NATIONAL SUGAR MARKETING

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Liquid Sugar Storage and Sanitation Guidelines

National Sugar Marketing continually strives to provide the highest quality liquid sugar available to the market. The following guidelines are provided to assist our customers in maintaining that quality during storage and incorporation into their products. Adherence to these guidelines will help insure that the quality of the liquid sugar as delivered will not deteriorate in storage. No representations or warranties, stated or implied, are made as to the accuracy, completeness or usefulness of the information, documentation, or specifications, or the conformity of any product to them. You, the user, agree to indemnify and hold harmless NSM, its officers, directors, employees, and agents from any and all losses, claims, or damages, resulting from the use of the information in this publication including injury or death of any person or damage to any property of whatsoever nature. You, the user, assume all responsibility for the use and interpretation of the contents and agree to use at your own risk.

Storage tanks

Liquid sugar storage tanks preferably should be 304L or 316 Stainless Steel. Mild steel tanks may be used if lined with a food grade, properly cured, epoxy liner. Epoxy liners such as Plastite7133HS, Plastite 9133HS, Sigma 5476PC, and Champion 466 FDA are recommended. Un-coated carbon steel, fiberglass, 304 Stainless and aluminum tanks should not be used. A carbon steel tank may release iron into the product. Curing solvents have been known to leach into product from fiberglass tanks. 304 Stainless is prone to pitting by the liquid sugar. Oxidation at the liquid surface interface with aluminum tanks has also been known to occur.

The tank should be sized so that it is at least 1.5 times the volume of a delivery. This will allow delivery of a full load while maintaining sufficient inventory. The minimum size should be calculated to include usage rates and delivery schedules. Since a typical truck delivery load is about 4,000 gallons the storage tank should have a minimum capacity of 6,000 gallons. The tanks should have dished heads and cone bottoms to facilitate cleaning. A drain valve should be located at the lowest possible point to facilitate complete drainage. Storage tanks located outside must be insulated. An in-line wire mesh coarse filter prior to the tank is strongly recommended.

The tank should be equipped with a filtered, UV light treated, forced air blower. The purpose of the blower is to scrub moisture from the headspace of the tank which could lead to microbial growth on the surface of the product. The blower must be adequately sized so that the air transfer rate is equivalent to four (4) tank volumes per hour. The supply air to the blower should be above 50°F to maximize the effectiveness of the UV light. The UV lamps must be changed at least every six months to maintain effectiveness. The filter must be

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HEPA-type that is 99% efficient at 0.3 microns. The tank must include a discharge vent equipped with a wire mesh filter (a U-shaped pipe is preferred). For easier maintenance access, the UV/blower unit may be installed at ground level but the piping will need to be insulated to prevent condensation. The tank must include an in-swing man-way or flanged man-way on the side to facilitate inspection and cleaning. The man-ways and all other access points on the tank should be secured with metal cable seals or locks.

A sanitizing clean-in-place (CIP) system including a top mounted spray ball is recommended to prevent incidental contamination during any cleaning or inspection activities. A temperature probe near the bottom of the tank and inserted 6-8 inches into the product may be used to monitor product temperature. An easily cleaned sanitary sample port should be located as close as possible to the tank discharge for tank monitoring sample collection.

The receiving port should be well identified with permanent placarding and include a fitting to
lock or seal the port.

Piping, Fittings and Gasket Materials

304L or 316 Stainless Steel piping is recommended and should be either heli-arc welded and polished or joined by sanitary in-line tri-clover type clamps and food grade gaskets. Fiberglass, plastic, PVC, CPVC, galvanized, and carbon steel piping should not be used. Any gaskets used must be food grade. Recommended gasket types are Teflon®, food grade Tygon® or neoprene. Any hoses and/or couplings should be of compatible material and must be food grade.

If multiple tanks are used, separate piping must be used for each sweetener type. Tanks should not be coupled together unless sanitary butterfly or ball valves are used to isolate each tank. To facilitate proper traceability, product should not be drawn from two tanks simultaneously. Inlet piping should be large enough to facilitate flow rates adequate to fill the tank as rapidly as desired. (Typical truck delivery hoses are three-inch brewer style hose with female cam-lock fittings). Discharge piping should be sized to prevent pump cavitation and meet process demand. It should also be engineered to consider temperature, viscosity, pipe length, flow meters, etc.

Pumps and Meters

A positive displacement stainless steel housed rotary pump, equipped with food-grade packing, internal by-pass, and a pressure relief mechanism is recommended. The pump should be sized to meet the required flowrate given the viscosity and temperature of

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the liquid sugar, the number of use points and the length of the piping required. A basket strainer and magnet may be placed in-line between the storage tank and the pump if desired. The pump should be equipped with micro switches for pump starting and stopping to prevent pipe hammer. An automatic stop mechanism should also be in place.

Meters which work well in liquid sugar applications include "Mag meters", volume displacement, and mass flow meters (i.e. coriolus). Design constraints should include the provision that the line to the meter remains full (no air entrainment) at all times. The meter should also include micro switches to minimize hammer during start-up and shut off.

Storage Conditions

Liquid sugar should be stored between 90° and 100°F to prevent color formation. Recommended delivery temperatures range from 80° to 110°F. At those delivery temperatures a well-insulated tank does not require external heating. If heating is required to maintain temperature, a hot water jacket around the base of the tank is recommended. Steam should not be used to heat the tank directly. Liquid sugar stored for extended periods (more than 2 weeks) should be monitored closely for color formation and fitness of use.

Sanitation

Daily sanitation tasks should include inspection of any in-line filters, strainers, or magnets. They should be cleaned or replaced as needed. The UV blower system should be inspected and cleaned at least monthly. The UV light should be unplugged and the cover removed. Any adhering dust or soil on the lamp should be removed by careful wiping. Inspect the filter and housing for any tears or openings. Replace the cover and turn the unit on immediately. As noted above the UV bulbs must be replaced every six months to maintain the proper wavelength. The microbial content of the stored liquid sugar should be monitored on a regular basis. Initially, it is recommended that daily samples be taken to determine a typical baseline. Weekly samples may then be used to evaluate the condition of the liquid sugar as stored. If the trend of the counts begins increasing at a higher than baseline rate the tank should be taken out of service, cleaned, and sanitized. Note: Since the tank is seldom drained completely during normal operation, the stored older liquid sugar will mix with fresh product and could lead to contamination of the entire tank. Viable count monitoring is critical to reducing this potential. Storage tanks should be cleaned at least annually.

Sanitize the Tank as Follows

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A clean-in-place hot water system is recommended. Empty the tank completely and flush any residual product with hot water until no sugar remains in the effluent. Allow the tank interior to cool and open the man-way. Using a high intensity light and without entering the tank, inspect the floor, walls, and interior roof of the tank. Any chipping or flaking of tank lining should be noted and repaired as needed. Rusty or pitted welds should also be repaired. Inspect for the presence of mold (typically light brown to black) on the upper side walls of the tank. Flush all inlet and outlet pipes, valves, pumps, etc. with hot water and close the man-way.

A clean-in-place hot water system is recommended. After the interior inspection, wash the tank for a minimum of 15 minutes at a minimum temperature of 180°F. If no CIP system is available, introduce steam directly into the tank such that the effluent condensate reaches a minimum temperature of 180°F for at least 15 minutes. An alternate method is to completely fill the tank with water that is at least 190°F and allow to set for 15 minutes. No cleaning or sanitizing solutions other than hot water are necessary or should be used. Drain the tank through the inlet and outlet pipes, valves, pumps, sample ports, etc. Allow the tank to cool. Use the UV blower system to scour any residual moisture from the headspace of the tank. Introduce fresh liquid sugar into the tank and immediately flush all the inlet and outlet pipes, valves, pumps, sample ports, etc. Use a refractometer to verify that any residual water has been removed and return the tank and piping system to operational service.