. An airlock pocket venting arrangement with a vent pipe leading to the top of the silo is recommended. Since air escaping upward through the airlock can cause fluidization and can inhibit flow, an airlock venting chamber should be used to separate the escaping air from the entering product.

Storage Silos

GENERAL GUIDELINES

Airlocks (Rotary Valves):

1. Open end rotors with adjustable metal tips should be used (316 SS rotors are recommended).
2. Cast iron body construction with chrome-plated insides on stainless steel is preferred to prevent rust corrosion.
3. Only external/outboard bearing design airlocks should be used—never inboard bearings designs.
4. Square inlet and outlet flanges are preferred to allow better inlet flow and improved venting.
5. Each stuffing box should be purged with dry air. The volume of air should be controlled by using flow meters. Each purge point should have its own meter. Teflon packing is best.

Airveying Blower Unit:

1. For optimum reliability, a maximum operating limit of 2,500 RPM is recommended for the blowers.
2. The blower unit should be equipped with the following:
   - A high-quality oversized inlet filter
   - Inlet and exhaust silencers
   - An adjustable pressure relief valve
   - A pressure gauge, 0-15 psig
   - A check valve

Airveying Lines:

1. Rust free aluminum or stainless steel tubing should be used for straight runs (aluminum is generally less costly than stainless steel).
2. To prevent erosion, stainless steel should be used for all product line elbows. Aluminum dust-return elbows are also acceptable.

   (Note: Only extra-long radius elbows should be used since polyvinyl alcohol may become packed in tight radius elbows.)
3. Only vertical or horizontal pipe runs should be used. 45° up or down runs should be avoided.
4. Only the absolute minimum number of elbows should be implemented. Neatness at the expense of extra elbows is a poor design practice.
5. Cross sectional continuity should be maintained. All IDs should be the same, and only round shapes should be used.
6. A #10 bare copper wire should be run from a ground rod along the air conveying line and clamped to each section of the line with sharp-toothed brass clamps. Plastic tie straps or tape can be used to secure the wire to the pipe between the clamps. The system should be checked regularly to insure continuity.

Miscellaneous Equipment

SLIDE GATE VALVES

Polyvinyl alcohol will have a tendency to accumulate in the rails/tracks of the slide mechanism in this type of valve and may bind the slide tightly in position. Dry material handling butterfly valves with Teflon seats and SS-316 disks are recommended instead.

CONVENTIONAL SCREW CONVEYERS

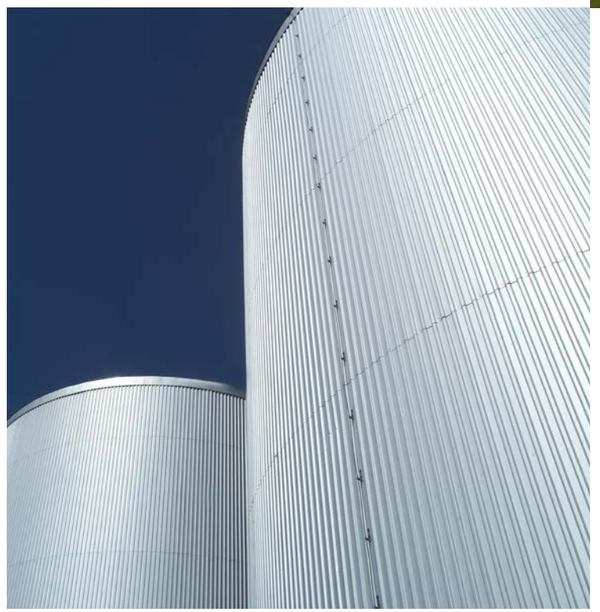
Hanger bearings inside the trough of this type of conveyer will generate troublesome"worms" of polyvinyl alcohol. These rope-like extruded forms will then be transferred with the product and could jam airlocks, diverter valves, etc. Avoid screw conveyors where possible.

BELT CONVEYERS

Enclosed-type belt conveyers (where the entire unit is placed in a dust-tight enclosure) should not be used. Even when equipped with quality sealed ball bearings, the polyvinyl alcohol dust will enter and destroy the bearings. Conveyers of open construction are also impractical for dust and moisture reasons.

BEARING CONTAINING DEVICES—IN GENERAL

Only regreasable bearings should be used around polyvinyl alcohol for the reasons mentioned above. Critical rolling bearing devices should be relubricated at regular intervals.



Bulk Chemical Quantity Standards

To assure that our customers receive the correct bulk quantity of polyvinyl alcohol, the following standards are used.

Product which is loaded into bulk trucks will be measured using Sekisui's or commercial certified scales. The quantity delivered will be within 1/2% of the certified gross weight of the shipment.

Product which is loaded into bulk railcars will be measured using certified scales or meters. The quantity delivered will be within 1% of the certified gross weight of the shipment. The stenciled tare weight of the railcar will be used to calculate the net weight.

QUANTITY DISCREPANCIES

Discrepancies between the bulk quantity of product that is delivered to you and the quantity that is indicated when weighing the product on your own scales can result from the inherent inaccuracy between scales or from problems encountered during unloading, as described below:

SCALE ERRORS

Industrial scales that are large enough for railcar and tank truck usage are accurate only within certain parameters due to the scale's size, age and weathering. The acceptable industry standard of accuracy for bulk trucks is plus or minus 1/2% of the gross vehicle weight (which could be as much as a 400 lb. difference); and for bulk railcars, the standard is plus or minus 1% of the gross vehicle weight (which could be as much as a 2630 lb. difference). Due to this accuracy range, the actual weight of the product delivery could be higher or lower than the weight that is stated on the printed weight ticket. After numerous studies, however, we have concluded that over the long term such scale errors offset one another; therefore, customers should feel confident that they are receiving "what they pay for."

UNLOADING PROBLEMS

Quantity discrepancies caused by unloading problems fall into two categories.

1. The transportation vehicle may not be completely unloaded because:
   - The unloading area is not level; therefore, the product in the vehicle cannot flow efficiently into the unloading system,
   - Product may cling to tank walls, thereby requiring additional time for all of the product to flow into the unloading system, or
   - The person unloading the vehicle prematurely discontinues unloading.

To prevent such problems, unloading procedures should include a method for determining if the vehicle is completely unloaded.

2. The scale reading obtained by the customer after delivery is taken incorrectly. This can be due to a variety of factors.
   - Some scale operators use the tare weight (given on the weight ticket) of the vehicle at the point of origin. This may cause a weight error due to a change in a tare weight because of fuel consumption; a tractor change between loading and unloading; or excessive snow or ice on the vehicle.

As an additional measure to ensure accuracy, your scale should be certified by appropriate state authorities and should be maintained under a preventative maintenance program. If you have questions regarding the quantity of your bulk chemical shipment, please contact your Sekisui service representative.

SELVOL™ POLYVINYL ALCOHOL

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