AQUASTORE® OPERATION and MAINTENANCE MANUAL

AQUASTORE®
Tanks

Aquastore Tank Operation and Maintenance Manual

This operator's manual is intended to be a guide for the safe and efficient operation of your CST Storage Aquastore® water storage tank, waste treatment tank, or trickling filter shell. This manual is considered as a portion of the equipment and should accompany the equipment.

The following topics are covered in this manual:

- Safety Guidelines
- Sanitization
- Winter Operation
- Inspection and Maintenance
- Glass Coating Touch-up and Care

Installation and service of Aquastore brand equipment is the responsibility of an authorized independent Aquastore tank dealer and the equipment owner/operator and not the manufacturer, CST Storage.

CST Storage is continually improving its products. Accordingly, CST Storage reserves the right to change design and/or specifications without notice.

The information contained herein is general in nature and is drawn from sources deemed to be reliable. It is intended for general information purposes only.

The results obtained by the use of these products are dependent upon strict adherence to manufacturer's instructions for proper operation of the equipment as outlined in the appropriate operator's manual. In all instances the

employment of good management practices in circumstances not specifically referenced in such manuals is required.

CAUTION:
Before using any equipment manufactured or distributed by CST Storage, you should thoroughly study and understand the appropriate Operator's Manual. If you do not have an Operator's Manual for a particular item of equipment, one can be obtained through your authorized independent Aquastore tank dealer. Decals as illustrated and placed on the equipment provide important safety and operating instructions which you should follow whenever using the products.

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Aquastore tanks are designed and manufactured by CST Storage, 345 Harvestore Drive, DeKalb, Illinois 60115. These tanks have been designed to specifications supplied by the tank purchaser and/or his specifying engineer. Specific design constraints have been provided by the specifying party including, but not limited to: the density of the stored product, the location of the overflow devices, the filling and emptying means, the design codes controlling the design of the tank, etc. This specific information has been supplied as an integral part of the submittal package prior to the construction process. You must consider this information as part of your operation and maintenance review.

Specific procedures may need to be generated by you as the tank operator based on a specific need of you, your employees, and others involved in the maintenance and use of this tank. Use of this tank for purposes other than those specified in the original design documents may void your warranty, damage the tank, and/or create the risk of personal injuries or death. Should you have need for specific information not available to you from your files, please contact the installing dealer and/or CST Storage at the address provided.

Aquastore is a registered trademark of CST Industries, Inc.
Edgecoat II and Vitrium are trademarks of CST Industries, Inc.

Section 1

SAFETY GUIDELINES

Aquastore tanks are used for many purposes and can be incorporated into larger storage or process systems. Therefore, other safety related guidelines, in addition to those presented in this section, may be appropriate for your installation. You or your system designers are in the best position to make these recommendations.

General

Access to all Aquastore tanks must be limited to authorized personnel. To deter vandalism or tampering, the owner operator should implement appropriate security measures including, but not limited to: enclosing the tank area with a fence, providing lighting at tank ladders and platforms, installing an alarm system and/or a ladder gate. If the tank has a roof, keep the top manway locked. This manway should be opened by authorized personnel only.

When entering a tank it is your responsibility to comply with the following safety information topics.

RECOGNIZE SAFETY INFORMATION

Look for this symbol, it means...
Attention! Be alert!
Your safety is involved!

DANGER:
Tanks may be considered to be “confined spaces” under certain local, state and/or national regulations and standards. You should establish and implement a confined space entry safety program to conform with such regulations, standards, and reasonable safety measures. CST Storage cannot design a program to suit your specific needs and situation.

Many well conceived confined space safety programs include the following:

1. Identification of the existence of a “confined space” and the hazard(s) associated with that confined space, i.e., a confined space has a restricted means for entry or exit and has the potential for containing a hazardous atmosphere or other dangerous condition;
2. Restrictions on access to a confined space so that only properly instructed and properly equipped personnel enter the confined space;
3. The use of various equipment and procedures to control the hazard presented by the confined space, i.e., the use of retrieval lines, respirators or special protective clothing;

4. The presence of an attendant outside the confined space to maintain contact with personnel inside the confined space and to monitor events; and
5. Access to properly trained rescue personnel and rescue equipment.

DANGER:
Flammable, explosive, or lethal gasses may be present in and around certain tanks. Do not smoke or allow open flames or sparks in the tank area. Fire or explosion may result. Use an approved breathing apparatus and protective clothing when dangerous gases are being handled or may be present in or around the tank. Failure to heed may cause serious personal injury or death.

Safety Decals

The safety decals that are located on the types of tanks covered in this manual are illustrated on the following page. You should inspect each decal or safety sign at least annually. Those which are worn, missing or illegible must be replaced by you. Use the attached graphic display to aid in your inspection. Contact your authorized independent Aquastore tank dealer if new decals are required.

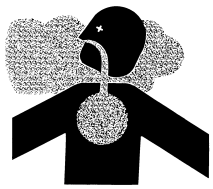
WATER STORAGE TANK DECAL

IMPORTANT

This tank contains a liquid that must not be contaminated. Keep manway locked at all times. Manway should be unlocked by operating personnel only for the purpose of visual inspection and/or sampling.

Part No. 257249-000

ALL TANKS and DOMES



DANGER

Dangerous gases may be present in area. Ventilate and monitor gases before entering any confined space. No flames or sparks. Gases can cause loss of consciousness and death and can be explosive. Consult your operator's manual for further information.

Part No. 262778-000

ALL TANKS

WARNING

Do not cut holes in or make attachments to any part of this tank without prior approval of a qualified structural engineer. Failure to heed this warning may result in structural failure, collapse, personal injury or death.

Part No. 260581-000

ALL TANKS

IMPORTANT

NO HOT SPARKS!

No hot sparks should come in contact with the panel!

- **NO WELDING**
- **NO GRINDING**
- **NO CUTTING**
- **NO CUT OFF SAW**

WITHIN 20 FEET OF THIS TANK

If working closer, you must protect the panel from hot sparks with a welding blanket, plywood, or other adequate means. Molten steel particles melted into the panel will quickly rust and may require the panels to be replaced at a substantial cost per panel. This tank was inspected by the Builder and there was no spark damage when the tank was completed.

Part No. 262166-000

Section 2

SANITIZATION

(Described for Potable Water Storage Tanks)

Forms of Chlorine

Various forms of chlorine are used for the purpose of sanitizing potable water tanks. Aquastore tanks are constructed using a joint sealant which can be substantially degraded during the curing process by a strong oxidizer such as chlorine. Care must be taken to follow the recommended chlorination procedures to prevent deterioration of the tank joint sealant.

Excessively high concentrations of chlorine will damage the tank joint sealant if granules or tablets are not dissolved prior to their being placed in the tank.

Methods of Chlorination (REFERENCE AWWA C-652)

The American Water Works Association (AWWA) Standard C-652 describes in detail several methods of tank chlorination. All of the methods described in AWWA Standard C-652, with the exception of any that use calcium hypochlorite, are acceptable. The chlorination of a tank after construction and prior to being placed in service needs to be coordinated with your authorized independent Aquastore tank dealer. Specific criteria apply to the cure time requirements for structure sealants prior to the first filling and/or sanitization process.

Care should be taken when handling any chemical. Only experienced personnel should attempt to chlorinate the tank contents. Use the utmost care and check local codes prior to disposal of chlorinated water.

Section 3

WINTER OPERATION

Minimize Ice Formation

Ice formation in water tanks can cause extensive damage. Interior sealer or coating damage may result from the abrasive action and/or impact of an ice cap moving within the tank with changing water levels.

CAUTION:
The formation of ice in a tank can result in damage to the tank, its roof (if applicable) and its accessories. The owner/operator must take appropriate steps to limit the formation of ice in the tank.

In any tank, catastrophic structural failure can result from the tremendous forces of ice expansion or the loads created by the weight of ice. Internal accessories, level gauges, overflow weirs, etc., can be ripped from tank walls causing structural damage.

To avoid this type of damage you must limit the formation of ice. There are various devices available to assist in this process, including the use of insulation to control heat loss. It is the owner's responsibility to determine if the use of this tank requires such devices.

The most widely used method to control ice in potable water tanks is to keep turning over the tank contents. It is recommended that pumping schedules be maintained so that water is kept moving during periods of lowest demand. On a daily basis, at least one third of the tank volume should be turned over. If necessary, water may have to be discharged to allow fresh, warmer water to be added. Take care to discharge water in an appropriate manner.

Additionally, on tanks supplied with a roof, roof damage can occur when ice formations come in contact with the roof. To help minimize the chance of this type of damage, the high water level in the tank should be lowered during the winter months to keep ice formations from contacting the roof.

Thawing a Frozen Tank

A tank which has frozen has a high risk of structural damage. A tank which is no longer operational because of excessive ice buildup must be thawed immediately to limit further damage.

The tank thawing process itself can create substantial risks. Experienced contractors should be employed to carry out the work, usually under the guidance of a consulting engineer. If the tank has experienced an extensive ice buildup requiring a thawing-out process, it should be drained and inspected for damage at the earliest opportunity. Your authorized independent Aquastore tank dealer can make this inspection and perform repairs at your direction.

Section 4

INSPECTION and MAINTENANCE

Inspection and maintenance are important parts of the use of every piece of equipment. Your CST Storage manufacturer's warranty may provide for certain maintenance responsibilities as conditions of your warranty. You should carefully review the terms of that document. In addition, the following listed steps will help you provide for the minimum maintenance needs of your equipment.

Tank Inspection and Maintenance

Periodic exterior and interior inspections and maintenance are needed to keep your Aquastore tank in proper operating condition.

Exterior This type of inspection is to be performed yearly and focuses on the exterior portions of the tank. You can do this type of inspection while the tank is in service.

Interior This type of inspection is to be performed at least every five (5) years and focuses on the interior portions of the tank. You perform this type of inspection while the tank is *out of service*.

Exterior Inspection (Yearly)

You should inspect the exterior of your tank on a yearly basis. The focus of this section is on those portions of the tank that can be inspected from the exterior, while the tank is in service.

1. Inspect all safety and information related decals for legibility.
2. Inspect overflow pipes, overflow weirs, and pipe terminations to assure that they will perform their design function.
3. Inspect the tank ventilation systems, including screens designed to prevent birds, insects, and debris from entering the tank.
4. Inspect the exterior coating of the tank for possible damage.
5. Inspect ladders, locks, platforms, ladder cages, and safety climbing devices (if specified) for corrosion and/or damage.

For each of the above items you should perform any necessary maintenance and repairs as part of the inspection process.

Interior Inspection (Five year interval, minimum)

You should inspect the interior of your Aquastore tank at a minimum interval of five (5) years, or more frequently if and as your experience indicates. The focus of this section is on portions of the tank that should be inspected while the tank is *out of service*.

1. Inspect for internal sheet and roof coating integrity, particularly in areas where external damage may have occurred.
2. Inspect tank/roof coating in general at all fastener locations and at sheet edges.
3. Inspect the condition of the sealant used in all joints, at the tank wall to floor junction, in the area of sumps, and other tank or floor penetrations.
4. Inspect the silt stop (if applicable) for function and integrity.
5. Inspect the coating on galvanized parts.
6. Inspect other interior tank components, riser pipes, level gages, overflow weirs, etc., as appropriate for each device.
7. Inspect the floor as appropriate for the floor type. Some tank floors are glass coated steel; other floors are coated or uncoated concrete.

   For each of the above items, you should perform any necessary maintenance and repairs during the time the tank is out of service for the inspection.

Inspection and Maintenance Documentation

Many successful tank operators have found a maintenance log document to be helpful. Often, forms fulfilling this purpose already exist within the owner's system and can simply be adapted for this use. The frequency, type of activity, and identity of persons performing maintenance should be reflected in the document. Generate a format that best serves your purposes, with the understanding that such a log will be most helpful to you in providing for the successful operation of your tank.

Tank Cleaning

Potable water tanks should be drained and cleaned at least annually to prevent accumulation of silt and sediment which may affect water quality and damage water meters, valves, etc. Normally a water hose with line pressure water is sufficient. Hot water or cleaning additives are not recommended. Do not use high pressure water.

A plan should be established for maintaining adequate water supply during the time the tank is out of service for routine inspection and cleaning. Cleaning schedules may also be appropriate for other types of Aquastore tanks.

Glass Coating Visual Inspection

At the time of the regular tank cleaning, a visual inspection must be made to check the glass coated sheets for any evidence of physical damage. See Section 5, “GLASS COATING TOUCH-UP and CARE” on page 15 for glass coating repair recommendations.

If structural damage is found, contact your authorized independent Aquastore tank dealer for recommended repair methods.

Ladders and Platforms

Ladder, ladder cage, and platform connection brackets must be visually inspected for corrosion or damage at each use. Replace damaged brackets if required. Ladder rungs should also be visually inspected to assure they are safe for use. If a safety climbing device was specified, follow the manufacturer’s instructions on proper care and use.

The installation or use of fixed interior ladders is not recommended as they are susceptible to corrosion and ice damage.

Ventilation For Roofed Tanks

The tank vent is provided to prevent damage to the tank from pressure and/or vacuum created by normal filling and emptying of the tank. It is designed to prevent most birds, insects and debris from entering the tank.

The vent screen must be inspected at least annually. It must be cleared of leaves and debris which would prevent it from functioning properly. The screen can be cleaned by removing the four (4) bolts that secure the top cover. (Two 9/16" wrenches are required.) Lift off the cover and clean the screen thoroughly with a soft brush. Reinstall the cover by reversing the above procedure.

Overflow Pipe

Overflow pipes can become clogged with debris. To prevent entry of birds or small animals, the discharge ends should be screened, provided with a flap valve, or other method of closure. The overflow pipe should be kept clear and checked regularly to be certain it operates freely.

Cathodic Protection System

Some Aquastore tanks include a manufacturer supplied cathodic protection corrosion control system. In order to comply with warranty requirements, this system must be checked on a periodic basis, and results of all checks must be retained. Your authorized independent Aquastore tank dealer can advise you of the inspections required as they apply to the warranty provided with this tank.

Graffiti and Vandalism

Aquastore sheets can usually be wiped clean of painted-on graffiti without damaging the coating. A hydrocarbon solvent paint remover wiped on the graffiti with a cloth should be sufficient to thoroughly remove painted-on graffiti. If not, a stiff brush can be used to remove paint. Follow label instructions for the paint remover being used, then wash the cleaned area with mild detergent and water. The coating typically does not suffer any damage from organic solvents. Avoid prolonged contact between the solvent and any sealant.

Dome Roof

Some Aquastore tanks may have a geodesic dome roof. The dome must be inspected in accordance with the manufacturers requirements.

Section 5

GLASS COATING TOUCH-UP and CARE

Following Porcelain Enameling Institute guidelines (PEI-101), Edgecoat II™ sheets are mechanically rounded to specific radii that provides maximum glass adhesion to steel. The combination delivers the maximum corrosion resistance of CST's Vitrium™ glass coating with the greatest protection on every sheet. Edgecoat II is the only process in the world that provides optimum glass encapsulation on all four sides of the sheet edges.

The glass coating on the Aquastore tank is a durable coating. This coating can, however, be damaged. This section covers the touch-up and repair of the glass coating.

The coating can be damaged by handling or if the coating is impacted. Additionally, some blemishes can occur during the manufacturing process. Although the steel parts are packaged at the plant to prevent shipping damage, some minor damage can occur during the erection process if the sheet is mis-handled. Also, during periods of regular service, the coating could be damaged by the impact of sharp tools or by the impact of small projectiles, such as rocks, air rifle pellets or rifle bullets. The coating should be inspected during the regular cleaning cycle and routine maintenance of the tank.

This procedure is designed to cover three possible repair situations:

- Touch-up and repairs during normal erection
- Touch-up and repairs during regular service
- Touch-up and repairs during routine maintenance

Erection Touch-Up

During tank erection, the installation crew is trained to observe the surface of the glass as each sheet is put in place. If, during this erection period, a coating discontinuity or a damaged section is noted, it will be repaired by immediately applying a 10 mil minimum thickness of sealer over an area approximately 3 - 4 times the size of the damaged area. No surface preparation is required for this repair. Repairs of this type do not affect the overall warranty of the Aquastore tank.

In-Service Repairs

CAUTION:
Any person involved in tank repair or inspection should be trained and equipped in personal safety and confined space entry procedures.

During the normal course of operation of an Aquastore tank, coating damage can happen. Such situations could include:

Vandalism The impacting of a projectile such as a bullet or thrown object.

Accident The striking of the tank by a large object, such as a fork lift, crane, truck, etc., in which damage might extend over one or more sheets of the structure.
The dropping of a small tool from a considerable height and impacting the tank roof or sidewall.

1. The touch-up or repair of the first of these damages, i.e., the impact of a small tool, would be very light surface sanding with a 100 grit sandpaper and then the coating of the damaged area with sealer.
2. The repair of a sheet or part of a sheet that has been impacted by a projectile can take two forms:
   - The first form would be the repair if the projectile did not penetrate the sidewall of the structure. In such a case, the damaged area should be lightly sanded with a 100 grit sandpaper and then coated with sealer, being sure to overlap the damaged area by at least one inch around the damaged area. If it is determined during this repair, that the steel has been bent, deformed, etc., there may be similar glass damage on the inside of the structure. This should be touched up as described above. While it is not necessary to do this immediately, as the penetration of any internal rusting will be relatively slow, repair should be accomplished within a year.
   - If the side wall of the structure has been penetrated, and the hole size is small, temporary repair can be accomplished by driving a wooden plug in the hole to stop the leak until a permanent repair can be made. To permanently repair this type of damage, drill out the damaged hole to a diameter of 9/16". Then insert a standard Engineered Storage Products Company encapsulated bolt into the hole along with an appropriate amount of sealer to cover the damaged and unglassed area. Secure the bolt with a washer and a nut similar to the type used to erect the tank. This type of repair will seal the leak. Additional coating touch-up may be required.

3. If the damaged area is large, i.e., it involves one or more sheets, the tank should be taken out of service at the first opportune time; the damaged sheets removed, and replaced with new sheets. This can be accomplished usually in less than one day's time by a trained crew employed by an authorized independent CST Storage dealer.

Routine Maintenance

Inspect the inside coating for discoloration (dark brown or reddish streaking) during routine maintenance. Such discoloration will indicate the presence of an electrical discontinuity in the glass coating or at an exposed edge of the sheet. The amount of rust will appear to be much larger than the electrical discontinuity itself. This rust accumulation should be removed. The damaged area should be lightly sanded with a 100 grit sandpaper and then coated with sealer, being sure to overlap the damaged area by at least one inch around the damaged portion.

For further information, call your authorized independent CST Storage dealer.

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