Bulk handling and storage of molten EASTOTAC™ hydrocarbon resins

Foreword

Eastotac™ resins are hydrogenated hydrocarbon tackifying resins that are characterized by low odor, good solubility, good heat stability, and low color. They also exhibit good tackifying characteristics and broad compatibility with numerous elastomers, polymers, and other resins.

Eastotac resins are used in a wide variety of applications. Components in pressure sensitive adhesives, hot-melt adhesives, and sealants are major applications.

All Eastotac resins are available in flaked form in four softening points: 100°C, 115°C, 130°C, and 142°C. Most of these softening points are available in a variety of color grades ranging from a Gardner™ color of <1 to 8. More information on flaked Eastotac resins can be obtained by contacting Eastman at the address and phone number listed on the back of this brochure.

Two Eastotac hydrocarbon resin formulas are available for molten shipping: H-100R and H-130R. The color of these products will typically be a 4 on the Gardner™ scale.

Introduction

This publication contains information on bulk storage and handling of molten Eastotac hydrocarbon resins, including tank components and materials as well as tank truck unloading. This information must be considered solely as a general guide in establishing procedures and facilities for handling these materials. Customers must determine for themselves the appropriate procedures and facilities for their particular operations.

In addition to this publication, pertinent Safety Data Sheets (SDS) and other applicable safe handling information should be thoroughly reviewed prior to the handling of Eastotac resins. It is the customer's responsibility to direct and control the unloading of any chemical or material into or out of bulk storage and handling facilities.

Local and state regulations regarding the handling and storage of chemicals may vary widely. The federal Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), National Fire Protection Association (NFPA), and a user's insurance company also impose safety standards. In addition, the U.S. Department of Transportation (DOT) prescribes rules and regulations for unloading hazardous materials from tank trucks (see 49 CFR 100.199). The customer is directed to consult with the appropriate technical and regulatory experts for guidance in establishing safe and lawful handling procedures for their specific facilities.

Benefits of molten Eastotac hydrocarbon resins

Users of Eastotac hydrocarbon resins that plan to switch from flake to molten resins may be able to realize benefits including:

- Reduced production cycle times
- Reduced energy requirements
- Significant labor savings compared with handling flake form
- No packaging scrap to manage, handle, or dispose of
- Opening up needed warehouse space
- Quicker delivery time for tank trucks versus freight trucks

Thermal characteristics of Eastotac resins

Thermal characteristics play a key role in how materials handle when molten. At room temperature, Eastotac resins are amorphous, glasslike solids. Eastotac resins have no sharp melting points. Instead, they slowly change from solid to liquid over a range of 100°–130°C (212°–266°F). They can be pumped readily at 163°–200°C (325°–392°F).

For uniformity, the data in this publication is based on 190°C (375°F), at which both H-100R and H-130R resins are suitable for bulk handling. Curves based on the data should not be viewed as specification values but rather as averages representing performance that may be considered typical.

Eastotac resins are stable at room temperature. When exposed to oxygen at elevated temperatures for more than several hours, Eastotac resins usually show increased viscosity and color. For optimum stability when molten, the resin should be handled entirely in closed systems blanketed with an inert gas, such as nitrogen. The molten resins can be stored satisfactorily under nitrogen in a steel tank at 163°–200°C (325°–392°F).

For safe, efficient bulk handling, Eastotac resins should be kept molten; stored in heated, insulated tanks under an inert, gaseous blanket; and pumped through heated, insulated lines using heated, insulated pumps. Lines and tanks can be heated using hot oil, electric heaters, or high-pressure steam. Any residual water must be blown thoroughly from the internal heating coils with hot, dry, compressed nitrogen before the coils are connected to the hot-oil line. The customer is responsible for proper disposal of such water.

If an Eastotac resin solidifies in the tank, considerable time may be required to remelt it. Remelt time can be reduced by circulating the material with a pump as it melts. A heated, insulated circulating line should be used between the pump and the tank. Circulating a molten resin during tank storage keeps it at a nearly uniform temperature.

When handling molten Eastotac resins, safety precautions appropriate for handling hot liquids should be strictly observed.

Molten material spilled on surfaces subjected to high temperatures (e.g., storage tank, transfer line insulation) may oxidize rapidly and burn and should be cleaned up immediately and insulation replaced.

Bulk equipment

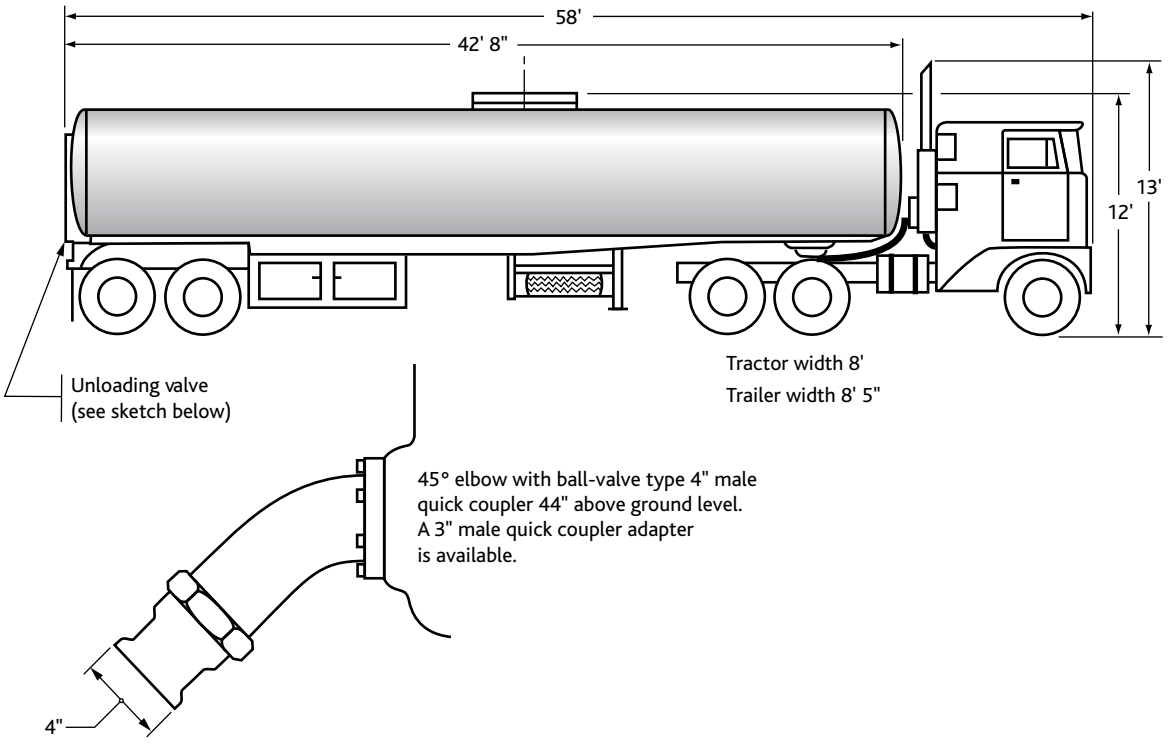
The following pages provide only general guidelines for unloading. It is the customer's responsibility to comply with all laws and regulations governing tank truck unloading.

Tank truck

Eastotac resins are shipped in 5,800- to 7,000-gallon insulated tank trucks. Figure 1 shows typical pertinent outside dimensions of the truck.

Each tank truck is equipped with electric heaters powered by a diesel generator. The heaters maintain the temperature of the resin at approximately 163°–200°C (325°–392°F), keeping it molten and pumpable during transit. An external 240-volt power source may also be connected to the heaters. The truck is not equipped with an unloading hose.

Figure 1 **Typical tank truck configuration 6,800–7,200 gal (42,000–44,000 lb)**



Bulk unloading

It is essential that care be taken when hot oil is used as a heating medium. Hot oil and water can create a hazardous situation.

Tank truck

The product discharge connection is at the rear of the truck (Figure 1). It has an unloading discharge fitting below the valve on a 45° elbow typically 44 inches above ground level.

The unloading (suction) line should be straight and short. It should be heated and, if possible, insulated. If the entire line cannot be heated, it should be thoroughly drained after each unloading operation. A short length of insulated, flexible metal hose with the appropriate end connection on the intake line will simplify joining to the tank truck discharge fitting. The unloading hose must be free of moisture before unloading is started. A rubber hose is not suggested for unloading since it cannot be heated. Heating is required if the material cools and stops or restricts flow inside the hose. With a flexible metal hose, resin flow can be restored by carefully heating the outside of the hose.

With the contents at 185°C (365°F), a 3-inch gear pump can unload the tank truck in approximately 2 to 4 hours. The unloading rate depends on diameters and lengths of the pump intake and discharge lines and the viscosity of the molten product. An inert gas pressure of about 25 psi on the contents of the trailer will shorten unloading time.

Pumps

A jacketed gear pump that can handle materials ranging from 163°–200°C (325°–392°F) is suggested for pumping Eastotac™ hydrocarbon resins. **Reciprocating and centrifugal pumps are not recommended.**

Rotary positive-displacement pumps, such as gear pumps, must be equipped with a discharge pressure-relief valve. In addition, a bypass line around the pump is suggested for regulating the pump discharge pressure and/or output. There should be a pressure gauge in the pump discharge line. A sealed water pressure gauge is suggested.

To achieve the maximum unloading rate, the pump and receiving storage tank should be as close to the unloading site as practical. When the tank truck is nearly empty, the unloading rate should be decreased to permit the remaining viscous material to drain from the wall toward the unloading outlet. This will allow the tank truck to empty as completely as possible. A bypass line around the pump can be used to alter the pumping rate. For specific applications, pump manufacturers should be consulted.

Eastotac resins can be unloaded without a pump. If unloading lines are large, short, and well heated, 20–25 psi of nitrogen on the tank truck can readily force the material into the receiving tank.

Nitrogen blanket—carrier

A nitrogen blanket is necessary for safe transport and unloading and helps ensure optimum quality of the molten Eastotac resins on arrival.

A 1-inch threaded pipe is available for connecting the nitrogen supply to the tank truck. The nitrogen supply must be sized in accordance with the rate of resin removal. This will avoid collapsing the tank truck. Approximately 9 cylinders of nitrogen will be required to maintain an inert gas pressure of 25 psi on a 6,000-gallon tank truck during unloading.

Each tank truck is equipped with a pressure relief valve (not a vacuum relief). However, as an added safety factor, it is suggested that the customer provide a relief valve in the nitrogen supply system. A standard pressure regulator should be used on the nitrogen cylinders followed by a standard relief valve set at the maximum allowable working pressure of the carrier's truck.

Bulk storage

Tank

An insulated, clean, dry, and heated steel tank is adequate for storing molten Eastotac hydrocarbon resin. The tank should be sufficiently large to provide ample reserve storage between deliveries. It is suggested that the tank hold at least twice as much product as the carrier truck. This reserve capacity simplifies the scheduling of deliveries.

The tank must have a heating medium provided. Maintaining Eastotac resins at 185°C (365°F) will require about 25 square feet of heating surface per 1,000-gallon storage capacity with the use of saturated steam at 600 psig. Storage tanks can be heated by various means, including internal and external coils. The tank should be well insulated and protected from the weather. A metal covering or other means should be used to adequately protect the insulation against spills.

The tank should be on a suitable foundation that meets appropriate federal, state, and local codes. To minimize static buildup, the tank should be properly grounded.

Dikes to contain spills should be considered, depending on proximity to other buildings and equipment. It is suggested that the system be designed with pressure safety valves, and indicators for pressure, temperature, and level.

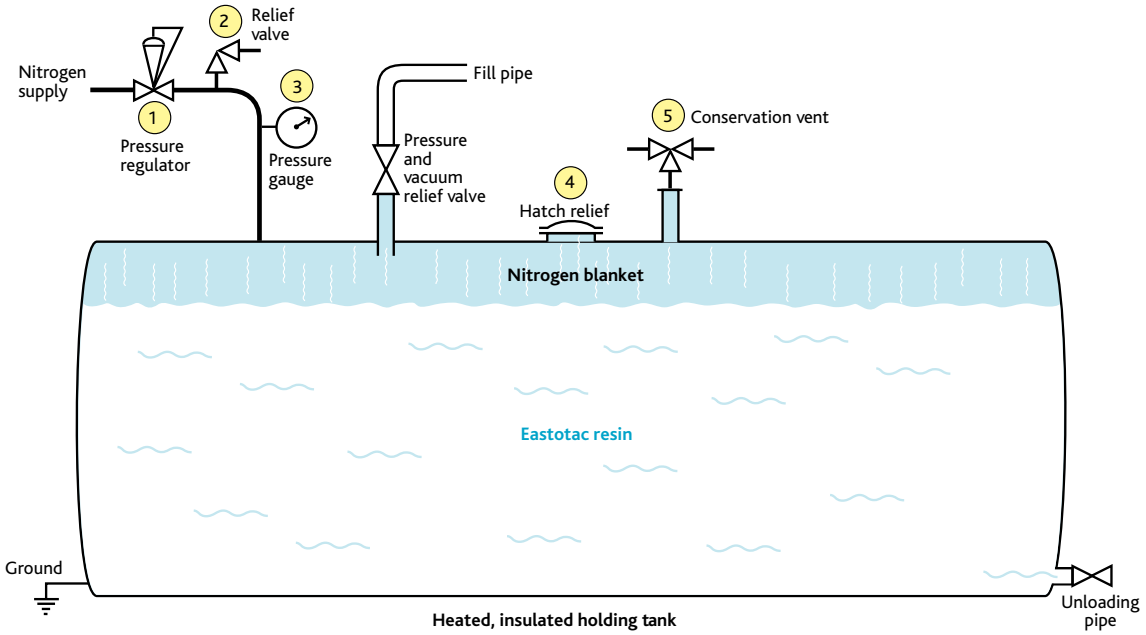
If any resin is spilled, check local regulations for disposal. The customer is responsible for proper disposal of any spilled material.

Nitrogen blanket—storage tank

The vapor space between the contents and the top of the storage tank will contain some concentration of volatile organic compounds that will vary over time. Therefore, it is strongly suggested that the vapor space in the storage tank be treated as though it is within explosive limits. A nitrogen gas blanket should be used to exclude air from materials that can form explosive mixtures. Blanketing the tank with inert nitrogen can help maintain optimum product quality and exclude oxygen that could otherwise contribute to ignition.

Figure 2 shows one possible design of the nitrogen system on a storage tank.

Figure 2 **Nitrogen blanketing of storage tanks**



1. Self-contained pressure reducer to maintain tank pressure.

2. Relief valve.

3. Pressure gauge (or manometer if desired).

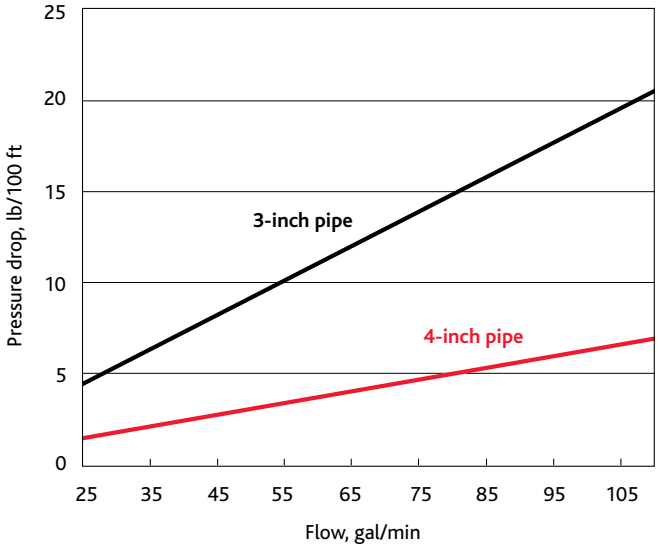
4. Hatch relief—relieves large surges in liquid or pressure.

5. Conservation vent—relieves excess pressure and vacuum.

Handling characteristics of Eastotac resins

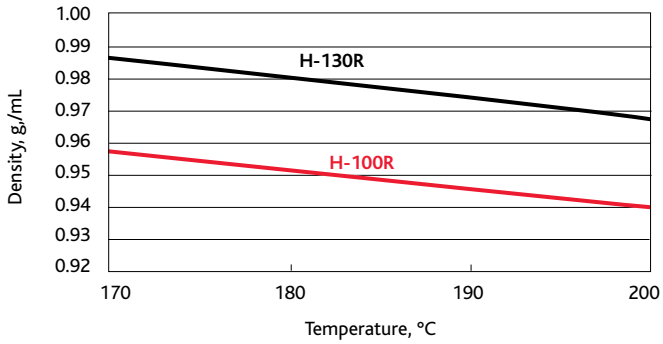
Specific heat—The specific heat of any substance will vary with temperature, usually increasing with increasing temperature. The specific heat of H-100R is approximately 0.38–0.49 cal/g/°C over a temperature range of 35°–155°C (95°–311°F). For the same temperature range, the approximate specific heat of H-130R is 0.29–0.50 cal/g/°C.

Figure 3 Pressure drop per 100 ft of pipe[a]



[a]*Data shown can apply to both formulas, H-100R and H-130R.*

Figure 4 Density vs. temperature



Viscosity

Viscosity of Eastotac resins is not a controlled parameter and will vary from lot to lot; however, average values are shown. At 190°C (374°F), the average viscosity is 155 cP for H-100R and 1,200 cP for H-130R.

Figure 5 H-100R viscosity change with temperature

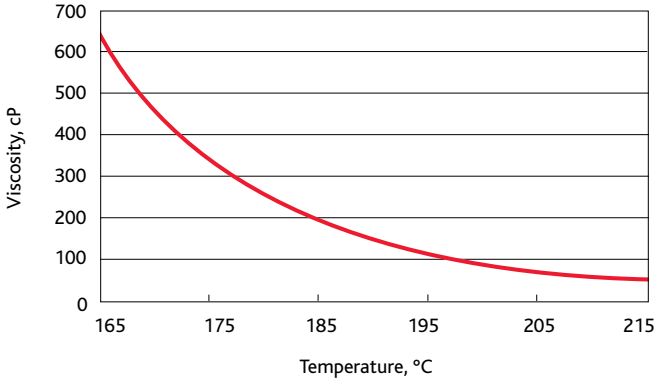
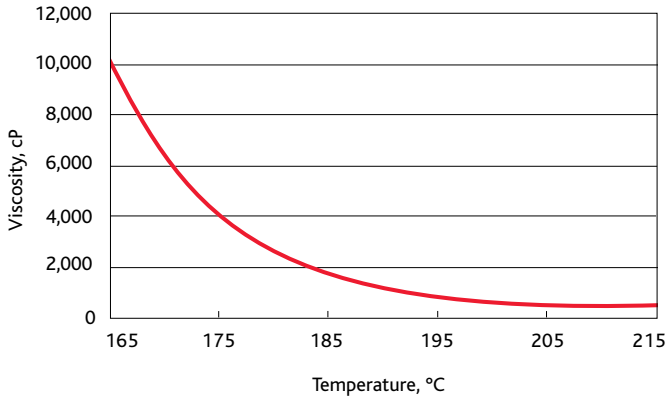


Figure 6 H-130R viscosity change with temperature



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