



# Design Guidelines for Bulk Storage and Handling Facilities for VERSENE™ 100, VERSENEX™ 80, and VERSENOL™ 120 Liquid Chelating Agents

## Introduction

This bulletin provides general guidelines for designing bulk storage and handling facilities for VERSENE™ liquid chelating agents, including VERSENE 100, VERSENEX™ 80, and VERSENOL™ 120 liquid chelating agents. Included are a brief overview of the physical properties of these aqueous compounds, system design guidelines, and a diagram of a typical bulk handling scheme. Material Safety Data Sheets (MSDS) for individual VERSENE products are available from Dow and should be reviewed before handling these products. (Call 1-800-447-4369 or contact Dow via [www.dow.com/versene](http://www.dow.com/versene) to obtain MSDS.)

## Physical Properties of VERSENE Products

The VERSENE family of chelating agents includes three technical-grade liquid chelants with various chemistries and physical properties. VERSENE 100 chelating agent is an aqueous solution of tetrasodium ethylenediaminetetraacetate ( $\text{Na}_4\text{EDTA}$ ). VERSENEX 80 chelating agent is an aqueous solution of pentasodium diethylenetriaminepentaacetate ( $\text{Na}_5\text{DTPA}$ ). VERSENOL 120 chelating agent is an aqueous solution of trisodium N-(hydroxyethyl)-ethylene-diaminetriacetate ( $\text{Na}_3\text{HEDTA}$ ). Table 1 provides the typical physical properties for these products. Several derivatives of tetrasodium ethylenediaminetetraacetate are also available.

## Designing a Bulk Handling System for VERSENE Liquid Chelating Agents

Before any bulk handling and storage procedures are adopted for VERSENE chelating agents, all personnel involved should be trained and practice the handling recommendations as specified on product Material Safety Data Sheets (MSDS). Call 1-800-447-4369 or contact Dow via [www.dow.com/versene](http://www.dow.com/versene) to obtain MSDS for individual VERSENE products.

Figure 1 shows a schematic of a typical bulk handling facility for VERSENE liquid chelating agents. Table 2 provides specifications for equipment used in a bulk handling system.

## Storage tanks

**Materials of construction.** The preferred materials of construction for storage tanks for VERSENE chelating agents are lined steel, stainless steel (304L or 316L), or fiberglass reinforced plastic (FRP). *Contact with aluminum, copper, zinc, and nickel must be avoided.*

Copper, zinc, and nickel are chelated by VERSENE products, rendering them ineffective for their intended use and increasing the potential for chelant spills. Storage of VERSENE 100, VERSENEX 80, or VERSENOL 120 chelating agents in aluminum can generate hydrogen gas, which is explosive.

Table 1. Typical Physical Properties for VERSENE Liquid Chelating Agents<sup>1</sup>

| Physical Property     | VERSENE™ 100 | VERSENEX™ 80 | VERSENOL™ 120 |
|-----------------------|--------------|--------------|---------------|
| Density g/mL at 25°C  | 1.29-1.33    | 1.28-1.32    | 1.26-1.31     |
| Freezing Point, °C    | -31          | -28          | -34           |
| Boiling Point, °C     | 106-107      | 106-107      | 106-107       |
| Viscosity, cps        |              |              |               |
| at 0°C                | 90           | 170          | 132           |
| 20°C                  | 26           | 43           | 21            |
| 40°C                  | 11           | 17           | 14            |
| 60°C                  | 6            | 9            | 7             |
| 80°C                  | 4            | 5            | 5             |
| Vapor Pressure, mm Hg |              |              |               |
| at -10°C              | 1.8          | 1.9          | 2.6           |
| 0°C                   | 3.8          | 4.0          | 5.3           |
| 10°C                  | 7.7          | 7.9          | 10            |
| 20°C                  | 15           | 15           | 18            |
| 30°C                  | 27           | 26           | 32            |
| 40°C                  | 46           | 44           | 52            |
| 50°C                  | 77           | 72           | 84            |
| 60°C                  | 124          | 114          | 130           |
| 70°C                  | 194          | 175          | 195           |
| 80°C                  | 294          | 261          | 286           |
| 90°C                  | 435          | 380          | 409           |
| 100°C                 | 629          | 541          | 573           |
| 110°C                 | 888          | 754          | 787           |
| 120°C                 | 1230         | 1030         | 1060          |
| 130°C                 | 1670         | 1390         | 1410          |
| 140°C                 | 2240         | 1830         | 1840          |
| 150°C                 | 2950         | 2390         | 2370          |

<sup>1</sup>Typical properties, not to be construed as specifications.

If a lined steel tank is chosen for storage, Epoxy Coat F, Plasite 9570 or 7122, or a proven equivalent resin should be used as the lining. In preparing the inside surface for coating, all rough welds should be ground smooth. However, welds do not necessarily have to be ground flush with the adjacent surface.

Where contamination by iron or color does not present serious problems, mild steel tanks are acceptable for storage of VERSENE™ liquid chelating agents.

Any rust or mill scale coming in contact with liquid VERSENE chelating agents will become loose and will be removed, yielding a discolored product. VERSENE liquid chelating agents are mild passivating agents which impart rust resistance to clean steel surfaces. For this reason, it is desirable to initially fill the tank completely with product in order to take advantage of this passivating effect.

Maintaining the alkalinity of VERSENE liquid chelating agents is important to ensure this passivating effect and corrosion resistance. The pH must never be reduced while the product is stored in mild steel equipment. When the above precautions have been observed, VERSENE liquid chelating agents can be stored in unlined steel tanks vented to the atmosphere. Under these storage conditions, a film of rust may form on surfaces above the level of the chelating agent, but rust will not form on surfaces consistently below this level.

**Gas blanketing.** Storage conditions may be improved by utilizing a pad of nitrogen or a similar gas that is essentially free of acidic constituents such as carbon dioxide or sulfur dioxide. This inert gas pad reduces the possibility of rust formation and provides the longest life for the chelant and mild steel storage equipment. Air or other gases should not be blown through the stored liquid. A pressure/vacuum relief valve will compensate for storage tank volume variances due to breathing.

**Table 2. Specifications for Bulk Handling Systems for VERSENE Liquid Chelating Agents**

| Tank                             |   |                           |   |
|----------------------------------|---|---------------------------|---|
| <b>Materials</b>                 | Stainless steel, lined steel, phosphatized steel <sup>a</sup> | <b>Weight/Gallon</b>      | 11.0  |
| <b>Lining</b>                    | Epoxy Coat F, Plasite 9570 or 7122                            | <b>Top Weld</b>           | Butt or lap weld outside <sup>b</sup>   |
| <b>Code</b>                      | API 650   | <b>Side Weld</b>          | Butt weld   |
| <b>P.V. Limits, min</b>          | Atmosphere  | <b>Bottom Weld</b>        | Butt or lap weld inside   |
|                                  |   | <b>Inlet Location</b>     | 12" off bottom <sup>c</sup>   |
|                                  |   | <b>Outlet Location</b>    | 1/2 nozzle diameter + 4" off bottom <sup>c</sup>  |
|                                  |   | <b>Recycle Location</b>   | 1/2 nozzle diameter + 4" off bottom <sup>c</sup>  |
| Valves and Lines                 |   |                           |   |
| <b>Tank Valve Type</b>           | Gate or ball with PTFE packing                                | <b>Pipe Materials</b>     | Stainless Steel (304L or 316L) <sup>a</sup>   |
|                                  |   | <b>Materials</b>          | Stainless steel (304L or 316L)  |
| <b>Line Valve Type</b>           | Gate or ball with PTFE packing                                | <b>Lining</b>             | None  |
|                                  |   | <b>Materials</b>          | Stainless steel (304L or 316L)  |
|                                  |   | <b>Truck Line</b>         | Required, 3" min.   |
|                                  |   | <b>T/C Line</b>           | Required, 3" min.   |
|                                  |   | <b>Recycle Line</b>       | Required, 2" min.   |
|                                  |   | <b>Drum Line</b>          | Optional  |
| Miscellaneous Equipment          |   |                           |   |
| <b>Dock Pump Type</b>            | Centrifugal   | <b>Filter Material</b>    | Stainless steel (304L or 316L) construction   |
|                                  |   |                           |   |
| <b>Tank Pump Type</b>            | Centrifugal   | <b>Type</b>               | Cartridge, 10 micron polypropylene wound (3M Cuno or equivalent)  |
|                                  |   |                           |   |
| <b>Tank Level Indicator Type</b> | Automatic float   | <b>Gaskets Material</b>   | Garlock 3510 or barium sulfate sealed PTFE  |
| <b>Tank Mixing Eductor Type</b>  | Penberthy CTE or equivalent                                   | <b>Type</b>               | Standard flat ring  |
|                                  |   | <b>Tape</b>               | PTFE or equivalent  |
|                                  |   | <b>Tube</b>               | Polypropylene   |
|                                  |   | <b>Hoses</b>              | Seamless stainless steel (304L or 316L), or chemical resistant flex hose (PTFE lined with Viton O-ring) |
|                                  |   | <b>Type and Materials</b> | Stainless steel wetted parts  |
|                                  |   | <b>Seals</b>              | Mechanical  |

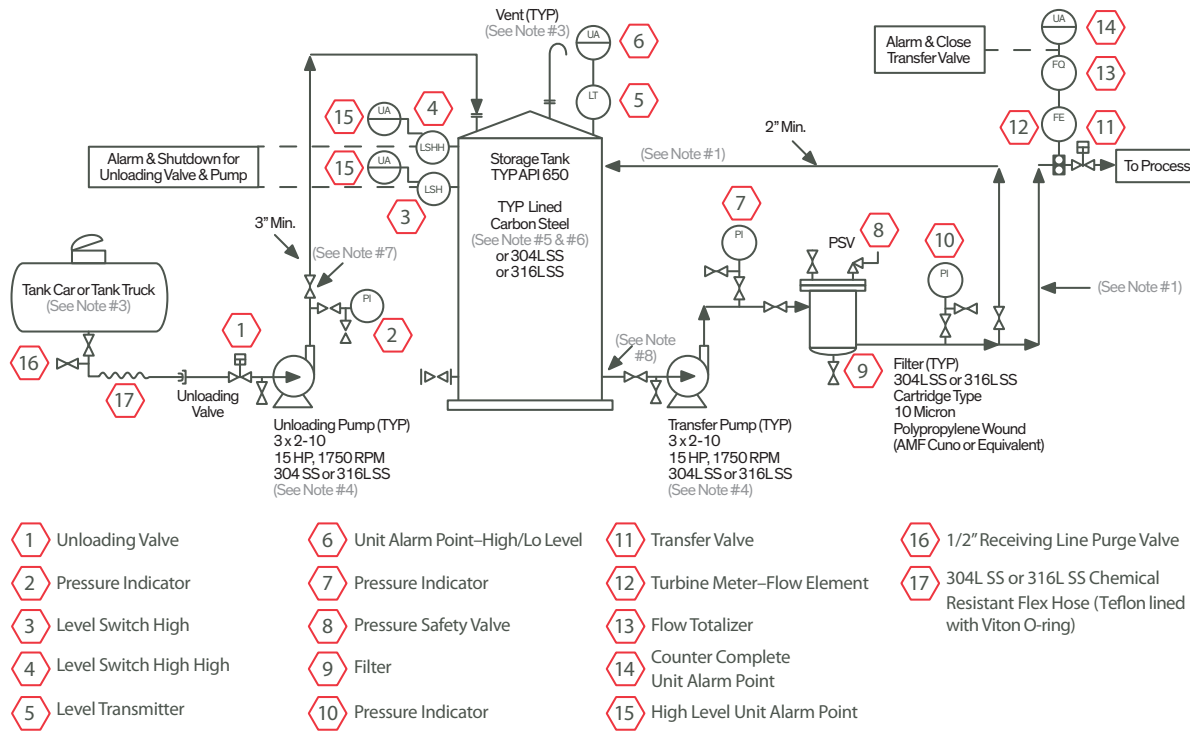
<sup>a</sup>Do not allow chelating agent to contact aluminum, copper, zinc or nickel

<sup>b</sup>If tank is lined, lap weld inside, too.

<sup>c</sup>Locate inlet and recycle 90° from outlet. Terminate recycle with internal eductor.

NOTE: TANK TRUCK OFFLOADING CONNECTIONS—Tank trucks carrying VERSENE liquid chelating agents are equipped with 3-inch male quick disconnect fittings. Dow's carriers also carry 3-inch female and 2-inch male quick disconnect reducers. The customer, then, has a choice to hook up to either a 2-inch or 3-inch quick disconnect fitting. Customers should specify which connection they plan to use so that the question does not have to be asked by our Customer Service representatives each time an order is placed.

**Figure 1. Typical Bulk Handling System**



**NOTES**

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|--|--|---|
| 1. Recycle can be bottom entry by using a tank mixing eductor by Penberthy CTE or equivalent | 4. Low amp pump shutdowns may be adapted to prevent dry pump operation | 7. Valves: Gate, Ball, or Plug, SS with seams |
| 2. Piping materials are typically 304L SS or 316L SS   | 5. Tank linings: Plasite 7122/9570/4550/9060                           | 8. Tank inlet/discharge 12" off bottom        |
| 3. Tank vent should be sized for adequate tank protection                                    | 6. If tank is lined, lapweld inside seams                              |   |

## Recommended Auxiliary Equipment

**Pumps.** A centrifugal pump, constructed of type 304L or 316L stainless steel, is recommended.

**Pipes and fittings.** Pipes should be ASTM A-312 GR TP-304L. Welds should be flush outside and inside, with pipe fully solution annealed, pickled, and passivated. Standard grade TP-304 may also be used.

**Valves.** Valves should be gate valves constructed of ASTM A351 GR CF8M with PTFE packing with a bolted bonnet and PTFE packing. Ball valves may also be used with ASTM A351 CR CF8M with a 316 stainless ball with a molecularly enhanced PTFE or PFA seating and packing.

**Tank level indicator.** The tank level indicator should be of the float type.

**Tank mixing eductors.** Tank mixing eductors should be Penberthy CTE or equivalent.

**Filter.** Construction should be of 304L or 316L stainless steel. A cartridge type, such as Model 304 WKG-10-2F from Commercial Filter Corporation or equivalent, is suggested.

**Gaskets.** Standard flat ring gaskets. 1/8" thick Garlock 3510 Fawn are suggested. Tape 1/2" by 3 mils thickness made of Teflon resin or equivalent is suggested for use as a joint compound.

**Heat tracing.** VERSENE™ liquid chelating agents should be stored at ambient temperature. If freezing is a threat, installation of heat tracing is recommended.

**Materials to avoid.** Brass, copper, most copper-containing alloys, galvanized iron, and aluminum are not suitable materials of construction for use in handling and storage of VERSENE liquid chelating agents. Aluminum is especially unsuitable since it will react vigorously with the excess caustic in liquid chelating agents to produce hydrogen gas, which is flammable and explosive.

Strong oxidizing agents such as sodium hypochlorite, chromic acid, potassium permanganate, and higher concentrations of hydrogen peroxide will degrade all of these chelating agents.

# Health and Safety Considerations

For health, environmental, and safety information for VERSENE™ 100, VERSENEX™ 80, and VERSENL™ 120 liquid chelating agents, consult the current Material Safety Data Sheets (MSDS) for these products. The MSDS are available from Dow and should be reviewed *before* handling these products. To receive the most current MSDS, call your local distributor or call Dow at 1-800-447-4369, or contact Dow via [www.dow.com/versene](http://www.dow.com/versene).

# Environmental and Disposal Information

**Action to take for spills or leaks:** Sweep up and wash remainder down with water. Avoid wash water entering natural waterways or public water supplies.

**Disposal method: Do not dump into any sewers, on the ground, or into any body of water.** For unused or uncontaminated material, the preferred management options are to send to a licensed recycler, reclaimer, or incinerator. The same management options are recommended for used or contaminated material, although additional evaluation is required (see, for example, 40CFR Part 261, "Identification and Listing of Hazardous Waste"). Any disposal practice must be in compliance with federal, state, provincial, and local laws and regulations. Check with appropriate agencies for your location.

**Combustion Characteristics:** These chelating agents, like most organic materials, will burn under the right conditions of heat and oxygen supply. Fires can be extinguished by conventional means.

Fire and explosion hazards with chelating agents occur when dusts are permitted to reach critical levels in air. Combustion products of incinerated chelating agents are typical of burning waste. Incineration should be done in conformance with local, state and federal air pollution standards.

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For more information, complete literature, and product samples, you can reach a Dow representative by calling the following phone numbers.

|                      |   |                        |
|----------------------|---|------------------------|
| <b>US and Canada</b> | 1-800-447-4369  | <b>dow.com/versene</b> |
| <b>Mexico</b>        | 01800 0834913   |                        |
| <b>Europe</b>        | +800 3694 6367<br>or +31 11567 2626<br>FAX +31 11567 4704 |                        |

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