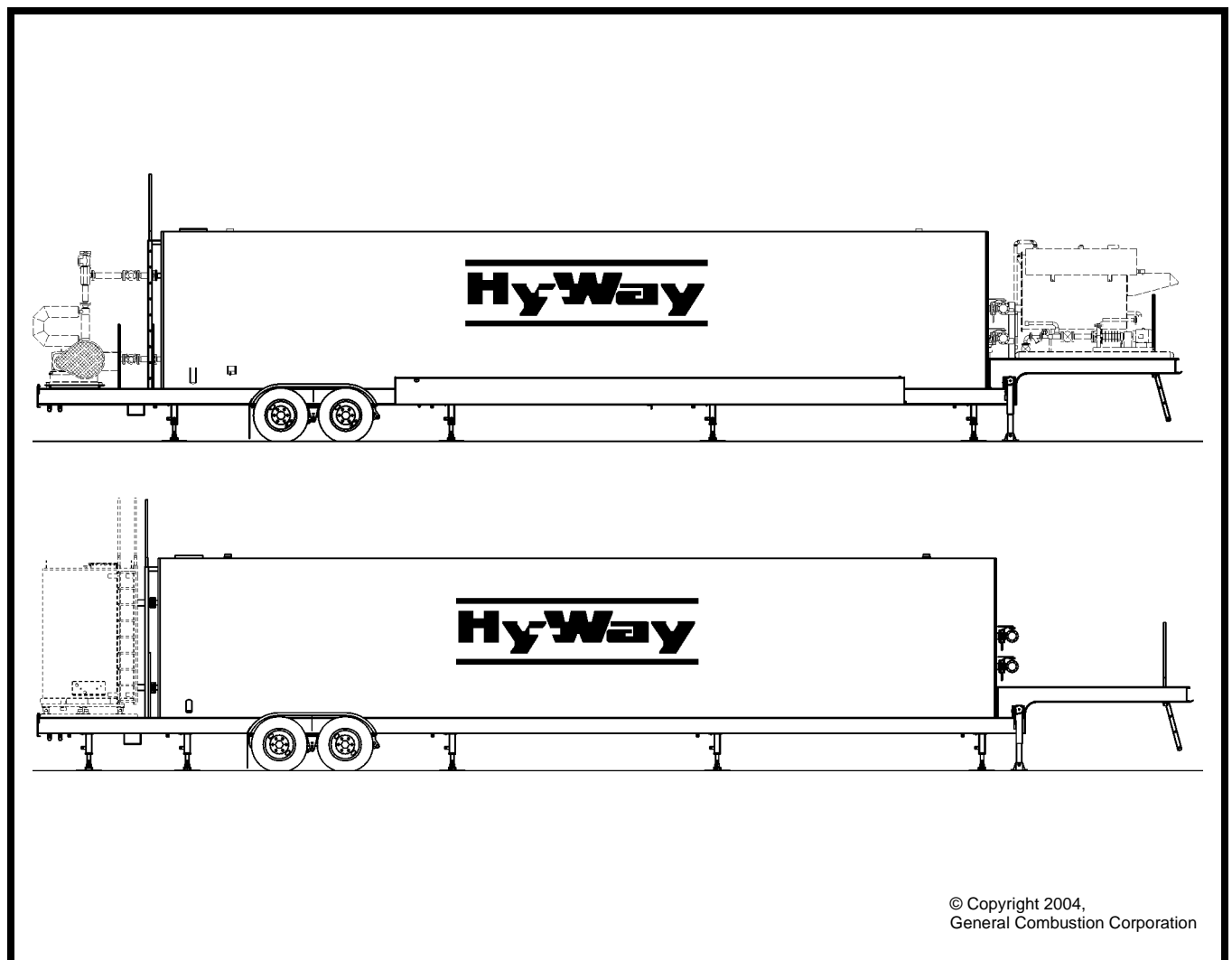


**GENERAL COMBUSTION**

Model CTT

# Horizontal Coil Storage Tank



## Operation, Installation & Service Manual



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## Safety Disclaimer

The information in this manual is not intended to cover every possible safety concern and hazard that might occur during hot mix asphalt (HMA) plant operations. General Combustion Corporation does not represent that this information is complete and all inclusive in terms of safety warnings. The use of caution and common sense while working in a HMA facility is the best safeguard against injury and equipment damage. It is the responsibility of plant owners and their designated officials to ensure and document training associated with ANSI (American National Safety Institute) procedures, OSHA (Occupational Safety & Health Administration) safety procedures, NFPA (National Fire Protection Agency) procedures, MSDS (Material Safety Data Sheets) guidelines, information provided by the manufacturer and the information contained within this manual. Users of General Combustion equipment and machinery must also install, operate, maintain, service and repair equipment in accordance with federal, state and local rules and regulations. Only competent, experienced and authorized personnel should perform maintenance or operational duties. Failure to observe the above written statements can result in costly equipment damage and or fatal injury.

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Additional Operation and Service manuals are available. For more information about pricing and reordering, contact the Parts Department at (407) 290-6000.

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# Section 1 - General Safety

---

## 1.1 General Safety Guideline



**READ THIS OPERATING MANUAL PRIOR TO PERFORMING ANY INSTALLATION OR START UP. INSTALL, OPERATE AND MAINTAIN ALL EQUIPMENT IN ACCORDANCE WITH THE ORIGINAL EQUIPMENT MANUFACTURER'S INSTRUCTIONS, FEDERAL, STATE AND LOCAL REGULATIONS.**

- Keep all operating personnel advised of the location and operation of all emergency controls and devices. Clear access to these controls and devices must be maintained.
- Maintain a safety equipment operation/maintenance training program for all employees in accordance with all applicable federal, state and local guidelines.
- Use appropriate lifting equipment when installing.
- Never start or operate any equipment until all plant personnel have been accounted for and are clear of the equipment.
- Follow all OSHA regulations regarding Lockout/Tagout and Confined Space procedures, NAPA standards regarding Asphalt Plant Safety and NEC requirements for electrical installation.

## 1.2 Handling of Liquid Hot Asphalt - General Safety

The safe handling, transportation and storage of hot asphalt is the responsibility of everyone involved, including owners, managers, supervisors, drivers and workers.

The handling, transportation and storage of hot asphalt requires:

- Strict adherence to the employer's safety rules, including the specific rules of the individual host facility.
- Complete understanding and proper operation of personal protective equipment and fall protection systems.
- Proper operation of unloading and loading equipment, tanker-trucks and storage tanks.
- Proper operation of all material handling equipment.
- Commitment to maintaining the safety of co-workers, equipment and property.

Maintaining worker and site safety requires full compliance and understanding of all applicable federal, state and local regulations, code requirements and industry practices. For work in the United States, any task involving hot asphalt, storage tanks or tanker-trucks should not begin without first meeting the requirements of the U.S. Occupational Safety and Health Administration (OSHA), as set forth in the Occupational Standards for General Safety (29CFR Part 1910). OSHA requirements for personal protective equipment are found in subpart 1 of Part 1910. OSHA standards can also be found on their website at <http://osha.gov>.

### 1.3 Use Personal Protective Equipment

All employees whose duties require exposure to hazards should use protective equipment. Appropriate equipment may include protective equipment for eyes, face, ears, head, feet and hands. Other protective equipment can and should include protective clothing, respiratory devices, safety harnesses and protective shields. Each employee should be instructed in the proper use and maintenance of equipment and the circumstances under which it shall be used.

The safe handling of hot asphalt during the unloading process requires special considerations and safety. Make sure your Personal Protection Equipment (PPE) is in good condition and properly worn.

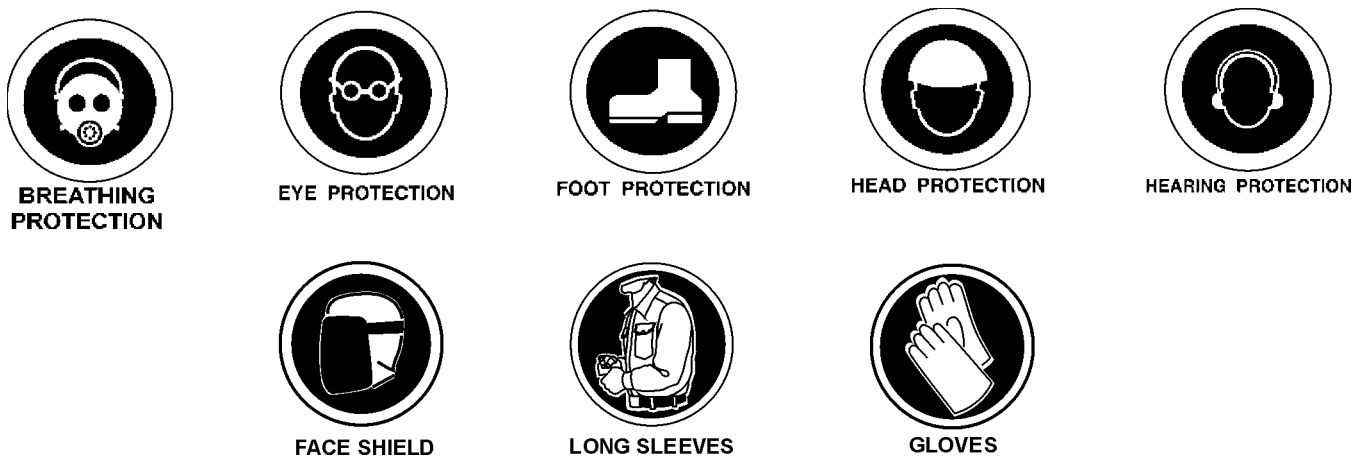


Figure 1-1: Personal Protective Equipment

### 1.4 Electrical Safety

Construction, erection, and operation of equipment under or near on-site high voltage power lines can be extremely dangerous. Minimum clearance requirements vary according to voltages involved and code requirements. Responsibility for compliance with all applicable codes is the responsibility of the purchaser and the lifting agent. When ever possible, avoid using a crane to retrieve equipment or components from beneath or near power lines. All electrical connections should be checked to ensure that they comply with the maximum requirement of the National Electrical Code (NEC). Only qualified electricians should perform electrical installation.

## 1.5 Vapor Hazard



**THIS TANK MAY STORE MATERIAL THAT IS FLAMMABLE OR EXPLOSIVE, OR IF THE STORED MATERIAL PRODUCES FLAMMABLE OR EXPLOSIVE GAS WHEN EXPOSED TO HEAT, YOU MUST THOROUGHLY CLEAN AND VENTILATE THE TANK BEFORE DOING ANY OF THE FOLLOWING:**



NO OPEN FLAME



NO SMOKING

- Welding/soldering/brazing on the tank.
- Using a cutting torch on the tank.
- Exposing the tank to any open flame or excessive heat.
- Failure to properly clean and ventilate the tank before performing any of the above actions may lead to an explosion or fire.

## 1.6 OSHA Confined Space Entry Rule

A permit-required confined space (PRCS) is a space that contains or has the potential to contain a hazardous atmosphere, has potential for engulfment or entrapment, has an internal configuration that could trap or asphyxiate the entrant and/or contains any other recognized serious safety or health hazard. Typical confined spaces in an HMA facility include: drums, silos, exhaust fans, ductwork, baghouses and storage tanks.

## 1.7 OSHA Lockout/Tagout



BE FAMILIAR WITH ALL OSHA REGULATIONS REGARDING LOCKOUT/TAGOUT AND ENERGY CONTROL STEPS AND PROCEDURES PRIOR TO INSTALLING, OPERATING OR SERVICING ANY EQUIPMENT. THE FOLLOWING INFORMATION IS NOT INTENDED TO BE COMPLETE AND ALL INCLUSIVE IN TERMS OF STEPS AND PROCEDURES. REFER TO THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION DEPARTMENT OF LABOR CODE OF FEDERAL REGULATIONS.

According to OSHA Federal Regulations **lockout/tagout** is the placement of a lockout device and prominent warning device which can be locked and securely fastened to an energy isolating device in accordance with established procedure, to indicate or ensure that the isolating device and the equipment being controlled may not be operated until the lockout or tagout devices are removed.

A **lockout device** is a device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in a safe position and prevent the energization of a machine or equipment. Included are blank flanges and bolted slip binds.

A **tagout device** is a prominent warning device, such a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating and the equipment being controlled may not be operated until the tagout device is removed.

Furthermore, lockout/tagout procedures must include an **energy control program**. The employer or facility must establish a program consisting of energy control procedures, employee training and periodic inspections. This program shall be implemented to ensure that all applicable equipment and machinery are free from unexpected energizing, start up or release of stored energy, which could cause injury, prior to performing maintenance or service. This includes, but is not limited to workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. Even simple routine operations like lubricating, cleaning, clearing jammed machinery and making minor adjustments may expose employees to unexpected start-up or release of stored energy. In order to eliminate the possibility of unexpected start-up or the release of stored energy, the machinery or equipment shall be shut off, isolated, locked, blocked and all stored energy dissipated.

**Some common forms of energy or stored energy in the workplace include:**

- |                    |   |
|--------------------|---|
| <b>Electrical:</b> | Currents that flow through conductors such as wires and cables.             |
| <b>Hydraulic:</b>  | Water or other liquid that moves through pipes or hoses.                    |
| <b>Pneumatic:</b>  | Pressurized steam, gases or compressed air.                                 |
| <b>Mechanical:</b> | Stored or built up energy in springs.                                       |
| <b>Chemical:</b>   | Fuel or other chemical compounds and substances that have energy potential. |
| <b>Thermal:</b>    | Heat or stored heat that has energy potential.                              |

## 1.8 Energy Control Steps

Prior to performing any maintenance or service on machinery or equipment, an authorized employee is required to follow a series of specific steps to ensure that all energy or potential energy has been controlled:

1. Determine and document what energy powers the machine, the amount of energy, the hazards and the method used to lockout and control the energy.
2. Notify all affected employees that the equipment will be shut down and locked out for service or maintenance.
3. Turn off the machine or equipment.
4. Deactivate the energy isolating devices, such as the circuit breaker; disconnect switch or other devices that provide energy to the machine or equipment.
5. Lockout and/or tagout the energy control switches in an "OFF" and "SAFE" position to prevent accidental start-up or energy releases.
6. Release or block stored energy such as tension in springs, trapped pressure or gravity driven moving parts.
7. Double check for safety by testing the operating controls. An authorized employee should make sure all employees are clear of machinery to be tested, then put all controls in the ON position. Confirm that there is no power to the machinery and that the equipment cannot operate. Use a voltmeter to verify that there is no power to the equipment. Turn the control back to the OFF position.
8. Once power is securely locked/tagged out to prevent accidental energization and all previous steps have been completed, perform the necessary repair or maintenance.
9. The authorized employee who installed the lock or tag may remove it.

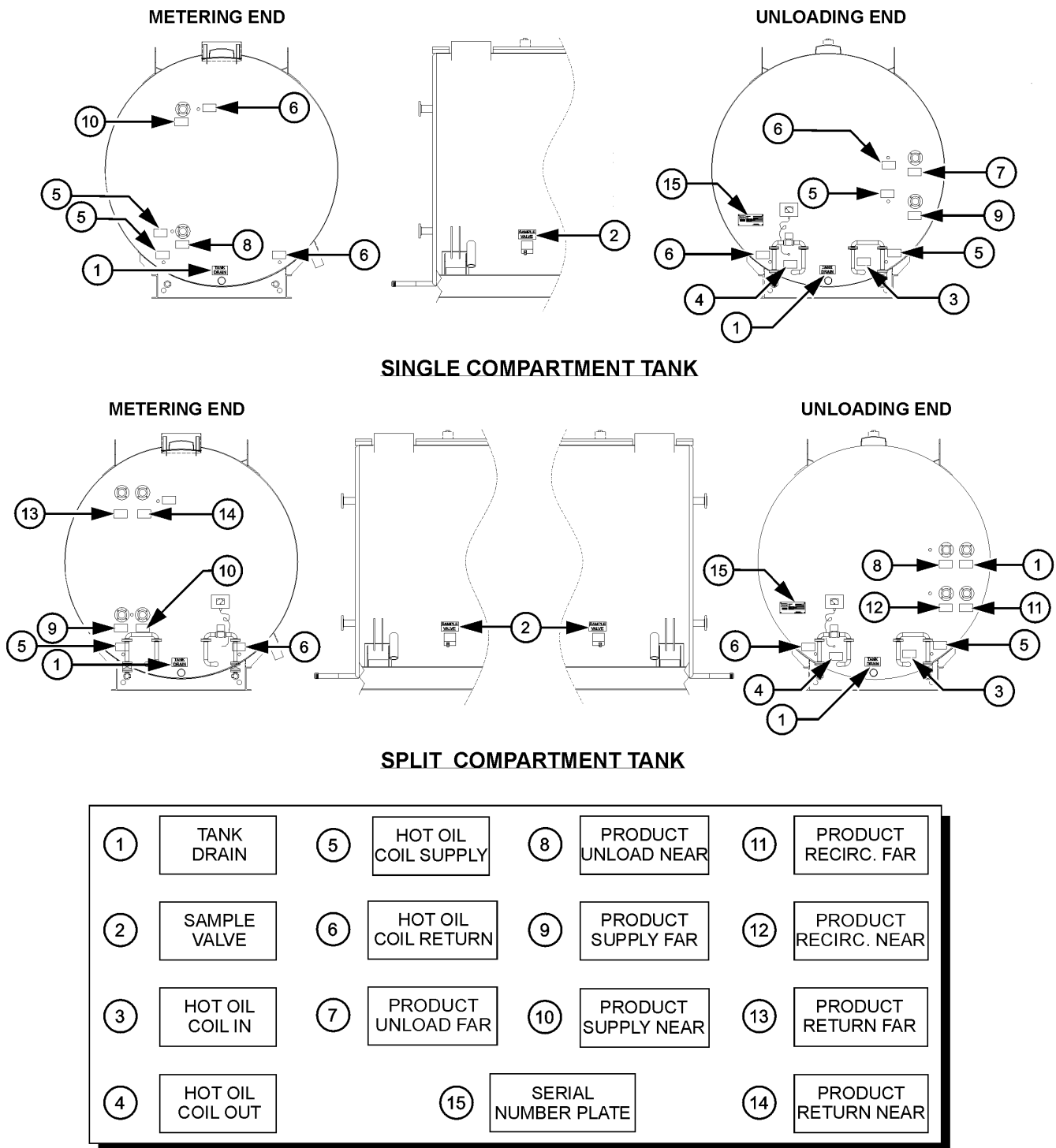


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**Figure 1-2: Lockout / Tagout Procedure**

## 1.9 Warning Decals & Identification Plaques

Your horizontal coil storage tank comes labeled with a variety of warning decals that must not be ignored. The illustration below provides an overview of all these decals.



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**Figure 1-3: Horizontal Coil Storage Tank Decal Locations**

## 1.10 Scope of Manual

These operational instructions are furnished to serve as a general guide for operating, troubleshooting, and maintenance of your new General Combustion unit. They are not intended to cover all potential operational problems, nor variations in equipment use, but rather to assist the operator in operating and troubleshooting the equipment to perform within the designated capabilities.

Only qualified personnel, thoroughly familiar with this General Combustion product, should attempt to operate, troubleshoot, or perform maintenance on this equipment. Written instructions are not intended to replace the intelligent thinking and reasoning of any operator, nor to relieve the operator of the responsibility of operating the equipment as it is designed to be used.

The responsibility and liability of General Combustion Corporation for this equipment is adequately covered in the sales contract and assumes no other responsibilities, nor permits any employee to accept or assume the responsibility for any equipment not so specified. Competent supervision and consultation are necessary to maintain safe, reliable, low cost operation of any equipment. Should the need arise for any additional information regarding the operation of this equipment, you are encouraged to call the Service Department of General Combustion Corporation at 407-290-6000.



**BEFORE ATTEMPTING TO INSTALL OR OPERATE THIS PRODUCT, READ THE OPERATING INSTRUCTIONS CAREFULLY AND UNDERSTAND THEM THOROUGHLY. IF IN DOUBT ABOUT ANY OPERATIONAL SEQUENCE OF THIS EQUIPMENT OR THE INSTALLATION OR PERFORMANCE THEREOF, DO NOT HESITATE TO CONTACT US BEFORE ATTEMPTING OPERATIONS BY CALLING OUR SERVICE DEPARTMENT. SERVICE CAN BE CONTACTED FROM 8:00 A.M. TO 5:00 P.M. EST, MONDAY THROUGH FRIDAY, AT 407-290-6000. AFTER HOURS SERVICE IS AVAILABLE THROUGH THE AFTER HOURS ANSWERING SERVICE.**

## ***1.11 List of Warnings, Cautions & Notes Used in Manual***

### ***1.11.1 Symbols Defined***

The warnings, cautions and notes listed below are used in this manual. Read all of them carefully and follow the instructions when performing the procedures. The symbols shown below are used to call your attention to some procedures that could cause death or injury to personnel and/or damage to equipment.



**A WARNING MEANS THAT A PROCEDURE THAT FOLLOWS COULD CAUSE DEATH OR INJURY TO YOU OR OTHER PERSONNEL IN THE AREA IF THE PROCEDURE IS NOT FOLLOWED AS WRITTEN.**



**A CAUTION MEANS THAT A PROCEDURE THAT FOLLOWS COULD CAUSE DAMAGE TO EQUIPMENT OF THE PROCEDURE IS NOT FOLLOWED AS WRITTEN.**



**A KEY INFO NOTE MEANS THE INFORMATION THAT FOLLOWS IS IMPORTANT, BUT CAN NOT POSE A DANGER TO EQUIPMENT OR FATAL INJURY TO PERSONNEL.**



### 1.11.2 Complete List



**THIS TANK MAY STORE MATERIAL THAT IS FLAMMABLE OR EXPLOSIVE, OR IF THE STORED MATERIAL PRODUCES FLAMMABLE OR EXPLOSIVE GAS WHEN EXPOSED TO HEAT, YOU MUST THOROUGHLY CLEAN AND VENTILATE THE TANK BEFORE DOING ANY OF THE FOLLOWING:**



**BE FAMILIAR WITH ALL OSHA REGULATIONS REGARDING LOCKOUT/TAGOUT AND ENERGY CONTROL STEPS AND PROCEDURES PRIOR TO INSTALLING, OPERATING OR SERVICING ANY EQUIPMENT. THE FOLLOWING INFORMATION IS NOT INTENDED TO BE COMPLETE AND ALL INCLUSIVE IN TERMS OF STEPS AND PROCEDURES. REFER TO THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION DEPARTMENT OF LABOR CODE OF FEDERAL REGULATIONS.**



**BEFORE ATTEMPTING TO INSTALL OR OPERATE THIS PRODUCT, READ THE OPERATING INSTRUCTIONS CAREFULLY AND UNDERSTAND THEM THOROUGHLY. IF IN DOUBT ABOUT ANY OPERATIONAL SEQUENCE OF THIS EQUIPMENT OR THE INSTALLATION OR PERFORMANCE THEREOF, DO NOT HESITATE TO CONTACT US BEFORE ATTEMPTING OPERATIONS BY CALLING OUR SERVICE DEPARTMENT. SERVICE CAN BE CONTACTED FROM 8:00 A.M. TO 5:00 P.M. EST, MONDAY THROUGH FRIDAY, AT 407-290-6000. AFTER HOURS SERVICE IS AVAILABLE THROUGH THE AFTER HOURS ANSWERING SERVICE.**



**MAKE SURE THE GROUND IS THOROUGHLY COMPACTED. THE SOIL NEEDS TO HAVE A BEARING CAPACITY OF 4,000 POUNDS PER SQUARE FOOT AND GRADED TO GRADE ZERO.**



**FAILURE TO FOLLOW THE SPECIFIC ERECTION PROCEDURES MAY RESULT IN PROPERTY DAMAGE AND/OR INJURY TO PERSONNEL. THE OWNER'S PRIMARY RESPONSIBILITY IS TO CONTINUALLY MONITOR THE ERECTION PROCEDURES AND TO GIVE CORRECT INSTRUCTIONS TO THE CONTROLS OPERATOR.**



**BEFORE STARTING THE ERECTION OF A HORIZONTAL COIL HEATED TANK IT IS IMPORTANT THAT THE WHOLE CREW BE BRIEFED ON THE SAFETY HAZARDS THAT EXIST WHILE ERECTING A HORIZONTAL COIL HEATED TANK AND WHAT PRECAUTIONS TO TAKE TO AVOID THESE HAZARDS.**



**MAKE SURE THE GROUND IS THOROUGHLY COMPACTED. THE SOIL NEEDS TO HAVE A BEARING CAPACITY OF 4,000 POUNDS PER SQUARE FOOT AND GRADED TO GRADE ZERO.**



**FAILURE TO PLACE THE CRIBBING/STEEL PLATE UNDER THE LANDING GEAR COULD RESULT IN THE CTT LANDING GEAR TO SETTLE INTO THE GROUND AND/OR POSSIBLE DAMAGE TO THE CTT.**



**DISCONNECTING THE AIR BRAKE LINES AUTOMATICALLY “LOCK” THE BRAKES. TO UNLOCK THE BRAKES THE AIR IN THE AIR CANISTER MUST BE BLED DOWN.**



**DISCONNECTING THE AIR BRAKE LINES AUTOMATICALLY “LOCK” THE BRAKES. TO UNLOCK THE BRAKES THE AIR IN THE AIR BRAKE CANISTER MUST BE BLED DOWN.**



**FAILURE TO PLACE THE CRIBBING/STEEL PLATE UNDER THE LANDING GEAR COULD RESULT IN THE CTT TANK TO SETTLE INTO THE GROUND AND/OR CAUSE POSSIBLE DAMAGE TO THE CTT TANK.**



**BEFORE BLEEDING THE AIR BRAKE CANISTER, LOWER THE LANDING GEAR, RAISE ALL JACK SCREWS AND CHOCK THE TANK WHEELS. FAILURE TO SECURE THE TANK TO PREVENT ACCIDENTAL MOVEMENT COULD RESULT IN DAMAGE TO THE TANK OR SERIOUS INJURY.**



**TEMPERATURE CONTROLLERS MAY VARY ACCORDING TO PURCHASE OPTIONS. REFER TO APPENDIX A: MANUFACTURER'S DATA FOR ADDITIONAL POWER INSTALLATION INSTRUCTIONS, AND APPENDIX C: DRAWINGS FOR YOUR SPECIFIC WIRING DIAGRAM.**



**BEFORE ENTERING THE STORAGE TANK, A THOROUGH REVIEW OF OSHA'S CONFINED SPACE ENTRY PROCEDURES AND ANY EXISTING COMPANY SAFETY PROCEDURES/POLICIES REGARDING CONFINED SPACE ENTRY SHOULD BE REVIEWED AND FOLLOWED. FAILURE TO FOLLOW THESE PROCEDURES COULD RESULT IN SERIOUS INJURY OR DEATH.**



**IT IS THE RESPONSIBILITY OF THE OPERATOR TO KNOW THE PROPER TEMPERATURE RANGE SET POINT FOR THE PRODUCT BEING STORED.**



**HYDROGEN SULFIDE IS A HIGHLY TOXIC AND FLAMMABLE GAS AND CAN REACH HAZARDOUS CONCENTRATIONS INSIDE A STORAGE TANK. AT HIGH CONCENTRATIONS, IT IS ODORLESS BECAUSE IT QUICKLY DEADENS THE SENSE OF SMELL.**



**THIS SECTION ONLY APPLIES TO THE SPECIFIC MODEL CTT TANKS COVERED WITHIN THIS MANUAL.**



**A 100-GALLON EXPANSION TANK IS USED, AND IS FACTORY MOUNTED AND PIPED DIRECTLY ON THE HEATER.**



**THE TOP COVER ON THE TANK SHOULD BE OPENED BEFORE UNLOADING TO PREVENT A VACUUM BUILDUP INSIDE THE TANKER-TRUCK WHICH COULD COLLAPSE IT - A SERIOUS SAFETY HAZARD.**



**USE EXTREME CARE WHEN DISCONNECTING THE LINE FROM THE TANKER-TRUCK, KEEP A GLOVED HAND OVER THE CONNECTION SEAM TO HELP CONTAIN POSSIBLE ASPHALT SPRAY IF PRESSURE HAS BUILT UP IN THE LINE.**



**IT IS IMPERATIVE THAT THE TANK COIL IS CHARGED WITH HEAT TRANSFER FLUID PRIOR TO PLACING PRODUCT IN THE TANK TO BE HEATED.**



**DURING THE UNLOADING PROCESS VAPORS PRESENT MAY BE HIGHLY FLAMMABLE OR EXPLOSIVE. NO SMOKING OR OPEN FLAME SHOULD BE PRESENT DURING THE UNLOADING OF PRODUCT.**



**PRODUCT TEMPERATURE PRESENT THAT COULD CAUSE SERIOUS BURNS, PROPER PERSONAL PROTECTIVE EQUIPMENT MUST BE USED DURING THE UNLOADING PROCESS.**



**SAMPLES TAKEN FROM THE EXPANSION TANK, OR FROM A “DEAD LEG” ARE NOT REPRESENTATIVE OF YOUR SYSTEMS FLUID.**



**THE INDEPENDENT LAB REQUIRES APPROXIMATELY 3/4 QUART TO PROPERLY CONDUCT THE ANALYSIS. PLEASE FILL THE SAMPLE JAR TO THIS LEVEL.**



**WHEN APPLYING GREASE VERIFY THAT THE SPECIFICATIONS OF ALL GREASE USED IS EQUIVALENT. MIXING DIFFERENT GREASES TOGETHER IS NOT ADVISABLE AND CAN LEAD TO PREMATURE FAILURE OF LUBRICATED COMPONENTS. IT IS VERY IMPORTANT ALL GREASE USED IS A HIGH TEMPERATURE RATED GREASE.**



**NEVER USE A POWER-OPERATED GREASE GUN ON ANY ANTI-FRICTION BEARINGS.**



**CARE MUST BE TAKEN WHEN GREASING BEARINGS TO KEEP ALL DIRT OUT OF THE AREA. WIPE ALL FITTINGS COMPLETELY CLEAN AND USE CLEAN EQUIPMENT. MORE BEARING FAILURES RESULT FROM IMPURITIES INTRODUCED INTO THE BEARING CAVITY DURING GREASING OPERATIONS THAT FROM INSUFFICIENT GREASE.**



**DO NOT MIX LITHIUM, CALCIUM, SODIUM OR BARIUM COMPLEX GREASES DUE TO POSSIBLE COMPATIBILITY PROBLEMS. WHEN CHANGING FROM ONE TYPE OF GREASE TO ANOTHER, IT IS NECESSARY TO INSURE ALL THE OLD GREASE HAS BEEN REMOVED.**

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# Section 2 - Introduction

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## 2.1 General Description

The CTT (Horizontal Portable Storage Tank) offers many features to assure long, safe and carefree operation. All tanks come equipped with four inches of firm fiberglass insulation on the shell and ends. The storage tank features embossed aluminum covering for all-weather storage.

Coiled tanks are equipped with a flat horizontal serpentine-type heat exchange coil for heating the product with thermal fluid.

### Advantages include:

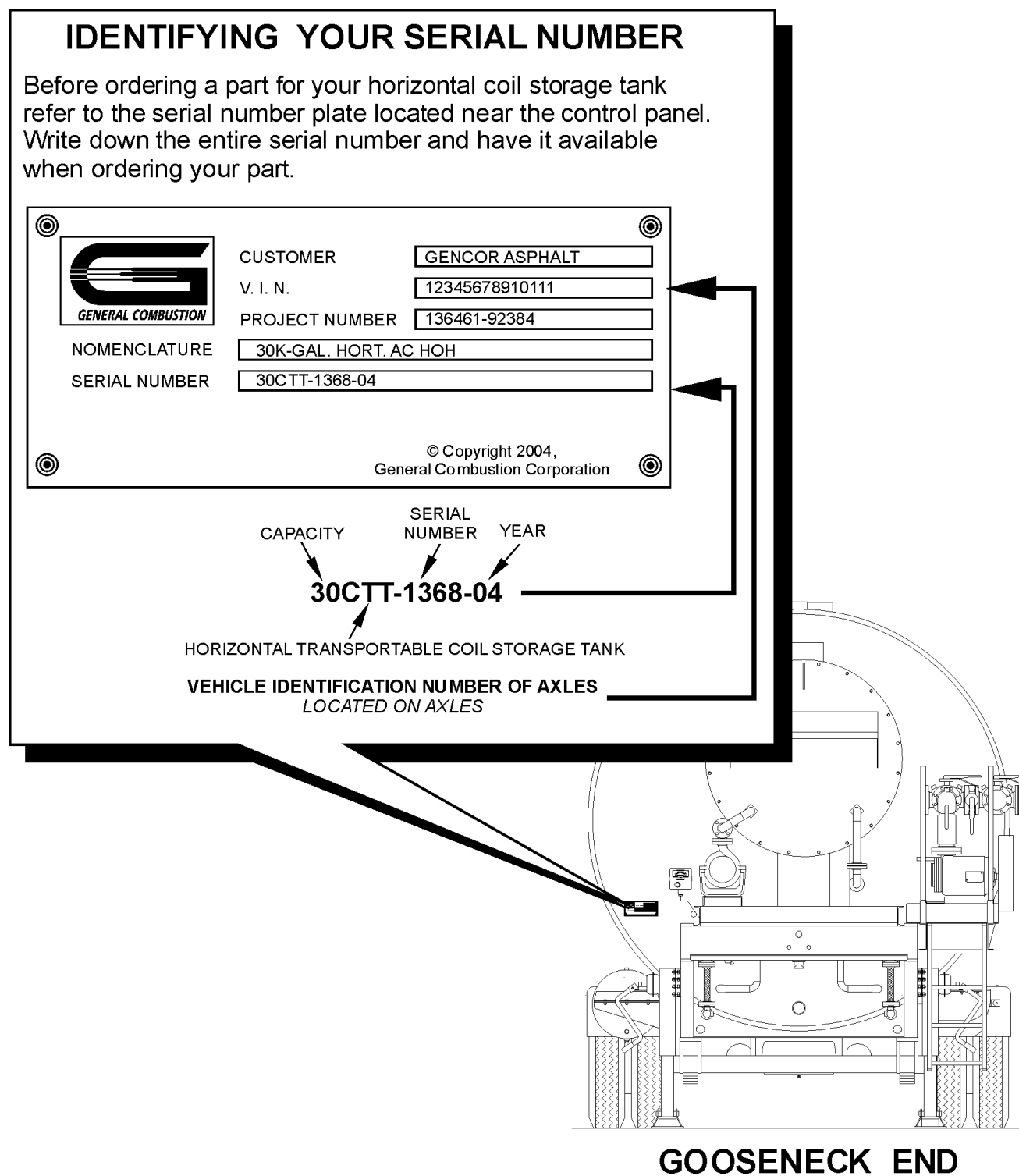
- Reduces Oxidation
- Minimizes heat loss
- Provides uniform heating
- Reduces installation costs
- Ideal for polymers & emulsions

### The following features are standard:

- UL-142 construction.
- Serpentine coil heating system.
- Mounted expansion tank.
- Quick disconnect cabling.
- Fifth wheel pin and glad hand connections.
- Indicating temperature controller/solenoid flow control valve.
- Pre-piped mounted metering & unloading pumps.
- 20" manway on top. Manway is equipped with a quick release hatch which allows for easy inspection. The top hatch pop-off vent prevents pressure buildup.
- Sampling valve.
- 3" process supply and return piping connection.
- Flexible jacketed piping with jumpers.
- Mounted pipe carrier.
- Dual axle portability.
- Budd wheels/air brakes/brake lights/mud flaps.
- External, OSHA approved ladders/catwalk & handrails on split compartment tank.
- Internal vent and overflow with bottom side external outlet, which prevents condensed vapors from collecting in insulation materials.

## 2.2 Model Identification

Refer to the illustration below when you need to identify your Horizontal Coil Storage Tank serial number when ordering parts.



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**Figure 2-1: Model Identification**



## 2.3 Product Line-up

The following illustration details the complete model line of CTT Storage Tanks.

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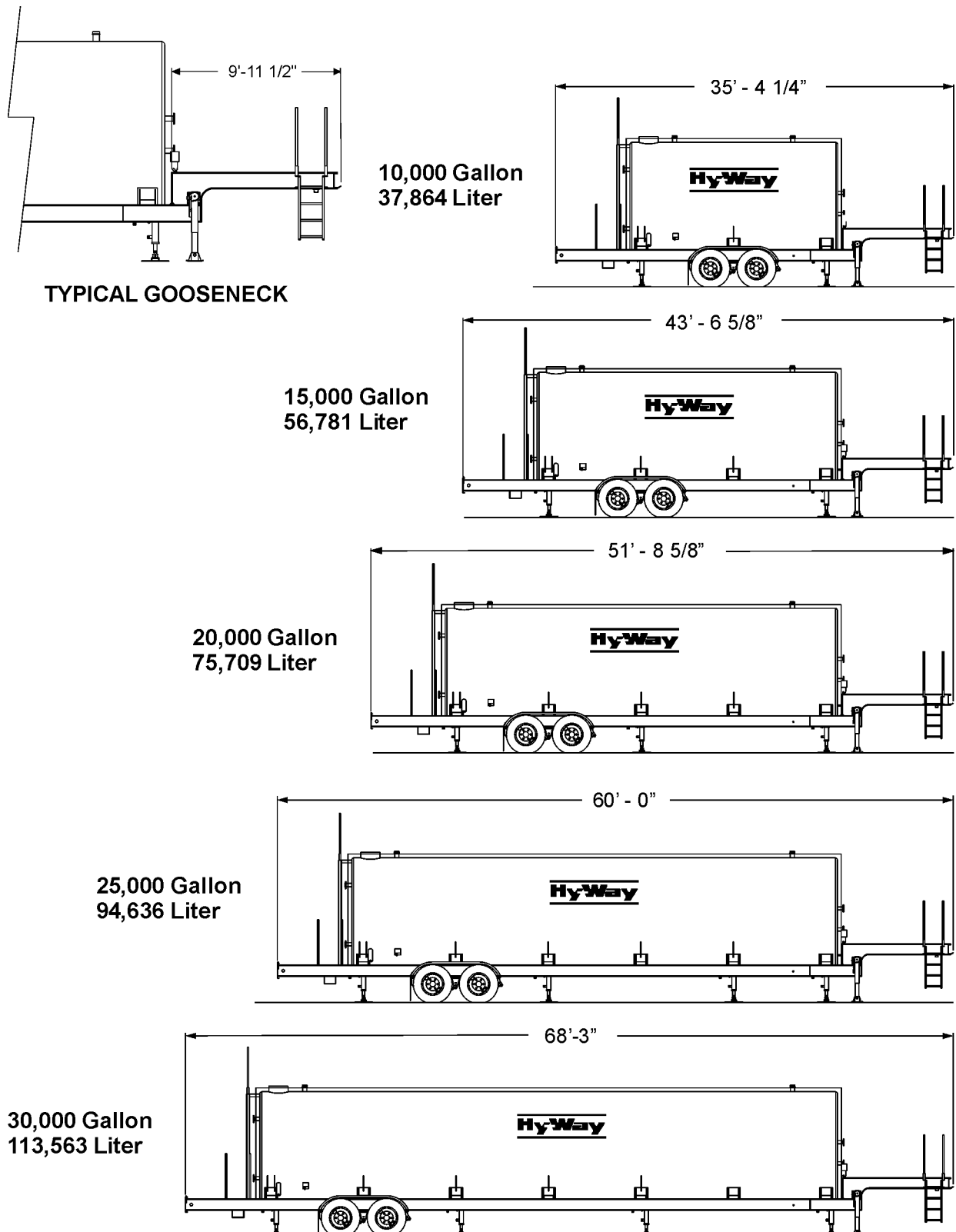
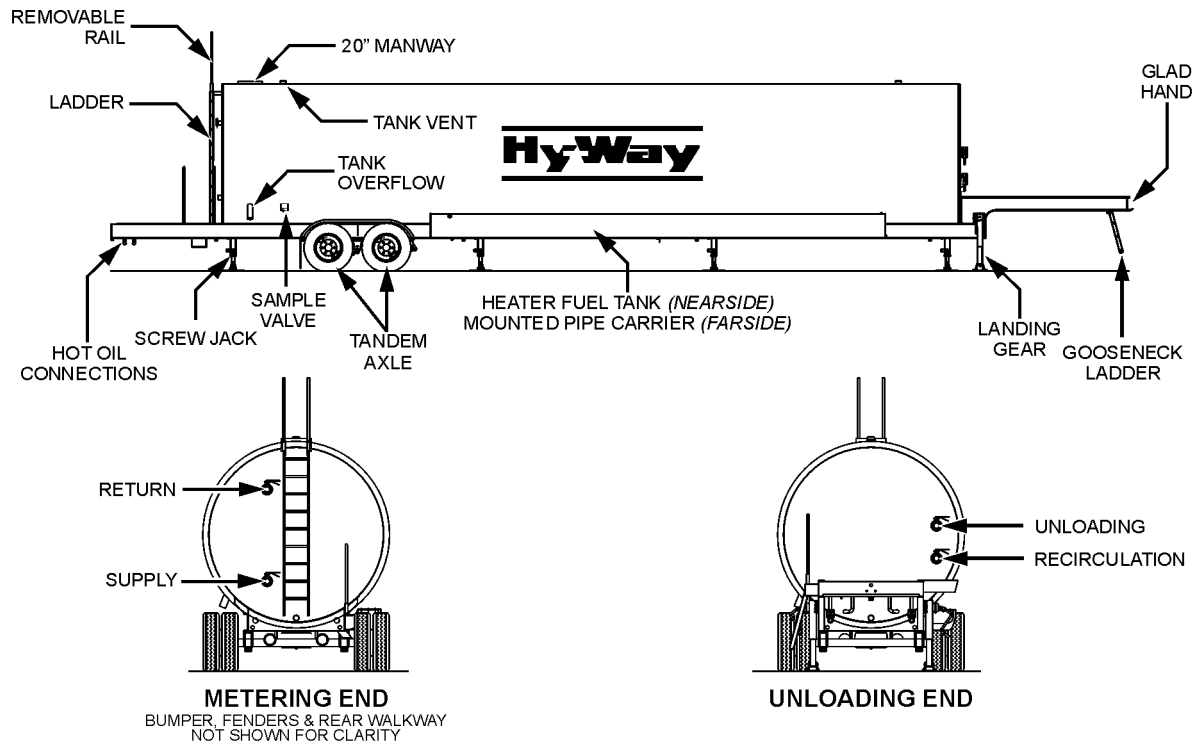


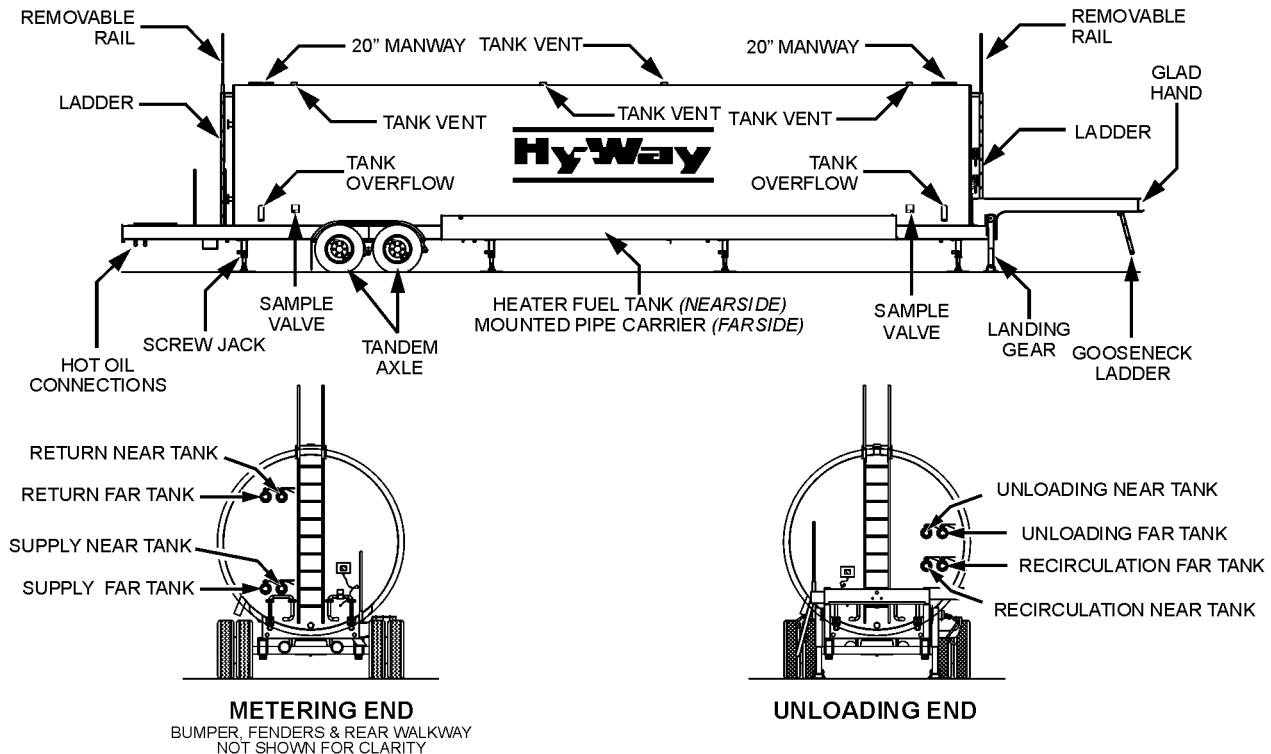
Figure 2-2: Product Line-up

## 2.4 Horizontal Coil Storage Tank Profile

The illustration below shows a typical Horizontal coil storage tank profile.



### SINGLE COMPARTMENT



### SPLIT COMPARTMENT

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Figure 2-3: Typical Profile

## 2.5 Tank Weights

The table below details the dead, live and total weights for the Horizontal Coil Storage tank product line.

| Horizontal Coil Storage Tank Product Line |                                  |                     |                                  |                     |                                  |                     |                                  |                     |                                  |                         |                         |
|---|----------------------------------|---------------------|----------------------------------|---------------------|----------------------------------|---------------------|----------------------------------|---------------------|----------------------------------|-------------------------|-------------------------|
| DESCRIPTION                               | 10,000 Gallon Horizontal AC Tank |                     | 15,000 Gallon Horizontal AC Tank |                     | 20,000 Gallon Horizontal AC Tank |                     | 25,000 Gallon Horizontal AC Tank |                     | 30,000 Gallon Horizontal AC Tank |                         |                         |
| Standard Weight                           | Nothing Mounted                  | With Heater & Pumps | Nothing Mounted                  | With Heater & Pumps | Nothing Mounted                  | With Heater & Pumps | Nothing Mounted                  | With Heater & Pumps | Nothing Mounted                  | With 100 Heater & Pumps | With 200 Heater & Pumps |
| DEAD WEIGHT                               | 20,000                           | 30,000              | 27,000                           | 37,000              | 34,000                           | 44,000              | 37,000                           | 49,000              | 40,000                           | 51,000                  | 54,000                  |
| LIVE WEIGHT                               | 106,000                          | 116,000             | 156,000                          | 166,000             | 206,000                          | 216,000             | 252,000                          | 264,000             | 298,000                          | 309,000                 | 312,000                 |
| TOTAL WEIGHT                              | 126,000                          | 146,000             | 183,000                          | 203,000             | 240,000                          | 260,000             | 289,000                          | 313,000             | 338,000                          | 360,000                 | 366,000                 |

Figure 2-4: Standard Weight (LBS)

| Horizontal Coil Storage Tank Product Line |                                 |                     |                                 |                     |                                 |                     |                                 |                     |                                  |                         |                         |
|---|---------------------------------|---------------------|---------------------------------|---------------------|---------------------------------|---------------------|---------------------------------|---------------------|----------------------------------|-------------------------|-------------------------|
| DESCRIPTION                               | 37,864 Liter Horizontal AC Tank |                     | 56,781 Liter Horizontal AC Tank |                     | 75,709 Liter Horizontal AC Tank |                     | 94,636 Liter Horizontal AC Tank |                     | 113,563 Liter Horizontal AC Tank |                         |                         |
|   | Nothing Mounted                 | With Heater & Pumps | Nothing Mounted                 | With Heater & Pumps | Nothing Mounted                 | With Heater & Pumps | Nothing Mounted                 | With Heater & Pumps | Nothing Mounted                  | With 100 Heater & Pumps | With 200 Heater & Pumps |
| DEAD WEIGHT                               | 9,078                           | 13,618              | 12,256                          | 16,795              | 15,433                          | 19,973              | 16,795                          | 22,242              | 18,157                           | 23,150                  | 24,512                  |
| LIVE WEIGHT                               | 48,116                          | 52,655              | 70,812                          | 75,351              | 93,508                          | 98,048              | 114,389                         | 119,836             | 135,269                          | 140,263                 | 141,624                 |
| TOTAL WEIGHT                              | 57,194                          | 66,273              | 83,068                          | 92,147              | 108,942                         | 118,020             | 131,184                         | 142,078             | 153,426                          | 163,413                 | 166,136                 |

Figure 2-5: Metric Equivalents (KGS)

## 2.6 Options

Available options for The Horizontal Coil Storage Tank:

- Electric heat.
- Temperature recorders.
- Safety switch shut offs for high or low tank liquid level.
- Condenser.
- Pump sets for unloading/recirculation/metering.
- AC Calibration Tank mounted on Tank.
- Triple Axle Portability.

## 2.7 Warranty

### 2.7.1 Warranty Statement

The Seller warrants to the first end-user that all of the equipment and parts will be of merchantable quality, free from any known defects in material and workmanship. The warranty period extends 90 days from the date of shipment to the first end-user. In the case of an extended period between shipment and first usage date [and only up to six (6) months maximum delay], the start-up date will be used subject only to evidence of proper storage during the interim period. This warranty is contingent upon proper installation, use, and service practices for which the equipment and parts were intended. In satisfaction of this warranty, a product or part will be replaced or repaired, or a credit issued, but only if the Seller is promptly notified in writing upon discovery of

an alleged defect and only if the Seller's examination discloses to its satisfaction that such defect has not been caused by misuse, neglect, improper installation, improper repair, alteration, or accident. The choice of product replacement, repair, or credit is at the discretion of the Seller. Equipment or parts must be returned only after authorization for such return has been obtained from the manufacturer and shipped freight prepaid. Equipment or parts supplied by the Seller, but not manufactured by the Seller, will be subject only to the warranties extended by the original manufacturer. In all cases, all field labor and expenses are to be borne by the buyer or user.

### **2.7.2 Local Codes**

General Combustion Corporation manufactures, wires, and plumbs equipment in accordance with normal industry practices. However, no guarantee is offered or implied that said equipment will meet all local or national code requirements.

In the event of special code requirements, General Combustion Corporation will quote, on request, to meet any existing or pending codes and regulations. General Combustion Corporation does not assume responsibility for field changes, modifications, or additions, to meet any code not specified on the initial purchase order.

### **2.7.3 Damage Claims**

All transportation related claims for breakage and damage, whether concealed or obvious, are the sole responsibility of the Buyer and must be made to the Carrier by the Buyer upon inspection of the unit at time of receipt.



**IT IS THE RESPONSIBILITY OF THE SYSTEM PURCHASER TO ENSURE THAT THIS PLANT IS IN CONFORMANCE WITH THESE STANDARDS. GENCOR CAN SUPPLY COMPONENTRY OR RECOMENDATIONS TO ASSIST YOU IN ACHIEVING COMPLIANCE.**

### 2.7.3.1 *Initial Inspection*

Walk around the unit inspections all of the major components. Check for any possible damage tat may have occurred during shipping.



**IT IS IMPERATIVE THAT ALL EQUIPMENT ON EVERY LOAD BE INSPECTED FOR SHIPPING DAMAGE BEFORE IT IS UNLOADED OR BEFORE SIGNING ANY BILL OF LADING. ANY DAMAGE MUST BE NOTED ON THE SIGNED COPY OR THE BILL OF LADING**



**AN INSPECTION MUST BE PERFORMED FOR MISSING PARTS AND/OR PARTS WHICH DIFFER FROM THE PURCHASER'S UNDERSTANDING OF THE EQUIPMENT PURCHASED. AN ITEMIZED SHIPPING MANIFEST IS SUPPLIED WITH ALL EQUIPMENT TO HELP WITH THE INSPECTION. IF ANY ITEMS ARE MISSING DO NOT UNLOAD THE EQUIPMENT FROM SHIPPER. IF DAMAGE IS NOTED OR PARTS MISSING NOTIFY GENERAL COMBUSTION CORPORATION WITHIN 24 HOURS.**

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## Section 3 - Pre-Installation

### 3.1 *Site Inspection*

Prior to scheduling the erection date make sure the access road, component storage area, and plant site are properly prepared and ready for set up at the time of delivery. Make sure that your site includes space for the equipment needed to erect your Horizontal Coil Storage Tank.

### 3.2 *Site Preparation*

All concrete footings, anchor bolts, base plates, and foundations are to be designed and provided by the Purchaser and a licensed engineering firm authorized to do business in the state where the equipment is to be erected. The Purchaser and his representative will be solely responsible for determining all applicable building codes and appropriate soil bearing values and insuring that all footings and foundations are adequate to support all dead and live loads, both positive and negative, exerted by the asphalt plant system and related equipment.

The Purchaser and his representative are solely responsible for all site work and determining and insuring adequate seismic and wind load bearing capability in the design of the footings. General Combustion Corporation is not be responsible for the cost, design, or installation of any footings, foundations, and site work. All footings and foundations must be complete and ready to support the plant equipment and components before erection of the equipment can begin. If concrete is used it must be adequately cured prior to erection.

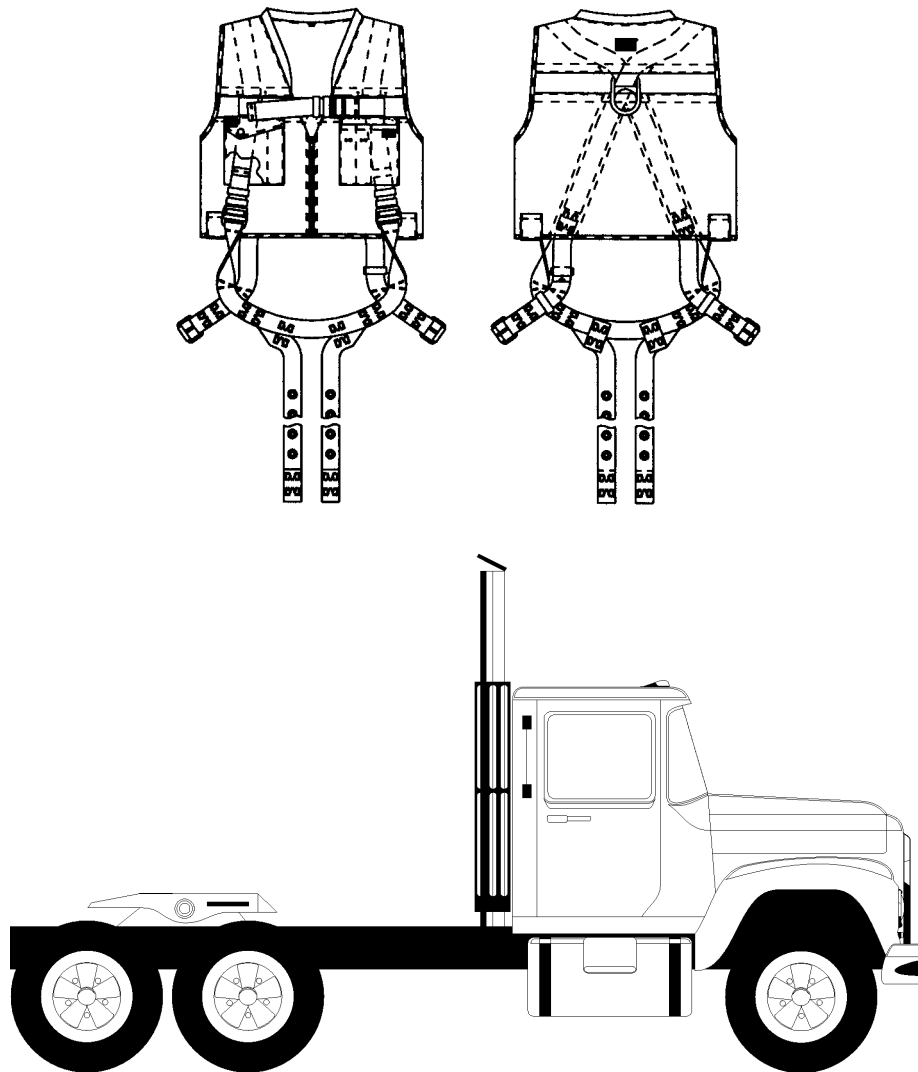
In the event the system/equipment is skid-mounted, the site must be graded appropriately and be of applicable dead and live loads. The Purchaser must adhere to the plant layout supplied by Gencor, and ensure the soil has a bearing capacity of 4,000 P.S.F.



**MAKE SURE THE GROUND IS THOROUGHLY COMPACTED. THE SOIL NEEDS TO HAVE A BEARING CAPACITY OF 4,000 POUNDS PER SQUARE FOOT AND GRADED TO GRADE ZERO.**

### 3.3 Tools & Equipment Needed

| General Tool List                         |                                 |
|---|---------------------------------|
| Open End Wrench 1/2" to 1-1/2"            | Phillips/Flathead Screwdrivers  |
| Socket Set with 1/2" Drive 3/4" to 1-1/2" | 2 100 Ft. String Lines          |
| Wire Cutters/Strippers                    | 4 Ft. Level / String Line Level |
| 100' Tape Measure                         | Shovels                         |
| Safety Harnesses/Lanyard                  | Bull Pins                       |
| 4 Ft. Pry Bar                             |                                 |



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Figure 3-1: Tools and Equipment Needed



### 3.4 Personnel

To erect a Horizontal Coil Storage Tank requires an installation crew of sufficient size to cover all tasks of the erection procedure. The following points relating to personnel should be reviewed before starting the installation of the storage tank:

- The entire crew must be present when the storage tank is originally set up on the site.
- The contractor should not attempt to set the storage tank without the manufacturer's instruction manual.
- Purchaser is responsible for erection and all associated costs unless specifically contracted with General Combustion Corporation for erection.
- Allow adequate time to properly train plant employees.



**FAILURE TO FOLLOW THE SPECIFIC ERECTION PROCEDURES MAY RESULT IN PROPERTY DAMAGE AND/OR INJURY TO PERSONNEL. THE OWNER'S PRIMARY RESPONSIBILITY IS TO CONTINUALLY MONITOR THE ERECTION PROCEDURES AND TO GIVE CORRECT INSTRUCTIONS TO THE CONTROLS OPERATOR.**



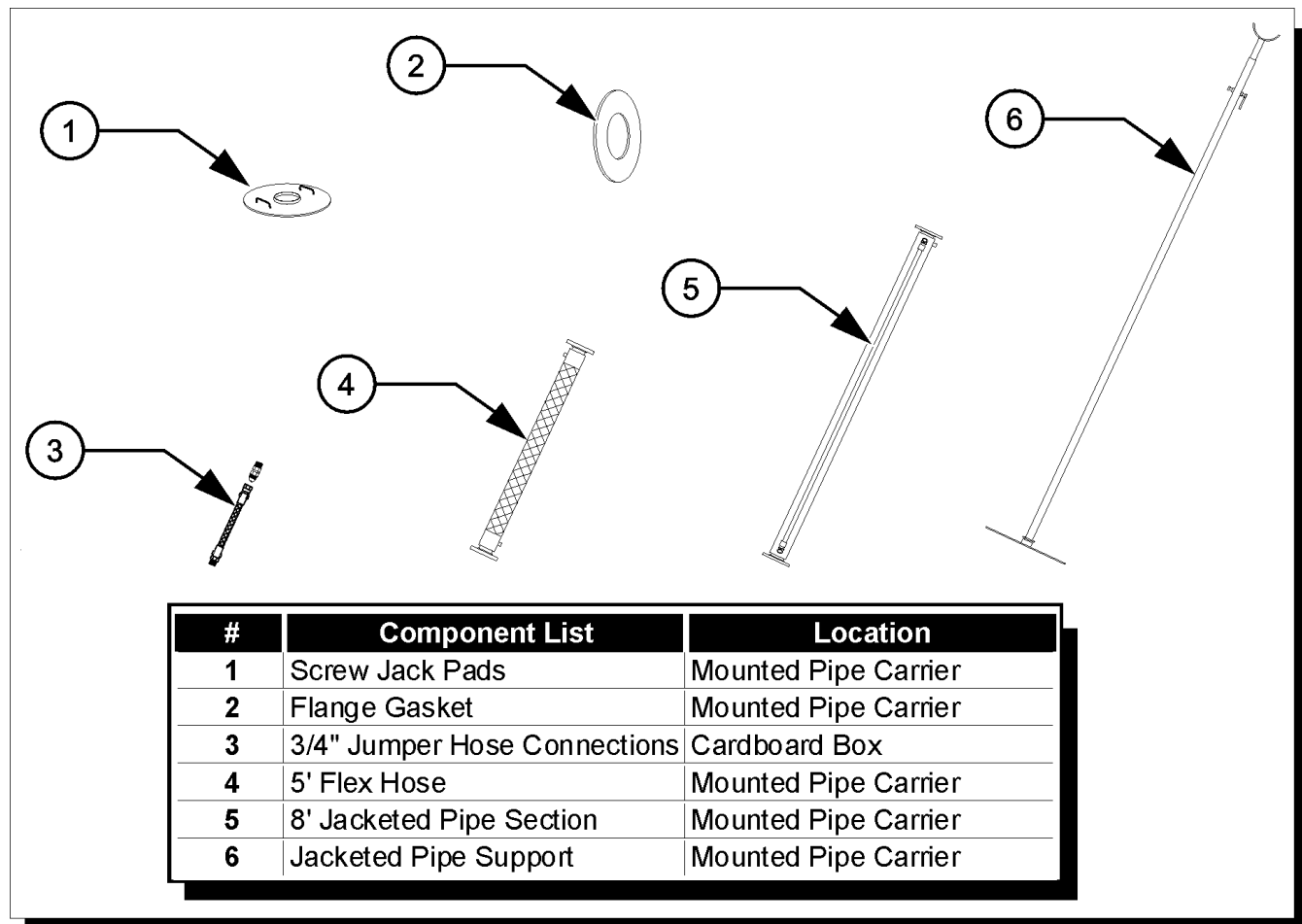
**BEFORE STARTING THE ERECTION OF A HORIZONTAL COIL HEATED TANK IT IS IMPORTANT THAT THE WHOLE CREW BE BRIEFED ON THE SAFETY HAZARDS THAT EXIST WHILE ERECTING A HORIZONTAL COIL HEATED TANK AND WHAT PRECAUTIONS TO TAKE TO AVOID THESE HAZARDS.**

### 3.5 Tank Component Unloading

The CTT Tank is designed to be transported via highways and commercial roads, conforming to certain height restrictions determined by Department of Transportation regulations. To meet these height restrictions some components must be unloaded and assembled onto the Tank. Other components shipped with the tank are used during erection or used to connect the tank to other components. Figure 3-2: on page 26 shows the components that are shipped with the CTT Tank and where they are stored during shipment. Some items such as small hoses, flange gaskets and fittings may be shipped in cardboard boxes secured elsewhere on the tank.

#### 3.5.1 Single Tank Standard Installation Components

The illustration that follows show the Standard Installation components that would ship with a single tank equipped with metering pump.

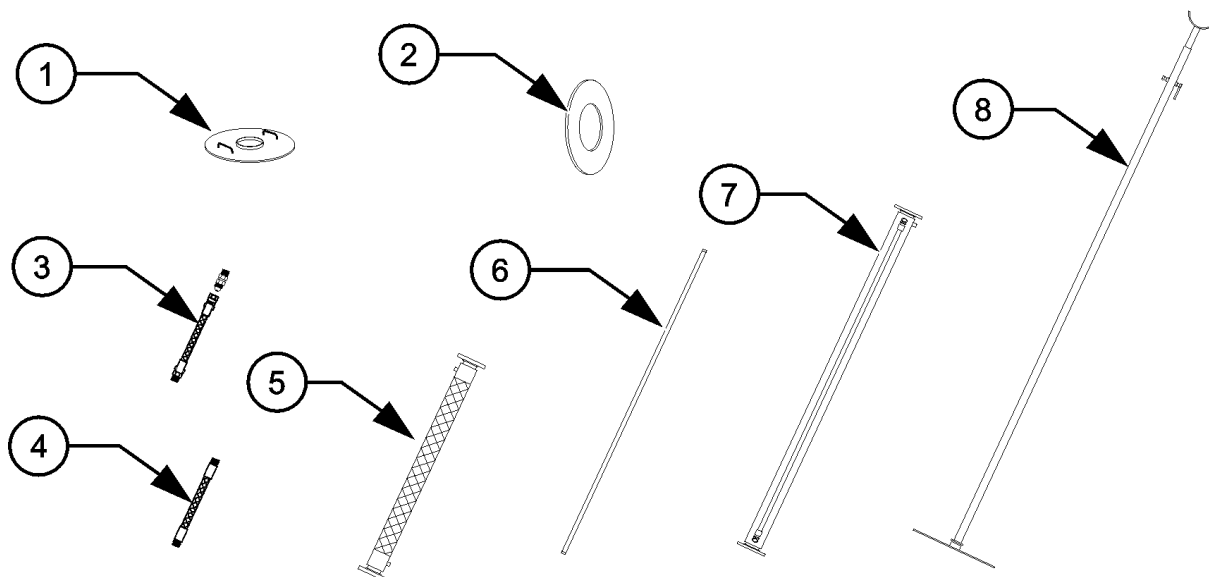


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**Figure 3-2: Standard Tank Components**

### 3.5.2 Second Tank Standard Installation Components

When a second tank is to be connected to the primary tank, additional components are necessary to complete the installation. These components are shown below with the location each component is stored.



| # | Component List               | Location             |
|---|------------------------------|----------------------|
| 1 | Screw Jack Pads              | Mounted Pipe Carrier |
| 2 | Flange Gasket                | Mounted Pipe Carrier |
| 3 | 3/4" Jumper Hose Connections | Cardboard Box        |
| 4 | 1-1/4" Flex Hose Connections | Cardboard Box        |
| 5 | 5' Flex Hose                 | Mounted Pipe Carrier |
| 6 | 1-1/4" Ridged Pipe           | Mounted Pipe Carrier |
| 7 | 8' Jacketed Pipe Section     | Mounted Pipe Carrier |
| 8 | Jacketed Pipe Support        | Mounted Pipe Carrier |

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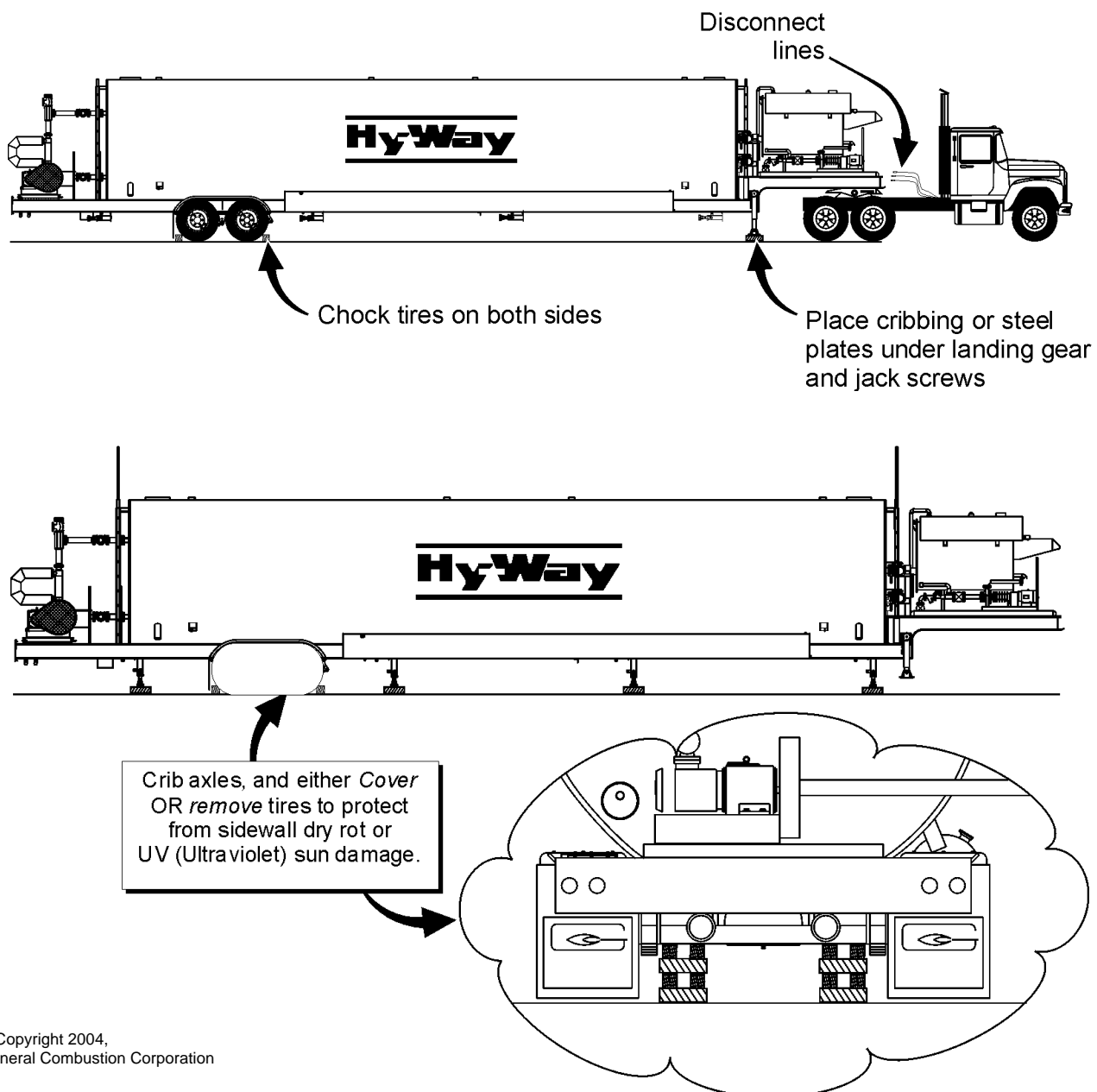
**Figure 3-3: Second Tank Standard Installation Components**

### 3.6 Long Term Storage of Tank Procedures



**MAKE SURE THE GROUND IS THOROUGHLY COMPACTED. THE SOIL NEEDS TO HAVE A BEARING CAPACITY OF 4,000 POUNDS PER SQUARE FOOT AND GRADED TO GRADE ZERO.**

This procedure is to be used when the CTT is to be parked or stored for a long period of time **without** liquid in the tank, such as for winter storage or lay up. Long term is considered to be three months and longer. The CTT should be placed on either wood blocks or steel plate on solid level ground to prevent the tank from settling and or sinking into the ground which could cause damage to the tank in the event the ground is soft and unstable. Refer to the illustration in Figure 3-4: on page 28, and the steps that follow for a complete understanding of this procedure.



**Figure 3-4: Long Term Parking**

To prevent damage to the CTT, proper parking of the CTT Horizontal Coil Storage Tank for an extended period of time is necessary as illustrated in Figure 3-4: on page 28 and explained below:

1. The site where the CTT Horizontal Coil Storage Tank is to be parked must be stable ground.
2. Chock the tires on both sides to prevent the CTT from moving during the disconnection process from the tractor.
3. Place cribbing/steel plate under the Landing Gear, then lower the Landing Gear taking the weight off the fifth wheel and allowing enough clearance to clear the fifth wheel from the trailer.



**FAILURE TO PLACE THE CRIBBING/STEEL PLATE UNDER THE LANDING GEAR COULD RESULT IN THE CTT LANDING GEAR TO SETTLE INTO THE GROUND AND/OR POSSIBLE DAMAGE TO THE CTT.**

4. Disconnect the power cable and the two air lines from the glad hands on the gooseneck of the trailer.



**DISCONNECTING THE AIR BRAKE LINES AUTOMATICALLY “LOCK” THE BRAKES. TO UNLOCK THE BRAKES THE AIR IN THE AIR CANISTER MUST BE BLED DOWN.**

5. Move the tractor out from under the gooseneck.
6. To prevent sidewall dry rot or UV (Ultraviolet) sun deterioration to the tires, it is recommended that the tires either be removed or covered. To Remove the tires jack up the axles taking the weight of the tank off the tires and place cribbing under the axles. Remove the tires and store out of sunlight to prevent UV deterioration.



**MAKE SURE THE GROUND IS THOROUGHLY COMPACTED. THE SOIL NEEDS TO HAVE A BEARING CAPACITY OF 4,000 POUNDS PER SQUARE FOOT AND GRADED TO GRADE ZERO.**

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# Section 4 - Installation

## 4.1 CTT Tank Erection Procedures

The tank should be placed on solid, level ground to prevent settling of the tank during use.



**MAKE SURE THE GROUND IS THOROUGHLY COMPACTED. THE SOIL NEEDS TO HAVE A BEARING CAPACITY OF 4,000 POUNDS PER SQUARE FOOT AND GRADED TO GRADE ZERO.**

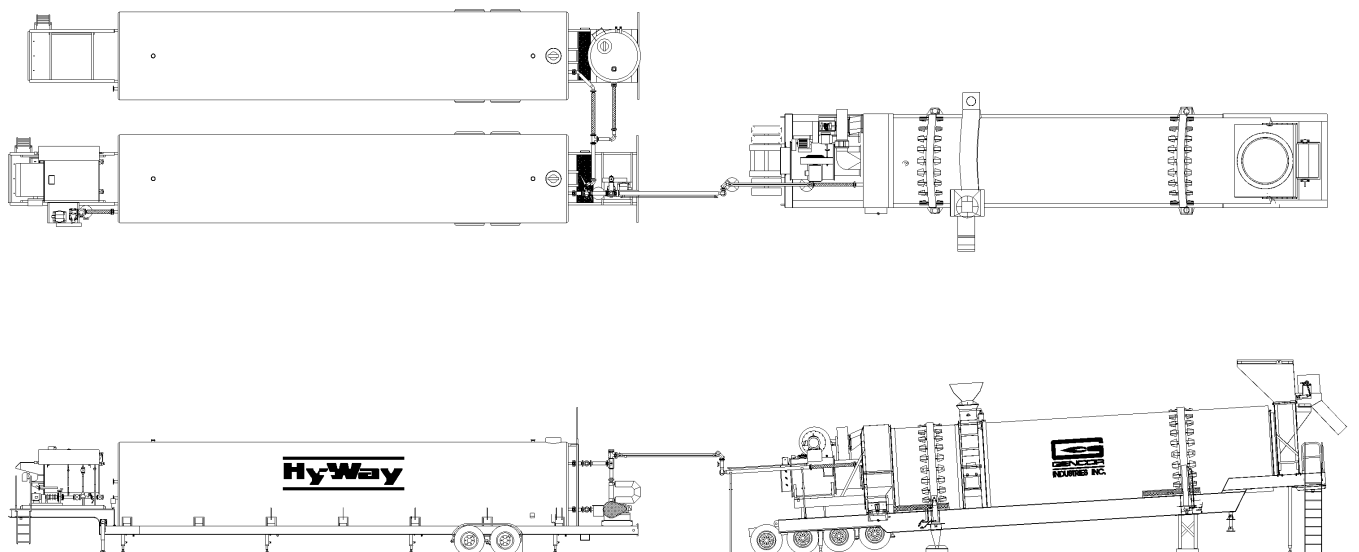
### 4.1.1 Sample CTT Tank Layouts

There is two layouts for the CTT tank, either inline, or at a right angle to the Ultradrum. The following illustration details the two layouts. The layout shows a second CTT tank with the optional Calibration Tank in position.

Check the site plan to determine if the right angle layout or the inline layout will be used for the installation of the tank(s) See "Site Requirements" on page 33. Maneuver the tanks into position taking into consideration the area onsite where the tank(s) are to be erected Figure 4-4: on page 34. It is important to locate the tank(s) in the configurations shown. The calibration tank (on two tank systems) must always be located to the right side of the primary tank when looking at the metering pump from the rear of the tank.

#### 4.1.1.1 Inline Configuration

On inline installations, the CTT is two foot to the left of the centerline of the drum. This places the metering pump discharge offset one foot from the inlet of the drum as shown in Figure 4-1: on page 31.



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**Figure 4-1: Typical Inline Layout**

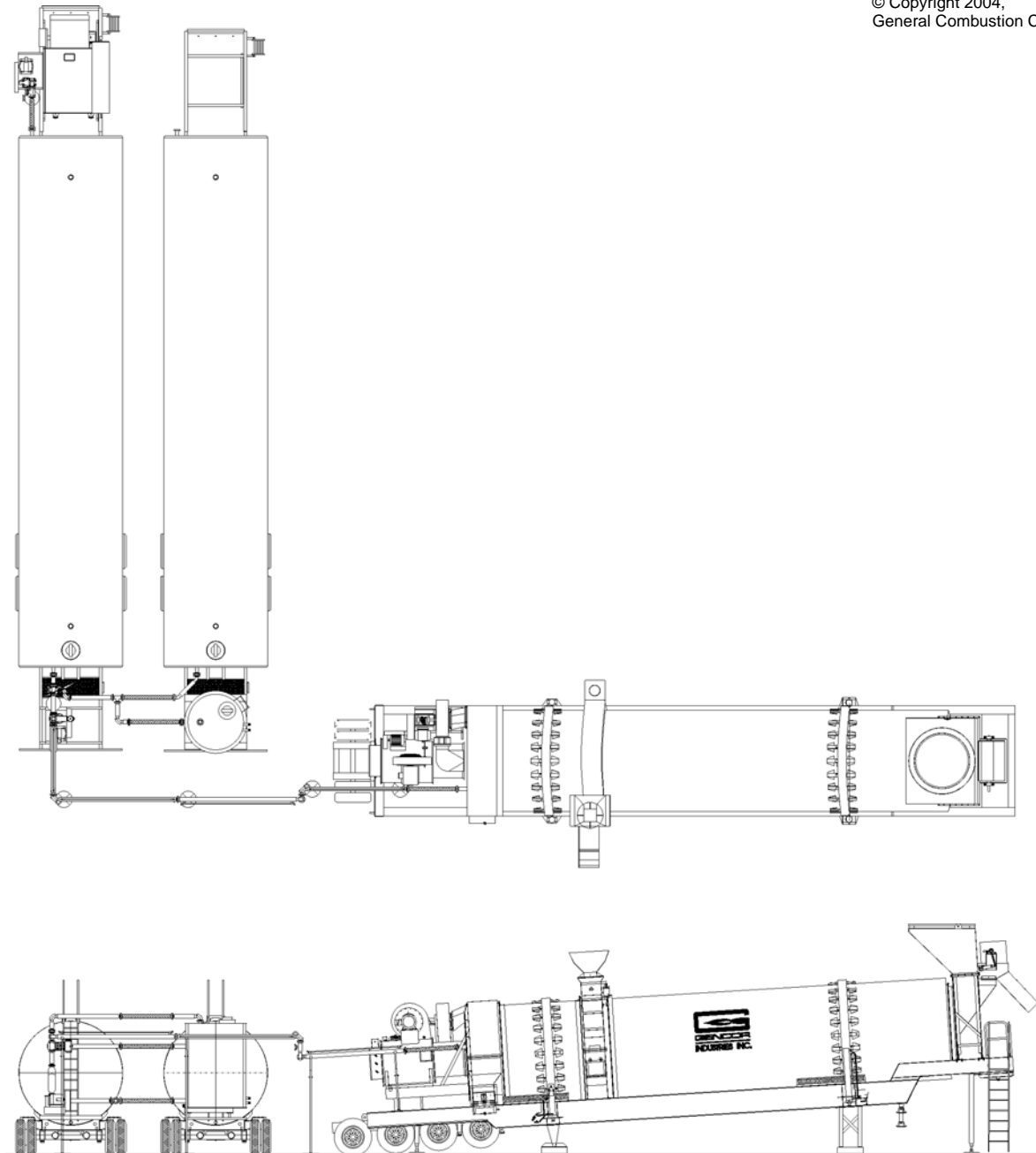
### 4.1.1.2 Right Angle Configuration



**MAKE SURE THE GROUND IS THOROUGHLY COMPACTED. THE SOIL NEEDS TO HAVE A BEARING CAPACITY OF 4,000 POUNDS PER SQUARE FOOT AND GRADED TO GRADE ZERO.**

On right angle installations, the tank is installed perpendicular to the Drum. The tailgate of the tank trailer is located centerline to the Drum as shown in Figure 4-2: on page 32.

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**TYPICAL RIGHT ANGLE**  
**Figure 4-2: Typical Right Angle Layout**



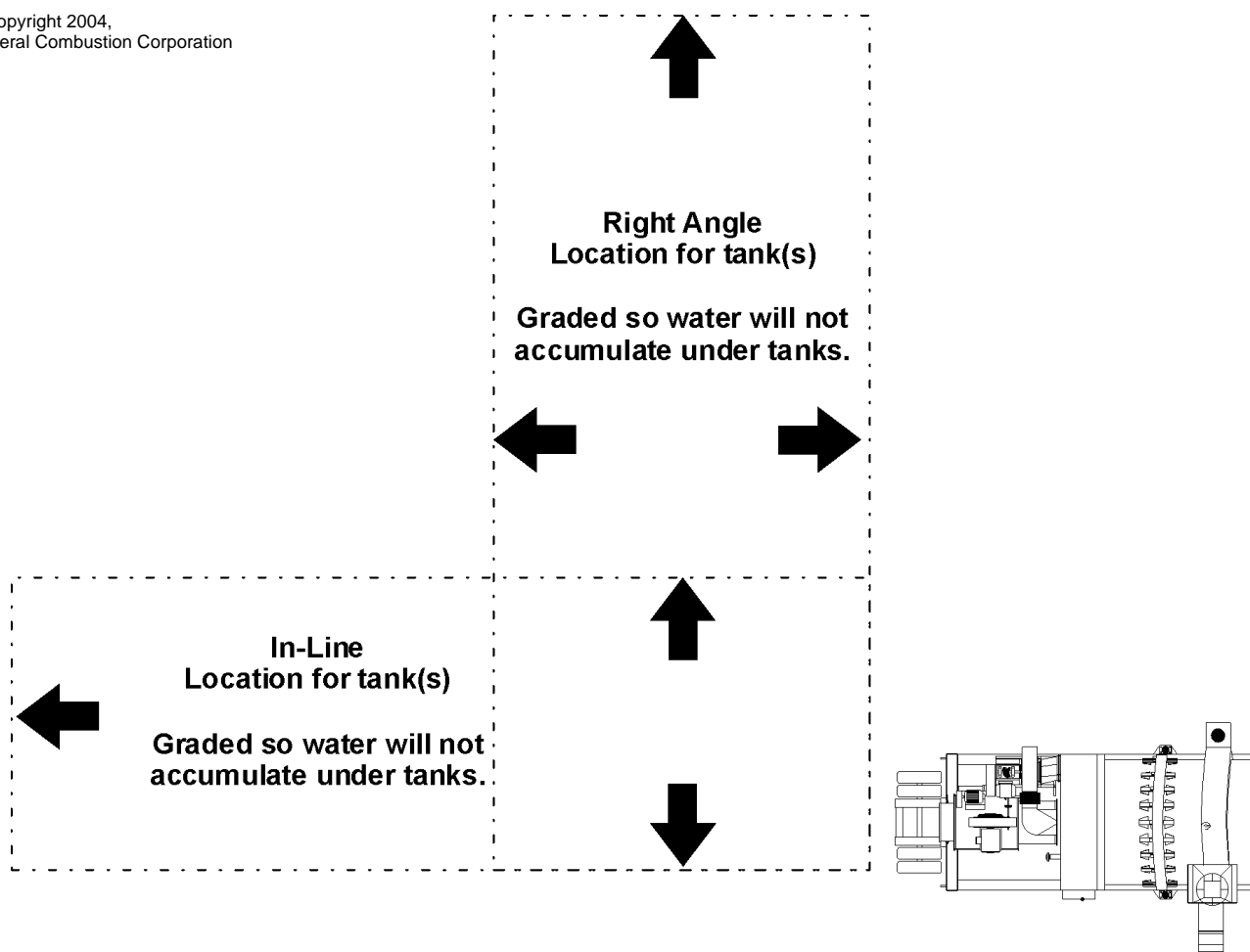
## 4.1.2 Site Requirements



**MAKE SURE THE GROUND IS THOROUGHLY COMPACTED. THE SOIL NEEDS TO HAVE A BEARING CAPACITY OF 4,000 POUNDS PER SQUARE FOOT AND GRADED TO GRADE ZERO.**

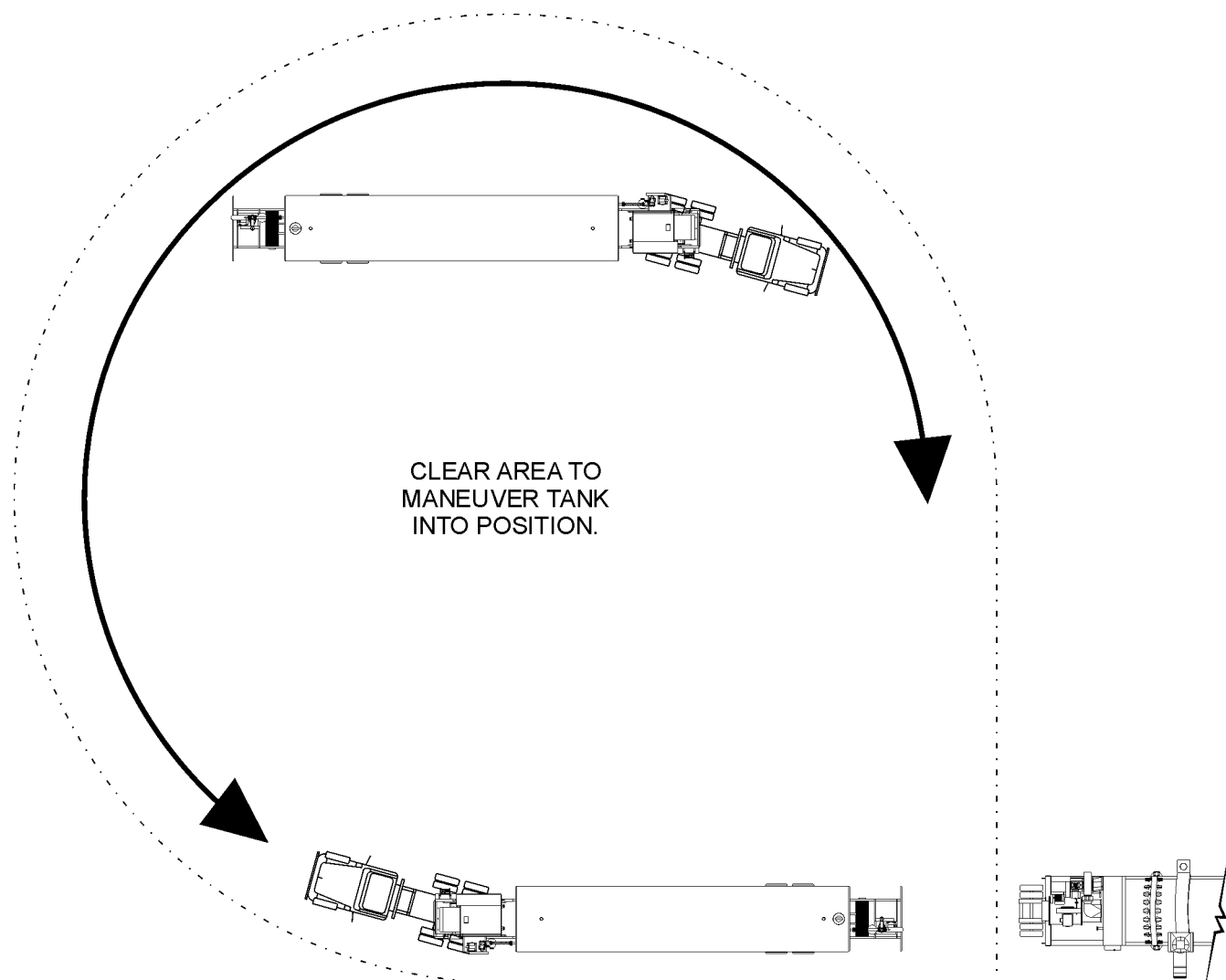
The area where the CTT Tank is to be placed should be graded to insure proper drainage, and will not allow water to accumulate under the tanks while being used. Allowing water to accumulate under the tanks will soften the ground and allow tank to settle and sink creating tank/piping alignment problems.

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**Figure 4-3: Site Plan**

In addition to proper grading of the area for the CTT Tanks, the area around where the tanks will be placed should be clear and available to use for maneuvering the tank(s) into position. Should the site not allow ample room for the truck to maneuver the tanks into position properly it may be necessary to pre-place the tanks into position.



**Figure 4-4: Clear Area**

Allow sufficient truck travel room to maneuver the tank(s) into position where the tank(s) will be placed. Allow enough room to allow the truck to disconnect after the tank is in position. See Figure 4-4: on page 34. Once the tank(s) are properly positioned, this area can be used for other purposes.

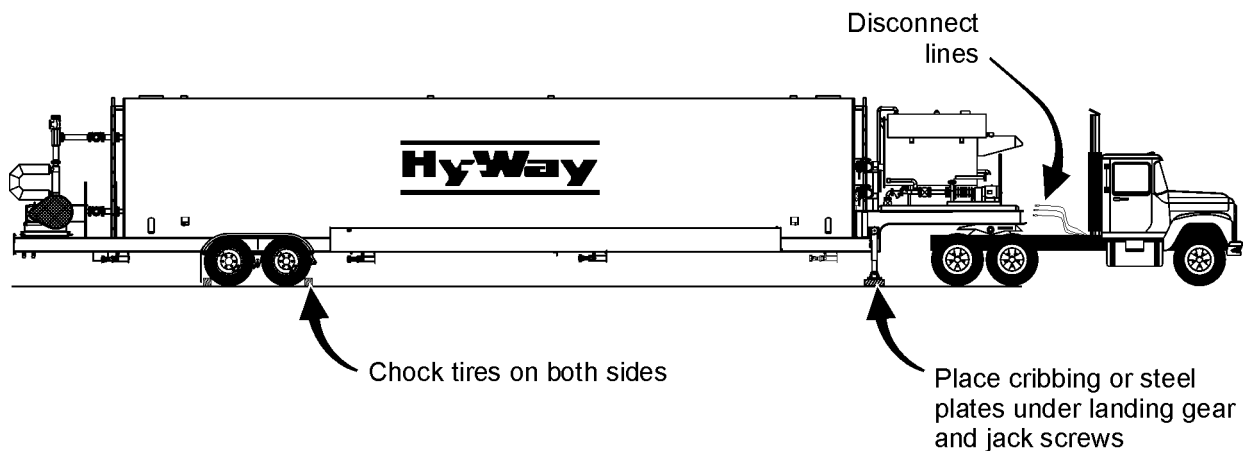
### 4.1.3 Disconnecting the CTT Tank from the Truck



**DISCONNECTING THE AIR BRAKE LINES AUTOMATICALLY “LOCK” THE BRAKES. TO UNLOCK THE BRAKES THE AIR IN THE AIR BRAKE CANISTER MUST BE BLED DOWN.**

The site must be graded to final “grade zero”. Disconnecting the CTT tank from the truck can only be done after the tank is positioned in its final erected location. To disconnect the CTT tank from the truck follow the steps outlined below:

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**Figure 4-5: Disconnecting the Tank from the Truck**

1. The site where the CTT Horizontal Coil Storage Tank is to be erected must be stable ground.
2. Chock the tires on both sides to prevent the CTT from moving during the disconnection process from the tractor.
3. Place cribbing/steel plate under the Landing Gear, then lower the Landing Gear taking the weight off the fifth wheel and allowing enough clearance to clear the fifth wheel from the trailer.



**FAILURE TO PLACE THE CRIBBING/STEEL PLATE UNDER THE LANDING GEAR COULD RESULT IN THE CTT TANK TO SETTLE INTO THE GROUND AND/OR CAUSE POSSIBLE DAMAGE TO THE CTT TANK.**

4. Disconnect the power cable and the two air lines from the glad hands on the gooseneck of the trailer.
5. Move the tractor out from under the gooseneck.



**MAKE SURE THE GROUND IS THOROUGHLY COMPACTED. THE SOIL NEEDS TO HAVE A BEARING CAPACITY OF 4,000 POUNDS PER SQUARE FOOT AND GRADED TO GRADE ZERO.**

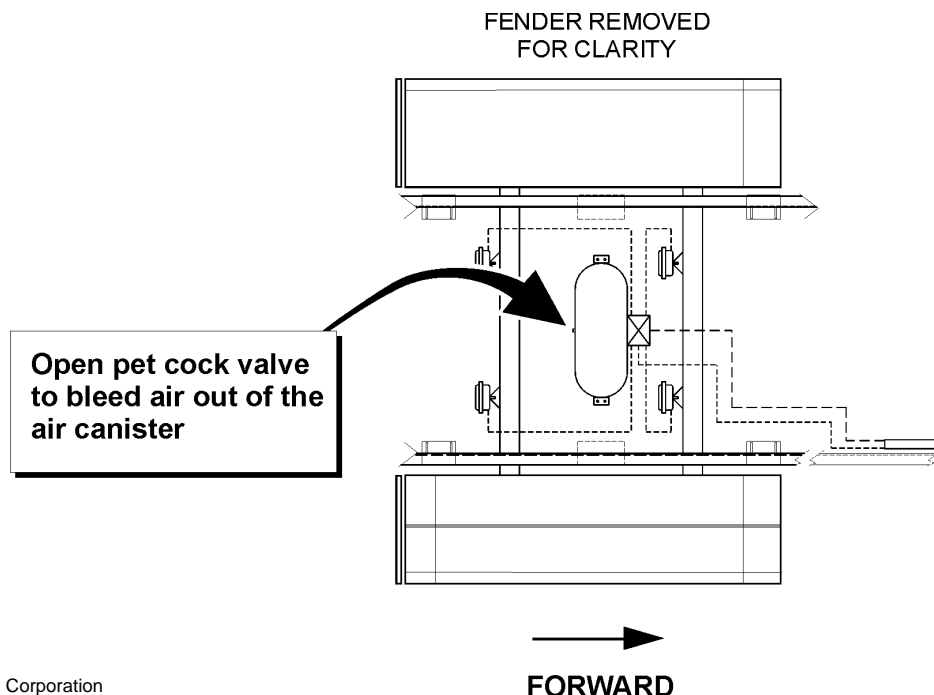
#### 4.1.3.1 *Bleeding the Air Brake Canister*

This step will only be done if the CTT Tanks axles/hubs needs to be rotated during maintenance procedures. Reconnecting the Air Brake lines from the truck will release the air brakes once the canister is pressurized.



**BEFORE BLEEDING THE AIR BRAKE CANISTER, LOWER THE LANDING GEAR, RAISE ALL JACK SCREWS AND CHOCK THE TANK WHEELS. FAILURE TO SECURE THE TANK TO PREVENT ACCIDENTAL MOVEMENT COULD RESULT IN DAMAGE TO THE TANK OR SERIOUS INJURY.**

The illustration below shows the location of the pet cock valve in relation to the tank's tandem axle. Slowly bleed the air out, using caution, the tank could move slightly as the brakes release and it settles against the wheel chocks.

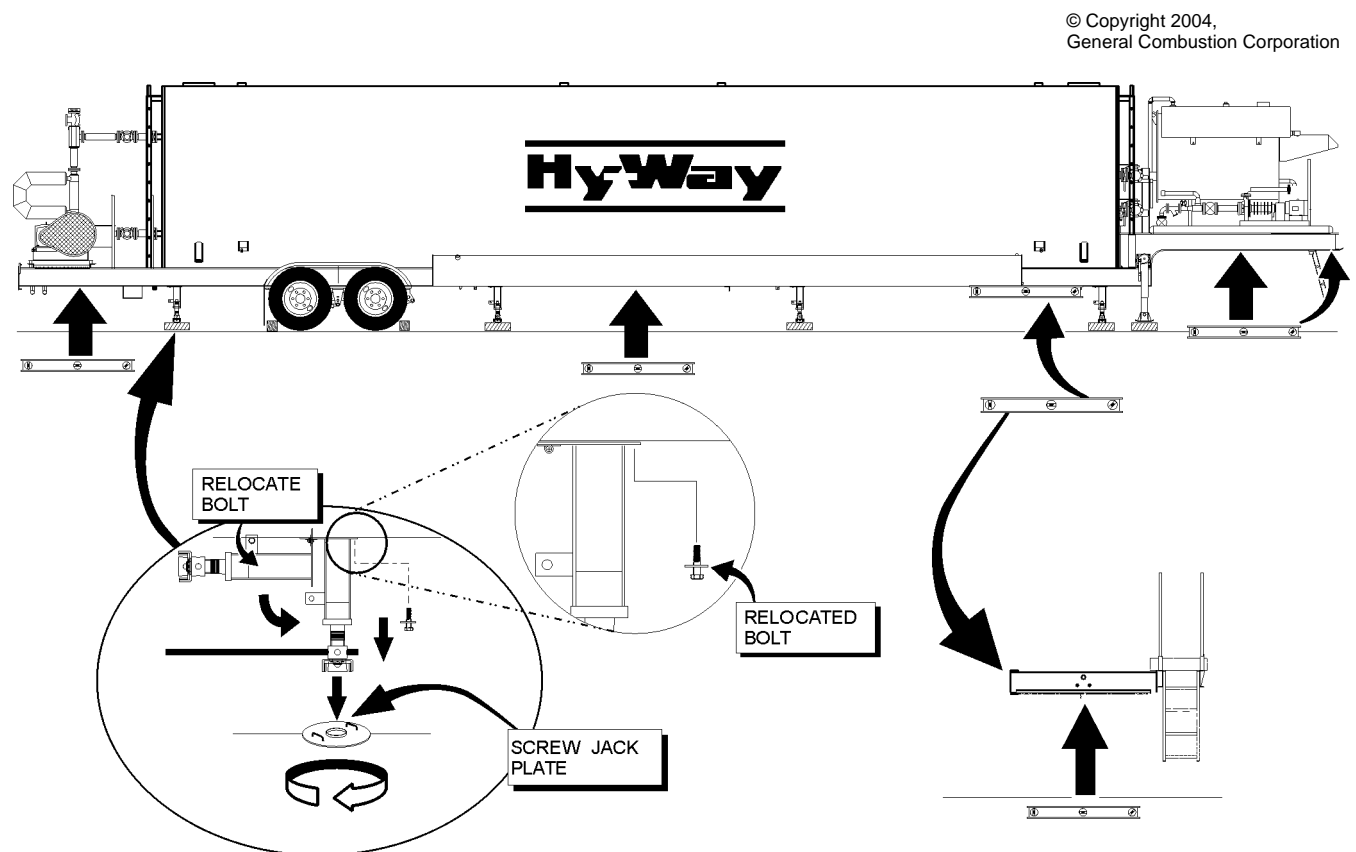


**Figure 4-6: Bleeding the Air Brake Canister**

### 4.1.4 Erecting and Leveling the CTT Tank

There are several considerations that need to be addressed when erecting and leveling the CTT tank. The length of time the tank will be stationary in this location will determine additional steps in the erection process. When the tank is to be placed in one location for a period of time longer than three months, additional cribbing under the axles and removal of the tires is suggested. Extended periods of time with the tires not moving and excessive weight on the sidewalls will dry rot the sidewall of the tires. Ultra-violet sunlight can also deteriorate the rubber tires. Placing cribbing under the axles and removing the tires prevents this deterioration. It is recommended that this procedure be used for short term use also, however when the tank is used for a short time, covering the tires to prevent UV damage is allowable.

To erect the CTT tank a 4ft level and a jack screw bar/pry bar is necessary. The illustration below shows a general overview of the steps to level the CTT Tank.



**Figure 4-7: Leveling the Tank**

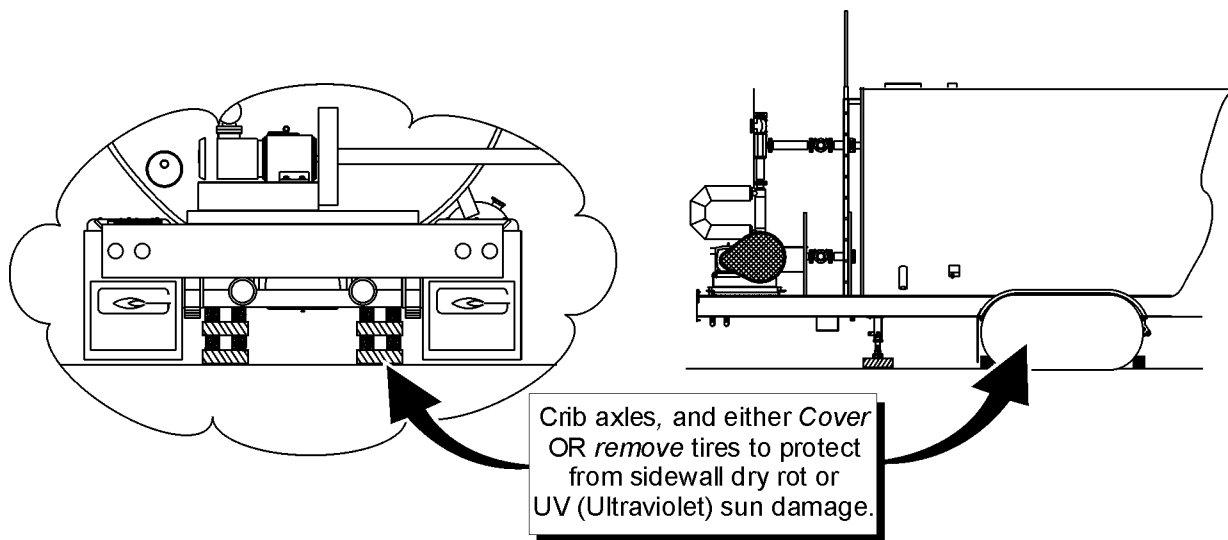
Follow the steps outlined to level the tank.

1. Determine a starting point by finding the high point and the low point. To do this place a level under the frame of the tank at several locations both parallel and perpendicular to the tank as shown in Figure 4-7: on page 37.
2. Once you determine where the high and low points are, begin to lower the screw jacks, placing the round metal plates under each screw jack. The round metal plates are stored in the pipe carrier located on the far side of the tank, see Figure 2-

- 3: on page 14. On unstable ground additional cribbing may be required to prevent the tank from settling when the tank is filled with liquid.
3. Work from the low end and raise the low points by extending the screw jack(s) in the area of the low point, then;
  4. Work from the high point and lower the high point retracting the screw jack(s) in the area of the high point.
  5. Repeat this procedure until the tank is level front to back and from side to side.
  6. With the tank level, raise the landing gear to prevent damage to the gear during the time the tank is being used.

#### 4.1.5 Additional Steps for Long Term Erection

As mentioned in the previous section, when the tank is to be used for an extended period of time, three months or longer, it is suggested to release the weight of the tank from the tires to prevent tire failure due to dry rot on the tires. It is recommended to crib the axles and remove the tires.



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**Figure 4-8: Additional Steps for Long Term**

### 4.1.6 Hand Rail Extension Installation

The illustration below shows the Hand Rail Extension locations for a split compartment CTT Tank, for a single compartment tank the handrail is located to the rear of the tank only.

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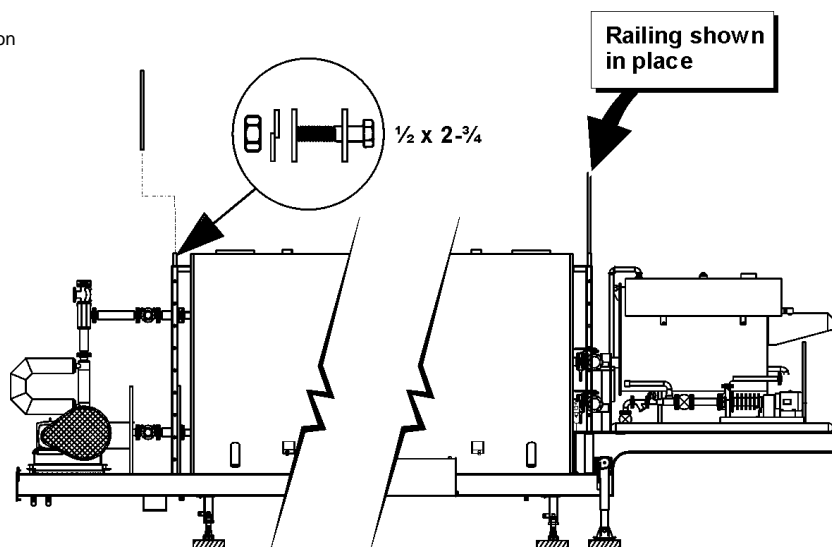
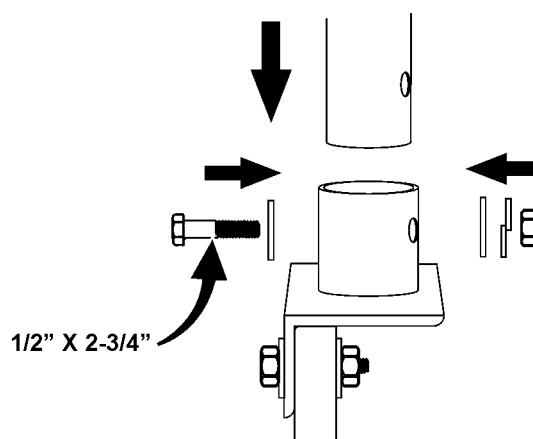


Figure 4-9: Hand Rail Extension Installation



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Figure 4-10: Hand Rail Detail

The Hand Rail Extensions are shipped loose. To install the extensions, locate the hardware as shown in Figure 4-10: on page 39. To assemble:

1. Insert a Hand Rail Extension into the socket on top of the ladder as shown in Figure 4-10: on page 39, then
2. Insert the 1/2" x 2-3/4" bolt in the order shown in Figure 4-10: on page 39, tighten the bolt.
3. Repeat for the next Hand Rail Extension. *For a split compartment tank repeat on the front ladder.*

## 4.2 Piping Installation Single Tank

Piping installation for the CTT tank is dependant on several factors. The options purchased with the CTT Tank, was the optional Calibration tank purchased and lastly, the location of the tank in relation to the Drum.

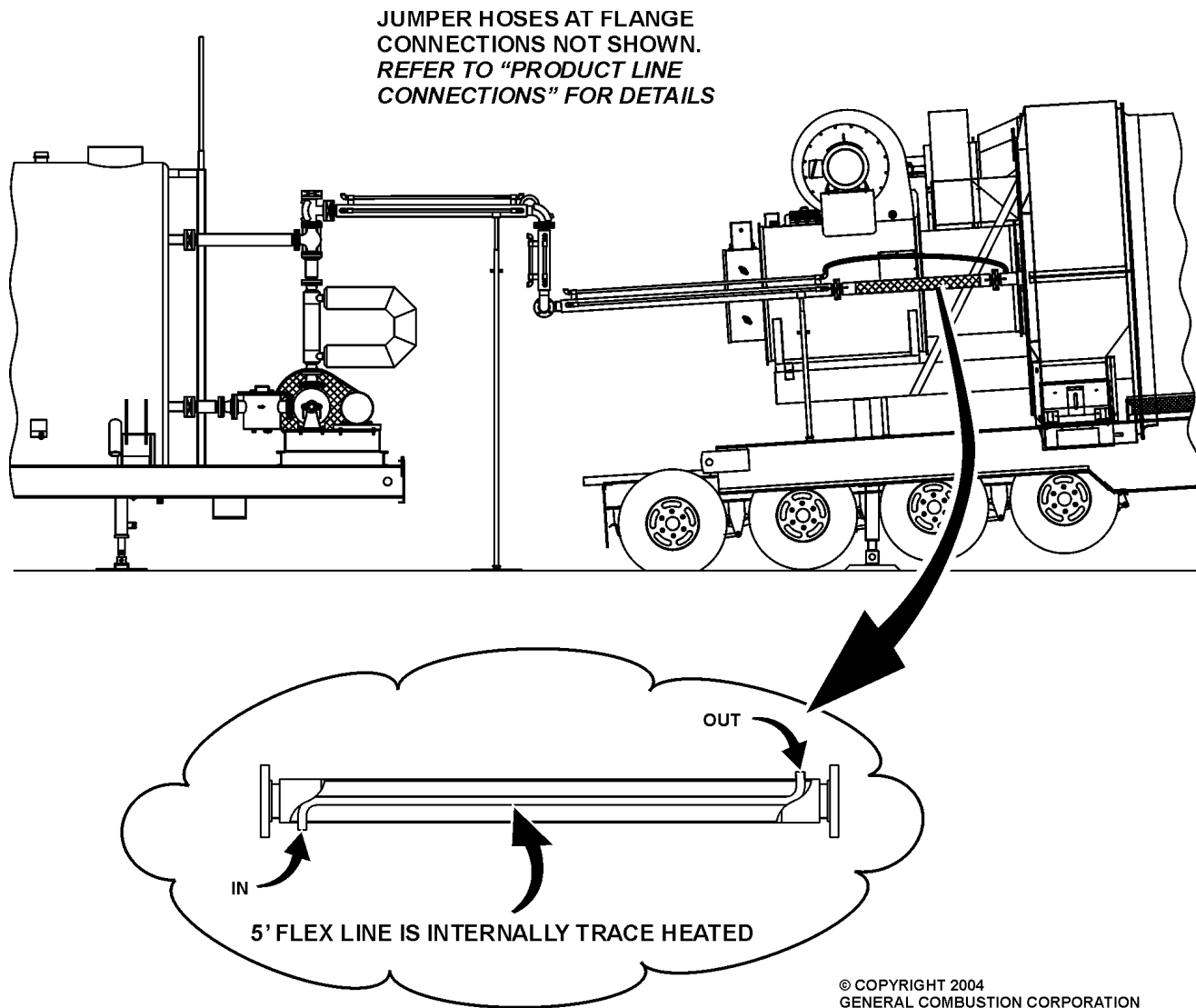


Figure 4-11: Typical Piping Installation Single Tank

### 4.2.1 Hot Oil Coil Connections

The Hot Oil Connections on the CTT Tank are pre-piped from the factory. With all tank connections on the Tank marked for easy identification of each connection. It is out of the scope of this manual to provide piping instructions if a remote Hot Oil Heater not provided with tank will be connected to the system.



## 4.2.2 Product Line Connections

Product line connection to the Ultradrums is accomplished by using Jacketed Pipe sections based on your specific configuration, Pipe Supports and 3/4"x 24" Jumper Hoses.

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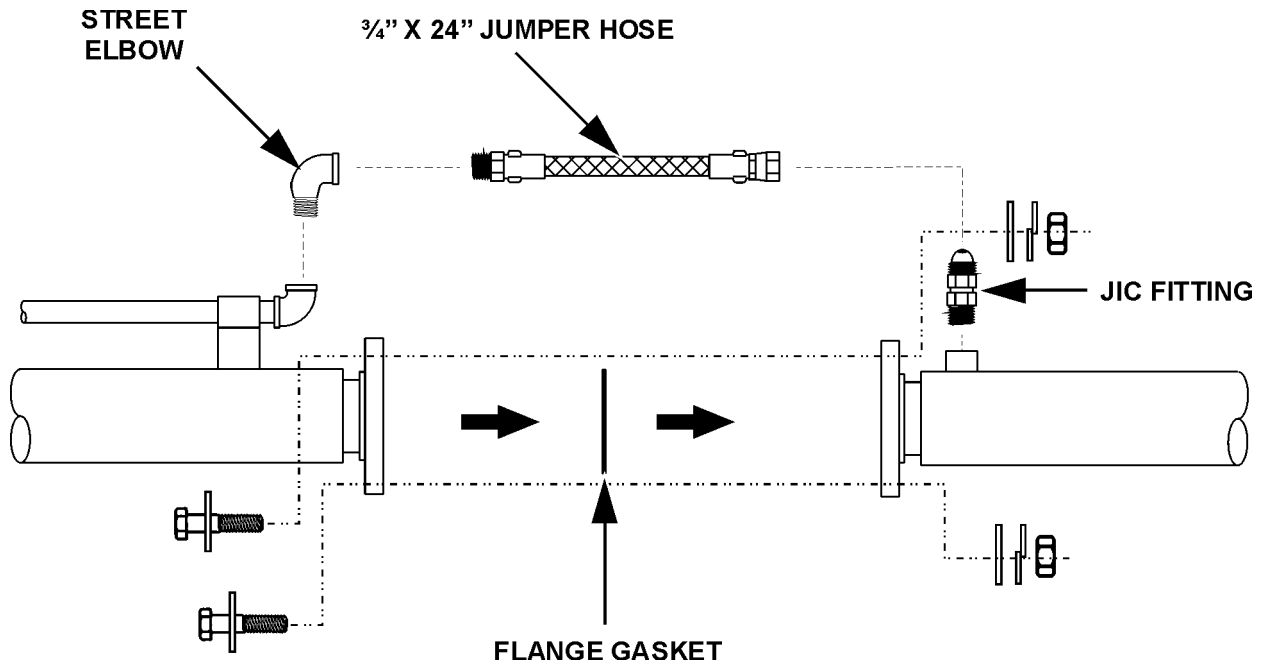


Figure 4-12: Product Line Connection

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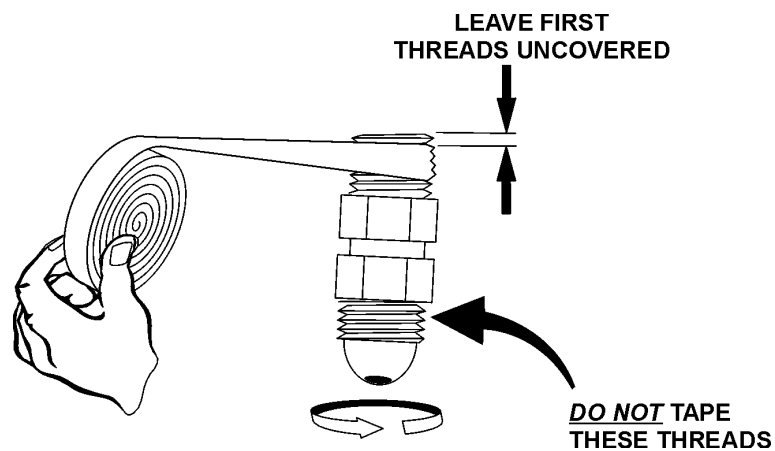


Figure 4-13: Teflon Taping Threads

### 4.3 Piping Installation for Connecting Second Tank.

Piping installation for a CTT second tank is dependant on several factors. The options purchased at the time the CTT Tank was ordered, is the tank a single or split compartment, does the tank have a Calibration tank. With the many options of piping to the second tank this manual will not cover exact piping layouts, but will cover the assembly for the connections.

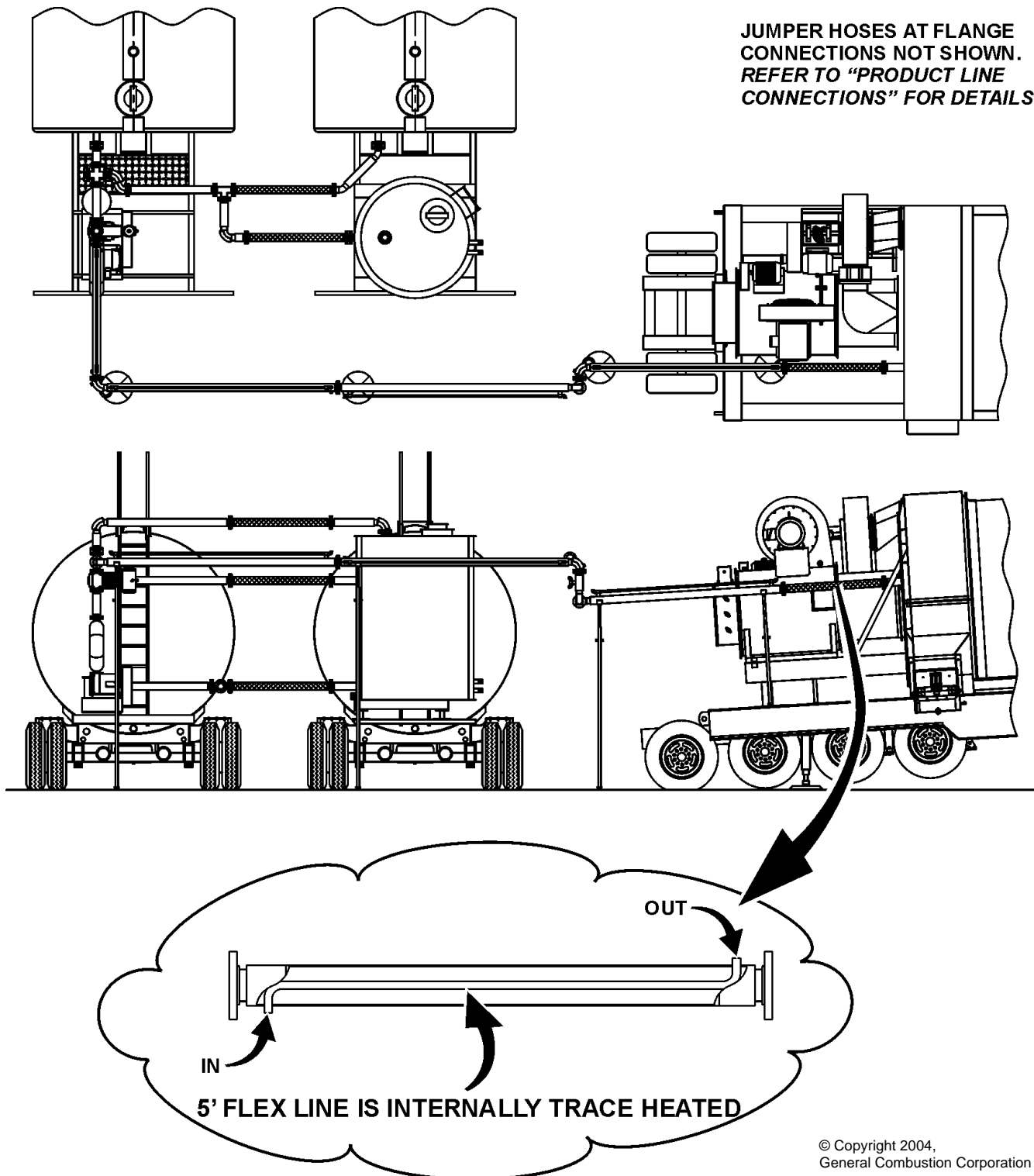
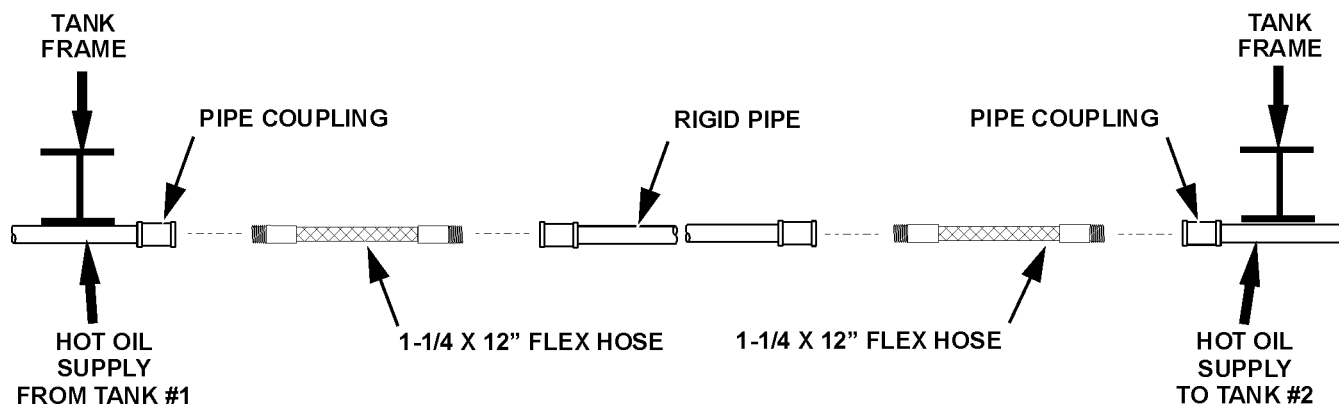


Figure 4-14: Piping Installation for Second Tank

### 4.3.1 Hot Oil Coil Connections Second Tank

For single compartment tanks, locate two 12" x 1-1/4 flex hoses and two 1-1/4 inch rigid pipe. For split compartment tanks locate four 12" x 1-1/2 flex hoses and four 1-1/4 inch rigid pipe. The illustration below details the connections:



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Figure 4-15: Hot Oil Connection Details Second Tank

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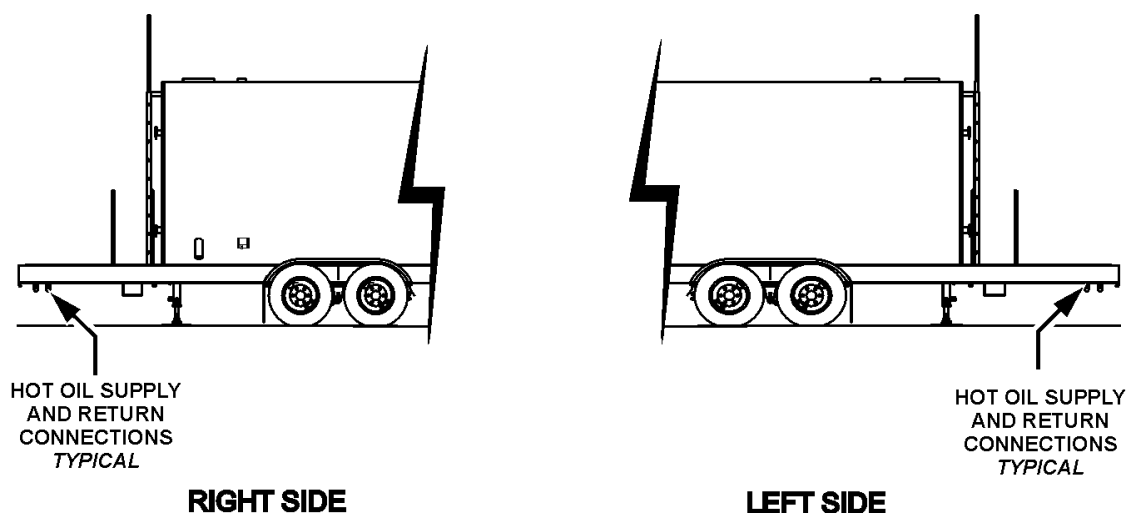
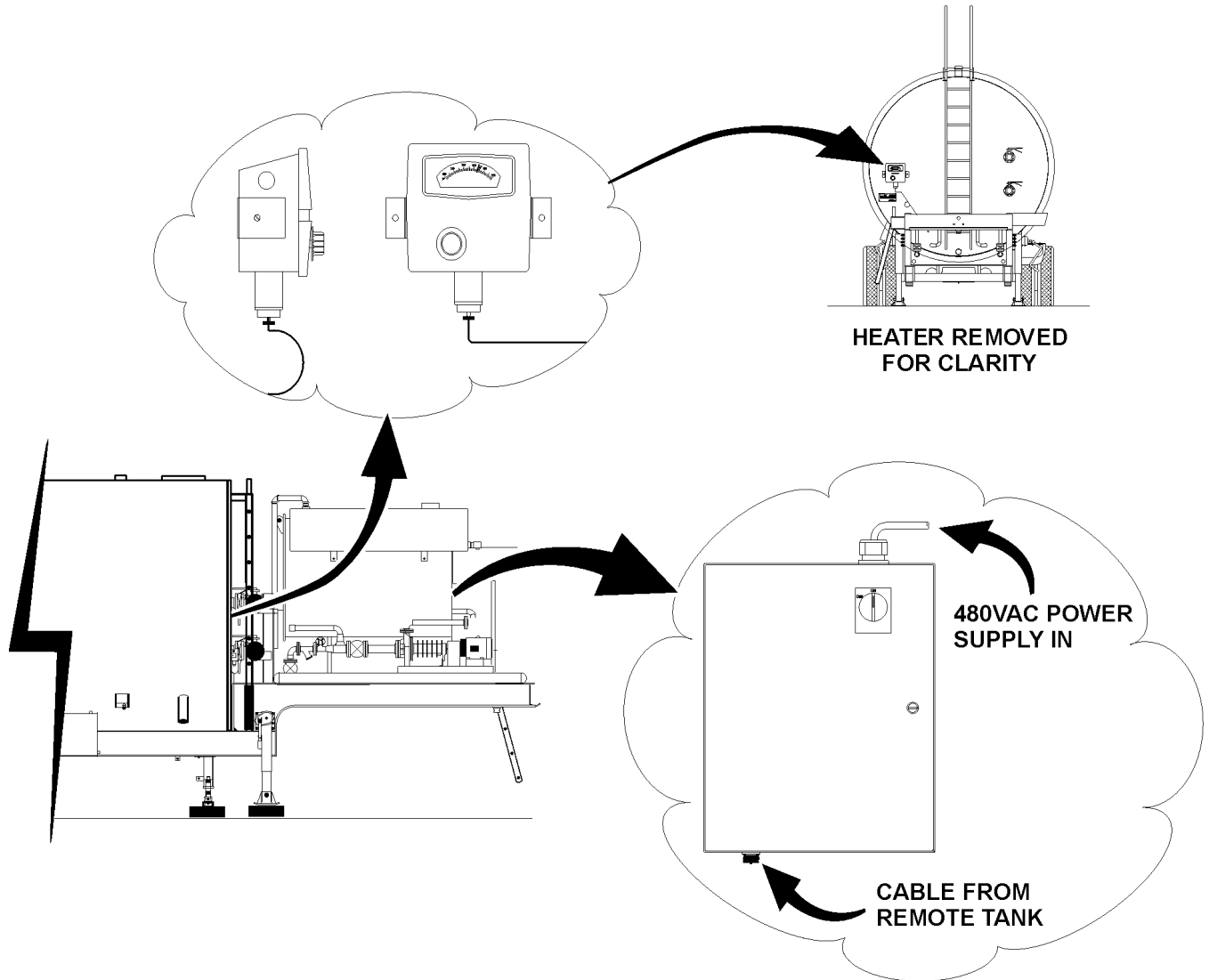


Figure 4-16: Hot Oil Connection Locations

## 4.4 Connecting Power

120VAC power to the Temperature Controller for the primary tank is pre wired from the factory. Power for the Temperature Controller on the second tank is obtained through the Hot Oil Heater Electrical panel and is field wired as required based on a single or split compartment tank.



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Figure 4-17: Power Panel



**TEMPERATURE CONTROLLERS MAY VARY ACCORDING TO PURCHASE OPTIONS. REFER TO APPENDIX A: MANUFACTURER'S DATA FOR ADDITIONAL POWER INSTALLATION INSTRUCTIONS, AND APPENDIX C: DRAWINGS FOR YOUR SPECIFIC WIRING DIAGRAM.**

# Section 5 - Pre-startup

## 5.1 Final Checklist Before Startup

Before PLACING your Horizontal Coil Storage Tank into production make sure all items in the check-off list below are checked off as completed.



**BEFORE ENTERING THE STORAGE TANK, A THOROUGH REVIEW OF OSHA'S CONFINED SPACE ENTRY PROCEDURES AND ANY EXISTING COMPANY SAFETY PROCEDURES/POLICIES REGARDING CONFINED SPACE ENTRY SHOULD BE REVIEWED AND FOLLOWED. FAILURE TO FOLLOW THESE PROCEDURES COULD RESULT IN SERIOUS INJURY OR DEATH.**

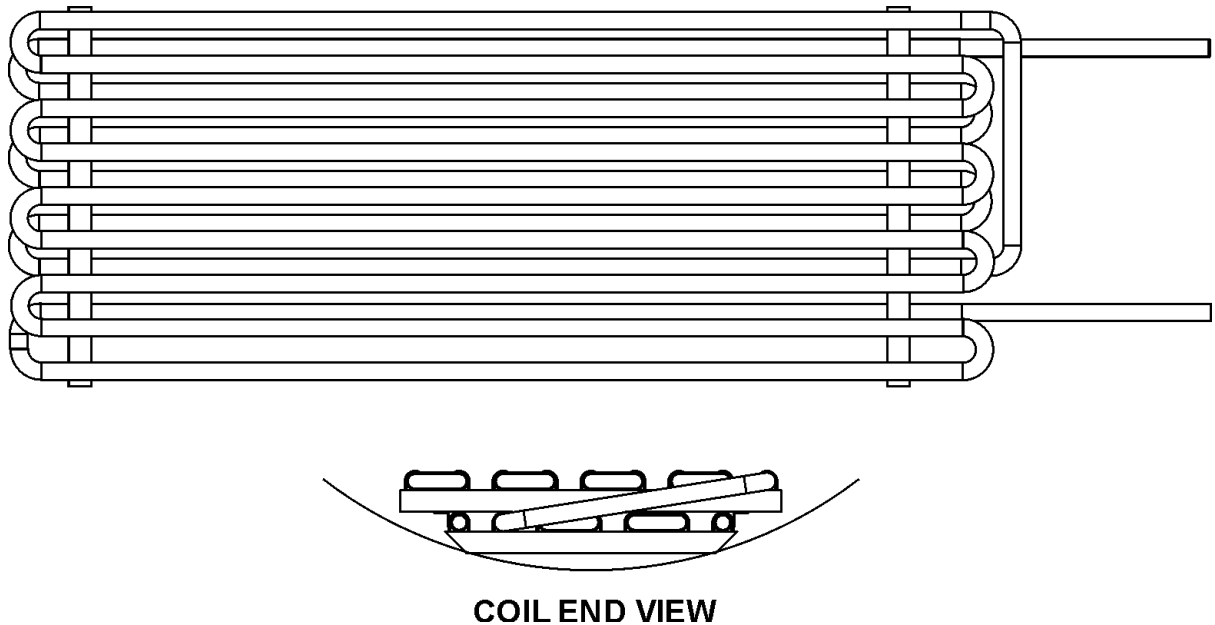
| <input checked="" type="checkbox"/> | #  | HORIZONTAL COIL STORAGE TANK PRESTART-UP CHECK-OFF LIST  |
|-------------------------------------|----|--|
|                                     | 1  | Enter the tank manhole and inspect internal of tank for debris from the installation/piping processes. <i>Be sure to follow established Confined Space Entry procedures.</i> |
|                                     | 2  | Verify all product piping connections are correct and tight.   |
|                                     | 3  | Verify all valve fittings are fully threaded and tight.  |
|                                     | 4  | Verify gaskets were installed at all product flanged piping connections.   |
|                                     | 5  | Verify all flange bolts at flange connections are tight.   |
|                                     | 6  | Verify all jacketed piping connections are completed.  |
|                                     | 7  | Verify thermal fluid piping connections to tank coil are correct and completed.  |
|                                     | 8  | Verify all thermal fluid jumper connections on jacketed piping are completed and tight.  |
|                                     | 9  | Verify all electrical connections have been made per blue print instructions and are correct.  |
|                                     | 10 | Verify all screw jacks are in place and down.  |
|                                     | 11 | Verify the tank is level end to end and side to side.  |
|                                     | 12 | Verify landing gear is retracted.  |
|                                     | 13 | Verify all piping connections from fuel tank are completed and correct.  |
|                                     | 14 | Verify thermal fluid level is at proper level in expansion tank.   |
|                                     | 15 | Verify all thermal fluid valves are in correct position.   |
|                                     |    |  |
|                                     |    |  |
|                                     |    |  |

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## Section 6 - Operation Overview

### 6.1 Heating System Coils

Heat transfer fluid from your hot oil heater is pumped into the tank coil inlet on the storage tank. The heat transfer fluid circulates through a series of heating coils. The heat transfer from the circulating of the heat transfer fluid through the coils heats the product inside the tank. The heat transfer fluid then exits the tank through the hot oil return outlet and returns back into the hot oil heater.



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**Figure 6-1: Heating System Overview**

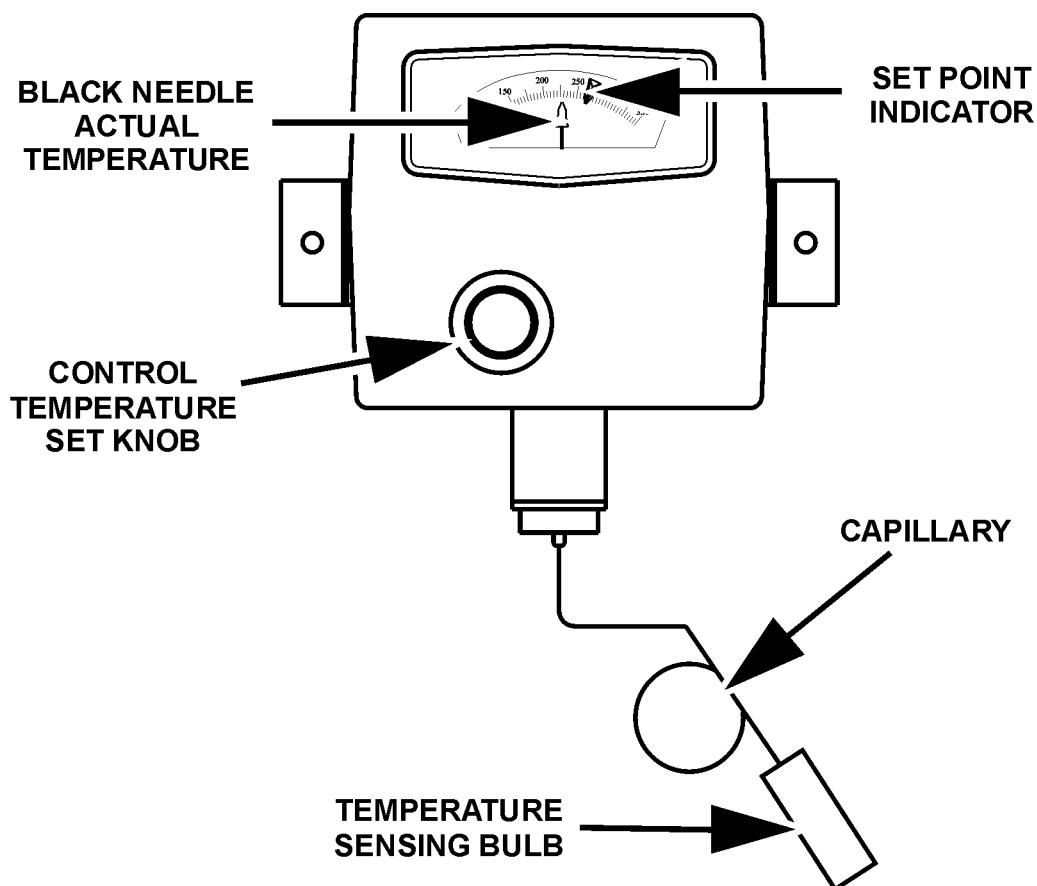
## 6.2 Temperature Controller

### 6.2.1 Temperature Controller Overview

The display of the temperature control has a *temperature indicator* and a *setpoint indicator*. The Black indicator indicates the actual temperature of the product inside the tank. The Red indicator indicates the temperature setpoint at which the flow of the Heat Transfer Fluid will be shutoff. The setpoint indicator can be adjusted manually by turning the knob located below the temperature display.



**IT IS THE RESPONSIBILITY OF THE OPERATOR TO KNOW THE PROPER TEMPERATURE RANGE SET POINT FOR THE PRODUCT BEING STORED.**



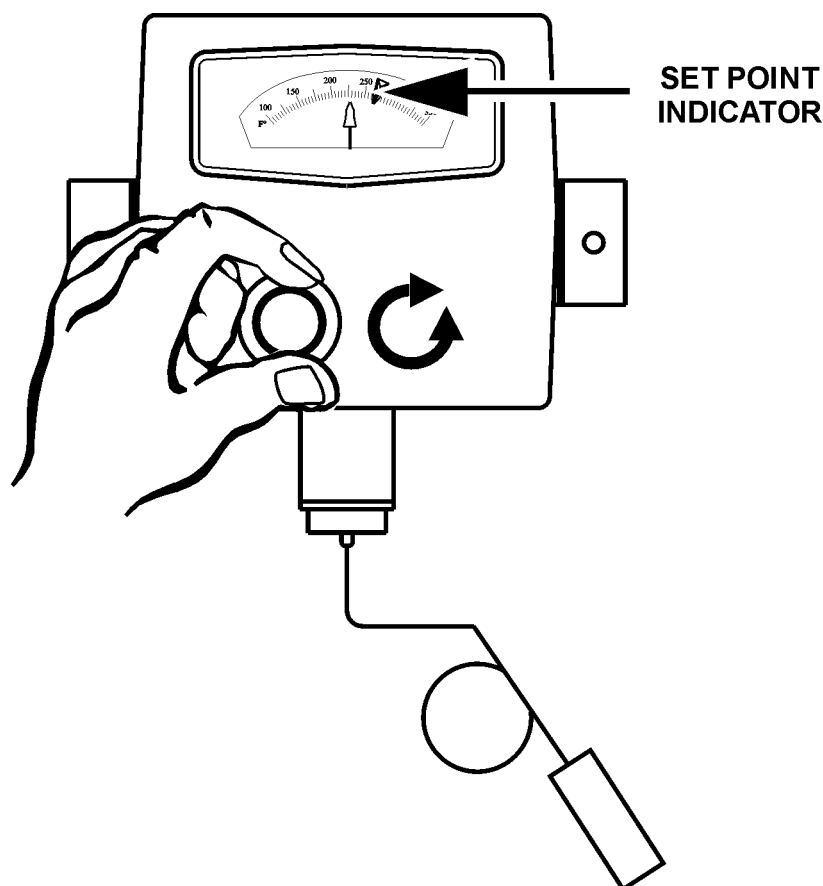
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**Figure 6-2: Temperature Controller Overview**



### 6.2.2 Setting the Temperature Controller

The CTT Tanks are supplied with a Temperature Controller prewired to a solenoid valve. A properly set Temperature Controller monitors the temperature of the product inside the tank, when the temperature reaches the pre-set high point the controller signals the solenoid valve to close. As the temperature falls below the set-up, the controller signals the solenoid valve to open. Follow the step below to set the Set point for your unit.



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**Figure 6-3: Temperature Controller Setting**

1. Set the temperature control to the desired high point. (see Manufacturer's Data section, Temperature Controller, in Appendix A).



**IT IS THE RESPONSIBILITY OF THE OPERATOR TO KNOW THE PROPER TEMPERATURE RANGE SET POINT FOR THE PRODUCT BEING STORED.**

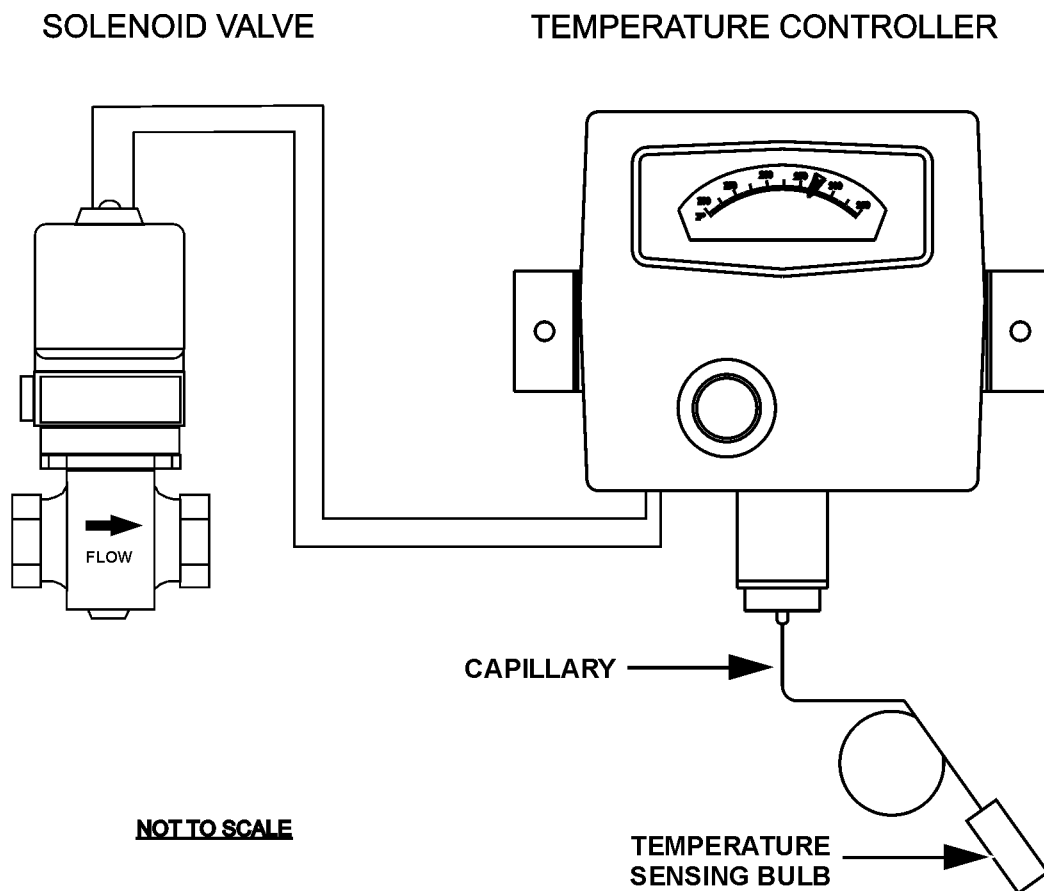
### 6.2.3 Checking the Temperature Controller Connections

Wiring connections may come loose from vibration during shipping. Therefore, check the following:

1. Verify that the temperature controller is connected to the solenoid valve.
2. Confirm that the temperature controller sensing bulb and capillary are seated securely in the thermowell.

## 6.3 Solenoid Valve

A solenoid valve is located on the tank coil outlet, and is activated by the temperature controller. When the product in the tank reaches the setpoint, the solenoid valve closes which prevents the hot oil from flowing through the heating coils. When the product temperature falls below the setpoint, the solenoid valve reopens, allowing the heat transfer fluid to flow through the heating coils. Make sure the solenoid valve is installed with the arrow pointed in the direction of product flow.



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Figure 6-4: Solenoid Valve

## 6.4 Fuel Tank

A Heater Fuel Tank is supplied with the CTT Storage Tank. Located on the right side of the tank. The fuel tank is pre-piped to the heater. The capacity of this tank is 496 gallons. Refer to the Heater Operation & Service Manual supplied with your heater for information on the fuel piping connections for the heater unit.

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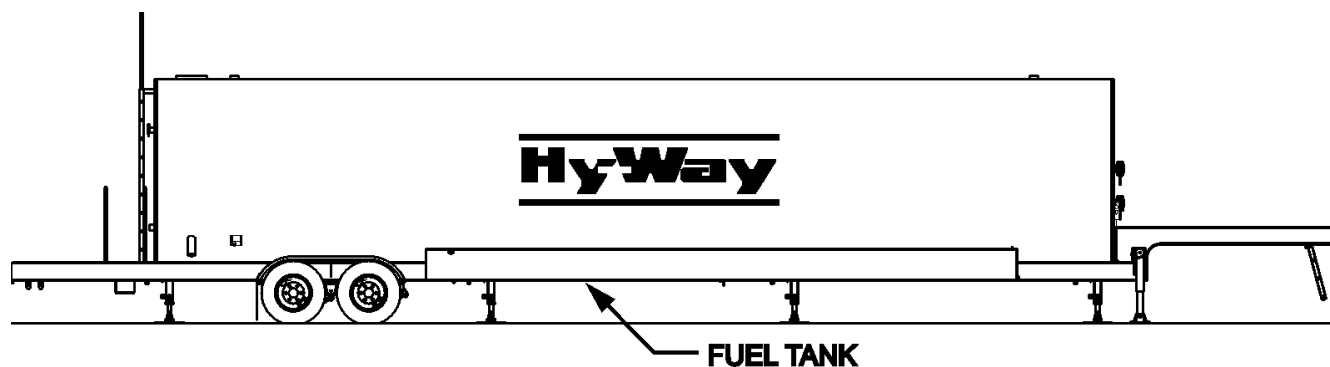


Figure 6-5: Fuel Tank Location

## 6.5 Expansion Tank



**THIS SECTION ONLY APPLIES TO THE SPECIFIC MODEL CTT TANKS COVERED WITHIN THIS MANUAL.**

The tank has a capacity of 100 gallons. Refer to the Oil Heater manual supplied with the tank for information on the expansion tank operation.

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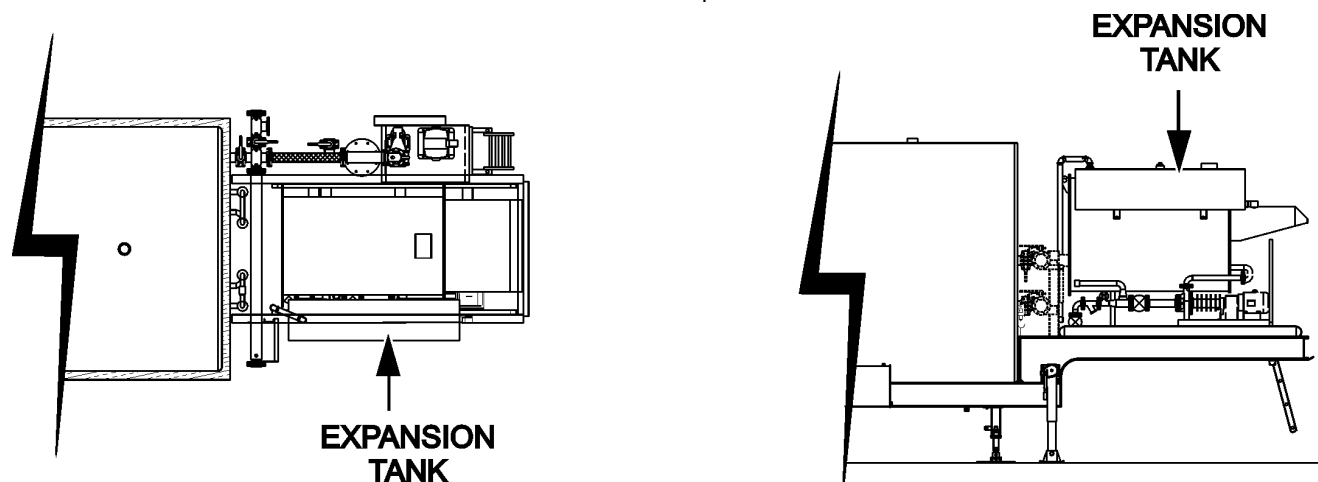
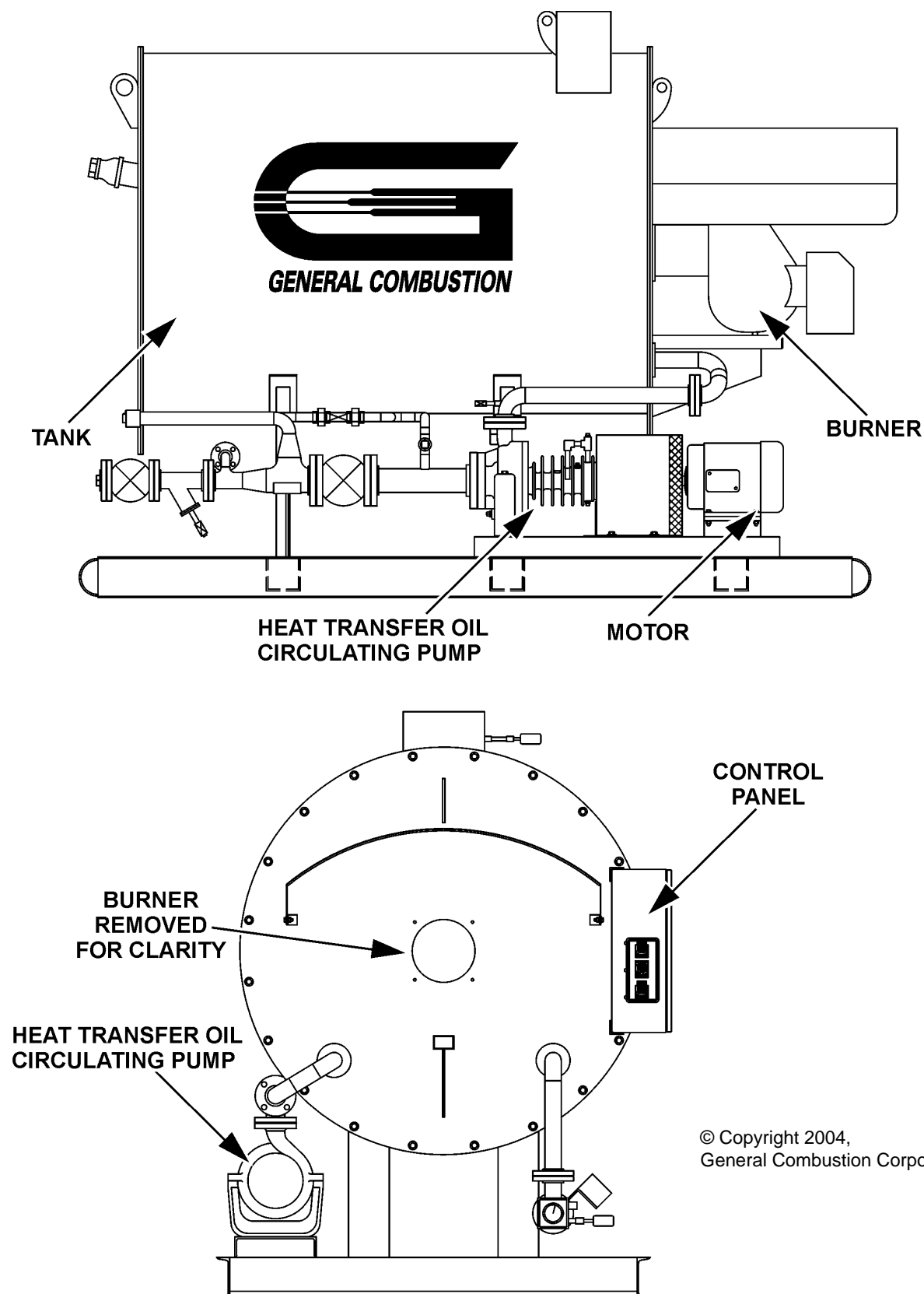


Figure 6-6: Expansion Tank

## 6.6 Hot Oil Heater

Refer to the Hot Oil Heater manual supplied with your Heater for information on your unit.



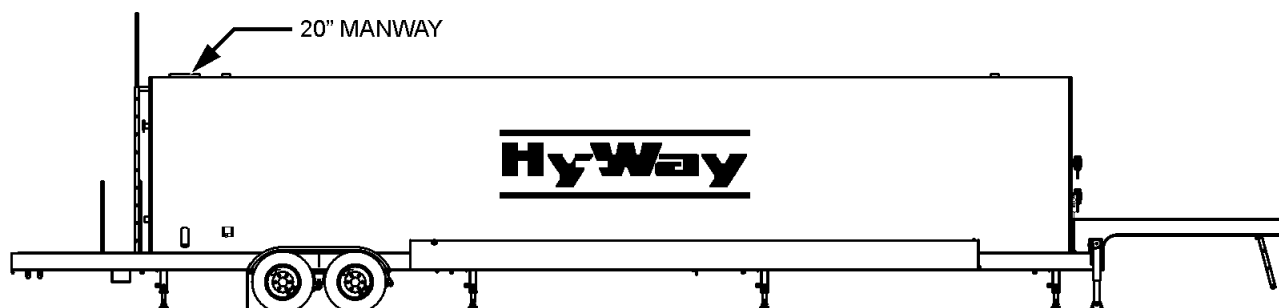
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Figure 6-7: Heater Profile

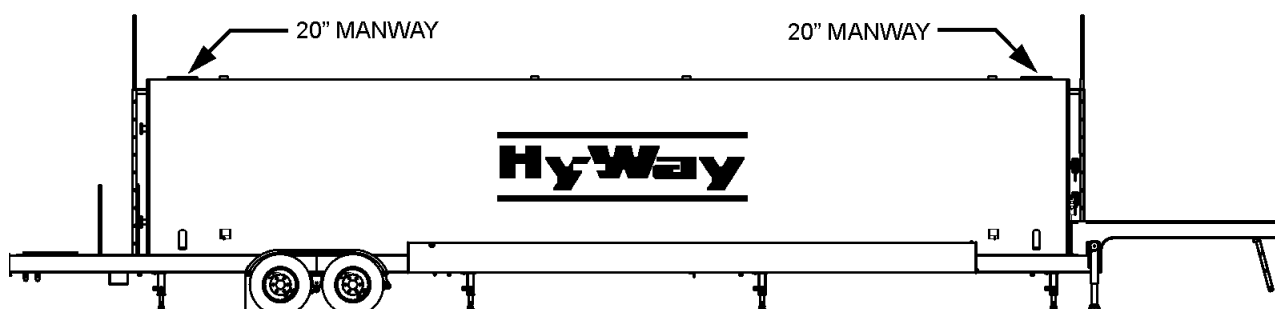
## 6.7 ***Charging the Tank Coil with Heat Transfer Fluid***

Prior to placing product in the tank, it is important that the tank is monitored and inspected through the tank top access manhole(s). As the heat transfer fluid is increased to operating temperature visually inspect the tank coil for any possible leaks that may have been caused by the shipping process of the tank.

Prior to placing the designated tank product into the storage tank, the tank coil must be filled with Heat Transfer Fluid.



**SINGLE COMPARTMENT**



**SPLIT COMPARTMENT**

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**Figure 6-8: Manhole Locations**



**IT IS IMPERATIVE THAT THE TANK COIL IS CHARGED WITH HEAT TRANSFER FLUID PRIOR TO PLACING PRODUCT IN THE TANK TO BE HEATED.**



**HYDROGEN SULFIDE IS A HIGHLY TOXIC AND FLAMMABLE GAS AND CAN REACH HAZARDOUS CONCENTRATIONS INSIDE A STORAGE TANK. AT HIGH CONCENTRATIONS, IT IS ODORLESS BECAUSE IT QUICKLY DEADENS THE SENSE OF SMELL.**

Direct the flow of Heat Transfer Fluid to the tank coil at the desired operating temperature. At this point the tank product Temperature Controller should be set at desired operating Set Point. The solenoid valve on the tank coil outlet (return) should be open allowing flow through the tank coil.

Allow the tank coil to be operated with Heat Transfer Flow through the coil for a minimum of 1 hour prior to placing Product in the tank. Re-inspect the coil for leaks.

After a thorough inspection of the tank coil under Heat Transfer Fluid temperature and no leaks have been detected it is safe to start filling the tank with product.

## 6.8 *Asphalt Storage Safety Tips*

The safe handling of hot asphalt during the unloading process requires special considerations and safety. Make sure your Personal Protection Equipment (PPE) is in good condition and properly worn.



EYE PROTECTION



FACE SHIELD



FOOT PROTECTION



LONG SLEEVES



GLOVES

**Figure 6-9: Personal Protection Equipment**

- Safety glasses or goggles.
- Face shield.
- Proper foot wear.
- Long-sleeved shirt buttoned at both the cuffs and collar.
- Long pants without cuffs.
- Heat resistant gloves. Gloves should have a tight fitting cuff or very long gauntlets to prevent hot asphalt from being trapped inside the glove.

Before unloading hot asphalt, a through inspection of the pipe lines should be performed, close inspection for damage to the flange gaskets and inspection of the connections to ensure they are tight.

Potential hazards to avoid like: the use of an open flame, spark or another ignition source near fumes from the tank, or a connection blocked with cold asphalt could cause pressure buildup in the line and cause the line to split and blow hot asphalt out and injure somebody.



**THE TOP COVER ON THE TANK SHOULD BE OPENED BEFORE UNLOADING TO PREVENT A VACUUM BUILDUP INSIDE THE TANKER-TRUCK WHICH COULD COLLAPSE IT - A SERIOUS SAFETY HAZARD.**

Never overfill a storage tank. There must be enough room in the tank for the asphalt to expand. Always make sure the storage tank that will receive the asphalt is the correct one, and there is enough room in the tank to receive the new load of asphalt.

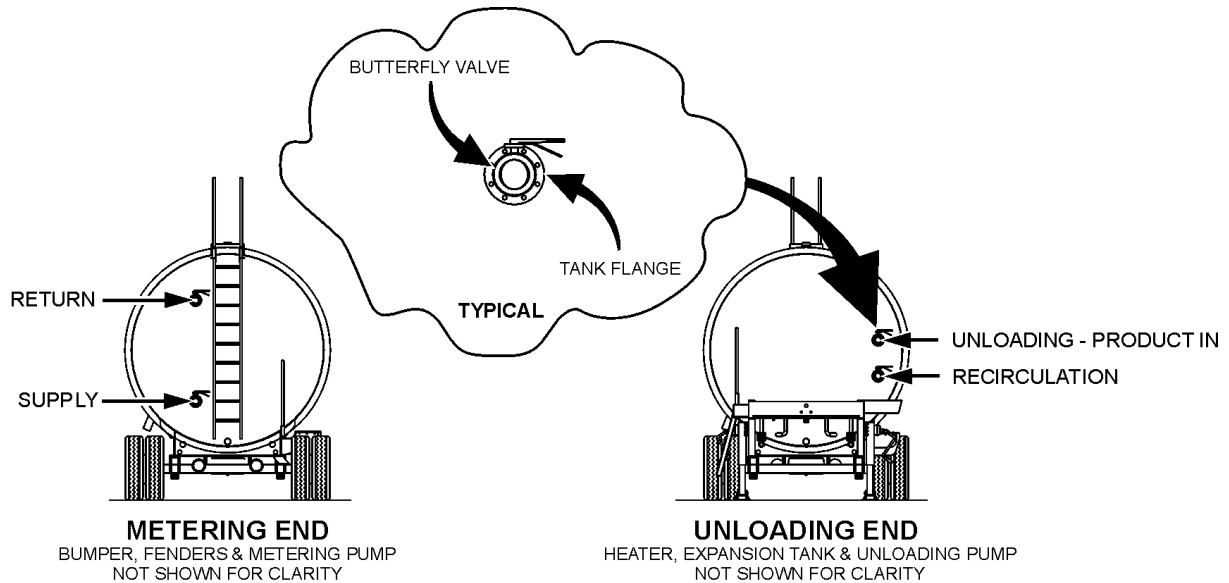


**USE EXTREME CARE WHEN DISCONNECTING THE LINE FROM THE TANKER-TRUCK, KEEP A GLOVED HAND OVER THE CONNECTION SEAM TO HELP CONTAIN POSSIBLE ASPHALT SPRAY IF PRESSURE HAS BUILT UP IN THE LINE.**

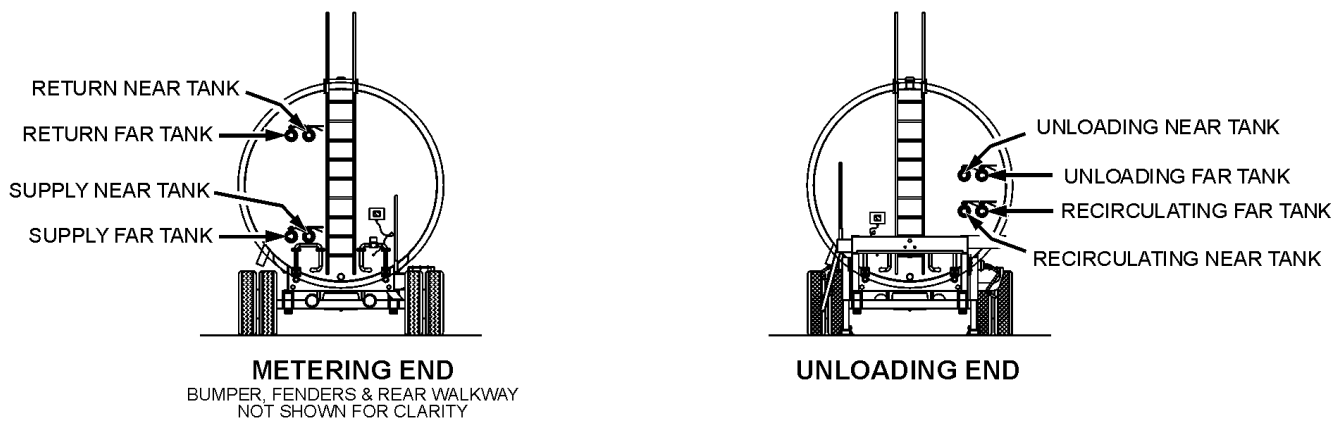
A storage tank, like the tanker-truck can become contaminated. Contamination for residuals such as light hydrocarbons, cleaning fluids or diesel oil become a potential hazard when mixed with hot asphalt. With as little as 2 gallons of residual solvents there is enough fuel to blow-up a half full 100,000 gallon tank of hot asphalt. To avoid possible contamination there should be clear communication between the hot mix plant personnel and the tank-truck driver.

## 6.9 Butterfly Valve Locations

The illustration below shows the CTT tank connections and locations of the butterfly valves. Verify the connections are tight and the valve is open/closed as necessary.



### SINGLE COMPARTMENT



### SPLIT COMPARTMENT

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**Figure 6-10: Tank Product Piping Locations**



## 6.10 Supply Tanker to Tank Connection

Before unloading a supply tanker into the CTT Tank, verify the supply tanker is *not* on level ground. The tanker must be parked so the tank discharge is the lowest point. This establishes the lowest point is at the tanker discharge.



**DURING THE UNLOADING PROCESS VAPORS PRESENT MAY BE HIGHLY FLAMMABLE OR EXPLOSIVE. NO SMOKING OR OPEN FLAME SHOULD BE PRESENT DURING THE UNLOADING OF PRODUCT.**



**PRODUCT TEMPERATURE PRESENT THAT COULD CAUSE SERIOUS BURNS, PROPER PERSONAL PROTECTIVE EQUIPMENT MUST BE USED DURING THE UNLOADING PROCESS.**



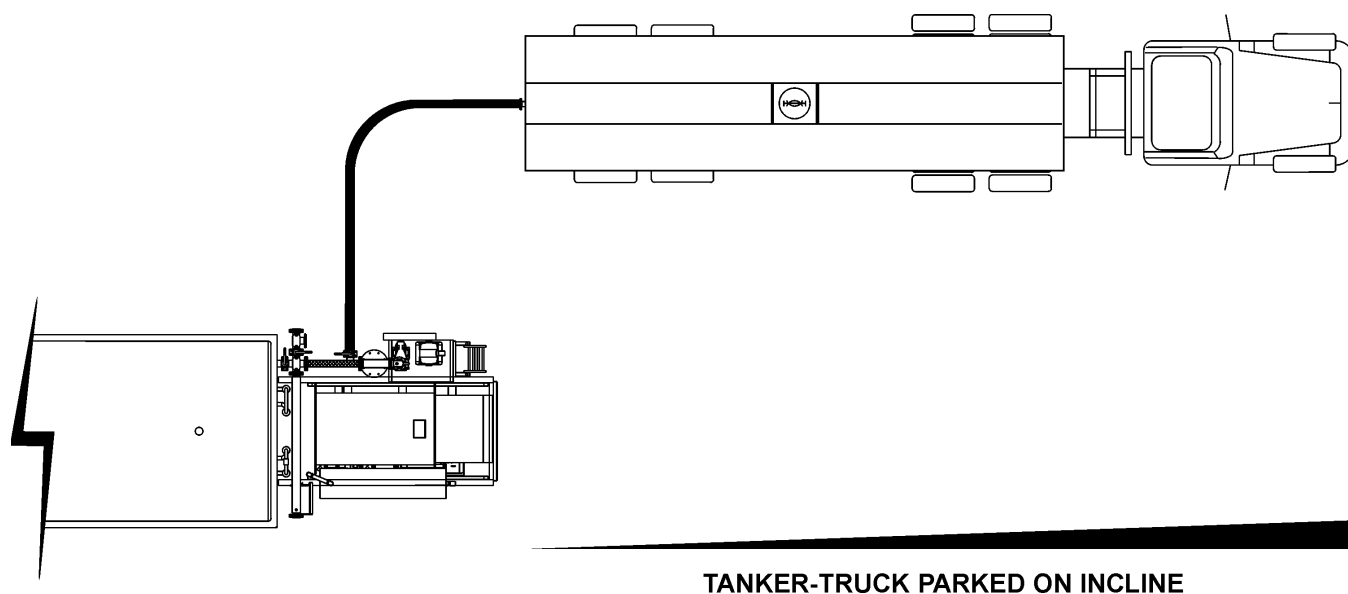
NO SMOKING



NO OPEN FLAME

- No smoking.
- No open flames.

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**Figure 6-11: Unloading Pump Location**

### **6.10.1 Unloading Pump Pre-checks**

Before starting the unloading pump the operator must pre-check the pump to insure proper operation. The steps below should be followed each time the unloading pump is used.

1. Verify pump shaft turns freely. *(Before connecting tanker to unloading pump).*
2. Verify the Strainer is clean. *(Before connecting tanker to unloading pump).*
3. Jog motor to verify rotation of pump. This means that when the pump is rotated, liquid will be delivered to the discharge side of the pump.
4. Lubricate any grease fitting on the pump using a good general purpose #2 ball bearing grease.

Strainer inspection is the only way to visualize what is happening inside of the tank, scaling, contamination, sludge and other debris collect on the strainer.

### **6.10.2 Unloading Pump Start-up**

1. Verify suction piping to be sure it is connected and tight.
2. Verify the flange connections are tight and correct.
3. Verify the butterfly valves are open on both suction and discharge side of pump.
4. Verify the end of the suction pipe is below liquid level.
5. Verify the discharge piping is connected and tight, and there is a place for the liquid to go.

The pump should start delivering liquid within 60 seconds, if it does not stop the pump otherwise you may damage the pump. Review the steps outlined above. If this does not resolve the problem refer to the pump manual in Appendix A for more details.

## 6.11 Tank Filling

1. After all piping connections have been made, turn on your existing filling pump, truck mounted pump, or fill source.
2. Watch the tank level gauge or view product level through the manway, located on top of the tank. When the tank is filled to the desired level, turn off the pump.
3. Close the shutoff valve at the tank product inlet flange.
4. Disconnect the supply source from your existing filling pump, truck mounted pump, or fill source.

Verify the Tank Temperature Controller is set to the correct desired maintaining set point for product in tank

## 6.12 Tank Gauging Hazard



**HYDROGEN SULFIDE IS A HIGHLY TOXIC AND FLAMMABLE GAS AND CAN REACH HAZARDOUS CONCENTRATIONS INSIDE A STORAGE TANK. AT HIGH CONCENTRATIONS, IT IS ODORLESS BECAUSE IT QUICKLY DEADENS THE SENSE OF SMELL.**

Hydrogen sulfide may be release from the storage tanks whenever the tank manway cover is opened for inspection or tank gauging. At low concentrations hydrogen sulfide emits an odor similar to rotten eggs. At high concentrations, it is odorless because it quickly deadens the sense of smell. Hydrogen sulfide is a highly toxic and flammable gas and can reach hazardous concentrations inside a storage tank.

## 6.13 Confined Space Entry

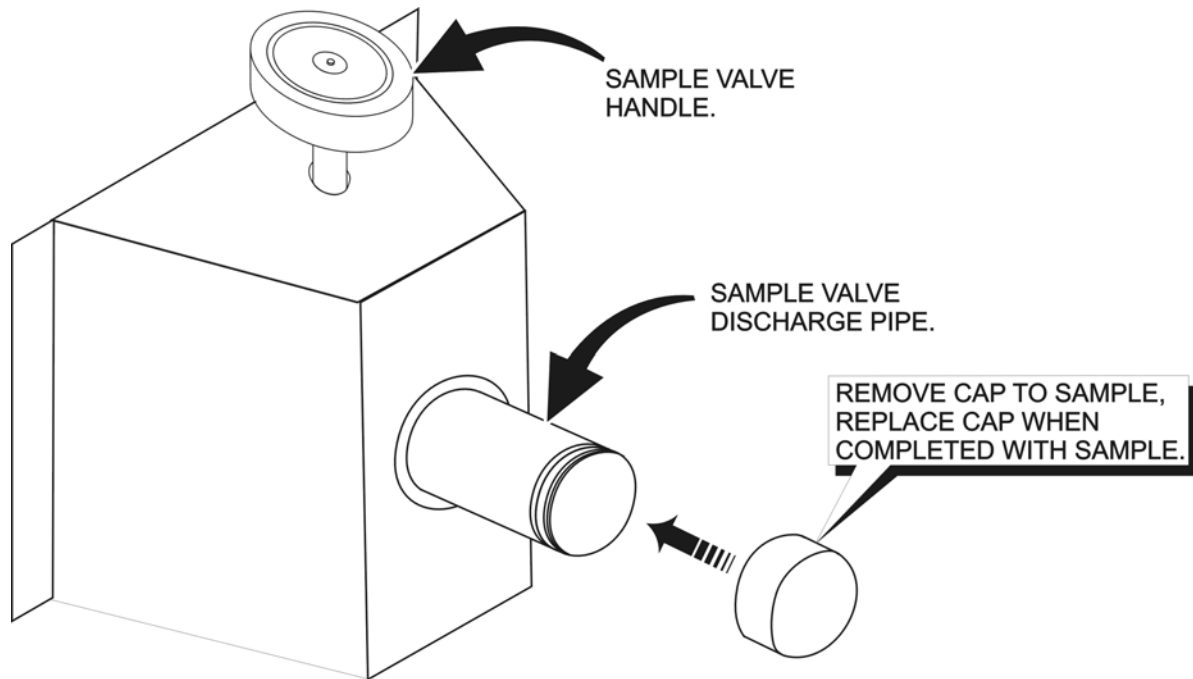


**HYDROGEN SULFIDE IS A HIGHLY TOXIC AND FLAMMABLE GAS AND CAN REACH HAZARDOUS CONCENTRATIONS INSIDE A STORAGE TANK. AT HIGH CONCENTRATIONS, IT IS ODORLESS BECAUSE IT QUICKLY DEADENS THE SENSE OF SMELL.**

Asphalt storage tanks are considered permit-required confined spaces by the OSHA regulations governing confined space entry. Never enter a permit-required confined space such as a tank without first meeting all provisions if the OSHA regulations for entering confined space, including provisions for rescue.

## 6.14 Sample Valve

The sample valve allows you to sample product directly from the storage tank without using a pump. Unscrew the cap from the end of the discharge pipe before using and replace the cap when finished. The sample valve handle allows for easy sampling of the product.



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Figure 6-12: Sample Valve

## 6.15 Product Sampling Hazards

The safe handling of hot asphalt during the product sampling process requires special considerations and safety. Make sure your Personal Protection Equipment (PPE) is in good condition and properly worn.



EYE PROTECTION



FACE SHIELD



FOOT PROTECTION



LONG SLEEVES



GLOVES

Figure 6-13: Personal Protection Equipment

- Safety glasses or goggles.
- Face shield.

- Long-sleeved shirt buttoned at both the cuffs and collar.
- Long pants without cuffs.
- Proper foot wear.
- Heat resistant gloves. Gloves should have a tight fitting cuff or very long gauntlets to prevent hot asphalt from being trapped inside the glove.

There are times during the storage of hot asphalt that it is necessary to take a product sample by drawing it from the sample valve. Should a sample valve become blocked, storage personnel will use a torch to reheat the asphalt trapped inside. This is a potential hazard, the valve can open suddenly and spray out hot asphalt which can cause severe burns. To avoid this situation, keep the sample valve clear.

When sampling hot asphalt, first flush out the sample valve by draining a small amount of hot asphalt into a metal bucket. This will clear the line and remove any cold asphalt from the valve. Cold asphalt in the valve opening can cause asphalt to spray out of the sample valve at odd angles and cause a burn.

If a sample valve needs to be heated with a torch, make sure the valve is in the closed position, also make sure there is product in the tank behind the valve before heating. Make sure you wear proper PPE. As you heat the valve carefully open the valve. DO NOT attempt to clear the blockage by placing a welding rod, wire or similar material into the valve. Never leave an unattended torch flame near any part of an asphalt process.

This process will eliminate potentially contaminated asphalt from inside the pipe and valve opening. Contaminated material if not properly drained, may cause a quality control test failure result.

If a sample valve needs to be heated with a torch, make sure the valve is in the closed position, also make sure there is product in the tank behind the valve before heating. Make sure you wear proper PPE. As you heat the valve carefully open the valve. DO NOT attempt to clear the blockage by placing a welding rod, wire or similar material into the valve. Never leave an unattended torch flame near any part of an asphalt process.

This process will eliminate potentially contaminated asphalt from inside the pipe and valve opening. Contaminated material if not properly drained, may cause a quality control test failure result.

## **6.16 Winter/Long Term Storage**

Long term storage as previously defined is 3 months or longer, the steps below should be followed to prevent damage to the CTT storage tank.

1. Drain product in tank as low as possible
2. Clean hot oil return line strainer or bag filter if installed.
3. Have thermal transfer fluid analyzed. Dilute as required. Replace twenty percent each year if no analysis is available. See "Sampling the Heat Transfer Fluid for Analysis" on page 63.
4. Follow Heater manual lay up procedures for the Heater Unit.
5. Close all valves to coil on tank to contain thermal transfer fluid in coil on tank.
6. Close all valves to expansion tank to contain thermal transfer fluid in expansion tank.
7. Seal expansion tank overflow pipe to prevent air low to expansion tank.
8. Disconnect all electrical power to tank.
9. Follow tire/axle crib procedures

## 6.17 Sampling the Heat Transfer Fluid for Analysis

Samples must be taken from a "live" part of the system. Good locations to sample from include any low-point drain near the pump or heater, and the blow-down valve mounted on the Y -strainer. You'll normally find the Y -strainer in the return line just upstream of pump suction.

It's best to draw the sample after the system has been on standby (the pump's still running but the fluid has cooled down). Not only is this considerably safer than taking a hot sample, but cool fluid will not oxidize (smoke) as it flows out the drain valve. If the fluid smokes, the TAN test may show artificially high acid levels.

When you first crack the valve, allow some fluid to drain into a metal container. Through this flushing you will be removing excess contaminants that have settled out in the valve or strainer. Make sure that the pump has been running so that the fluid you get is truly representative of the fluid in your system.



**SAMPLES TAKEN FROM THE EXPANSION TANK, OR FROM A "DEAD LEG" ARE NOT REPRESENTATIVE OF YOUR SYSTEMS FLUID.**



**THE INDEPENDENT LAB REQUIRES APPROXIMATELY 3/4 QUART TO PROPERLY CONDUCT THE ANALYSIS. PLEASE FILL THE SAMPLE JAR TO THIS LEVEL.**

## **6.18 Optional Equipment**

The following optional equipment is available on the CTT Tank.

### **6.18.1 Thermal Fluid Heater**

Heater BTU rating size HY-100 series or HY-200 series.

### **6.18.2 Condenser Unit**

An optional shell and tube Condenser Unit is available for light end vapor recovery.

### **6.18.3 Level Float**

There are two style Level Float indicators available, a bobber style or a scale board style.

### **6.18.4 Agitator**

An optional agitator is available.

### **6.18.5 Temperature Recorder**

Remote/local chart recording capabilities for DOT requirements.

### **6.18.6 Calibration Tank**

A 1000 Gallon Calibration Tank is available mounted on a second CTT tank only.  
A stand alone model is also available.



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# Section 7 - Maintenance

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## 7.1 *Maintenance Safety Section*

### 7.1.1 *Prior to performing any Maintenance*

Carefully read and follow the safety precautions below. Also, review the Safety Section, and specific manufacturer's data in the Operation and Maintenance Manual prior to checking and repairing equipment. Failure to follow the instructions, procedures, and safety precautions provided may increase the possibility of accidents and injuries.

### 7.1.2 *General Safety Guidelines*

- Wear appropriate protective equipment and clothing such as gloves, safety glasses, respirators, earplugs, head coverings, respiratory protective equipment, hard hats, and safety shoes when performing troubleshooting activities.
- Avoid loose-fitting clothing, confine long hair, and remove jewelry when working around moving equipment.
- Keep clothing, arms, hands, and other bodily parts away from hot or moving parts.
- Keep personnel clear from the discharge opening of hoses or tools. NEVER engage in horseplay with air hoses or other equipment.
- Avoid bodily contact with hot oil, hot coolant, hot surfaces, and sharp edges and corners.
- Clean up spills of lubricant or other combustible substances immediately when such spills occur. Keep hands, feet, floors, controls, walking surfaces and railings free of oil, water or other liquids to minimize the possibility of slips and falls.
- Keep sparks, flames and other sources of ignition away from equipment when adding lubricant or when refilling airline anti-icer systems with antifreeze compound.
- DO NOT use flammable solvents for cleaning purposes.
- DO NOT exceed manufacturer's rated safe operating pressures for air tools, air and hydraulic hoses, pipes, valves, filters and other fittings.
- Perform repairs only in clean, dry, well-lit and ventilated areas.
- Secure and tag access doors in the open position to avoid the possibility of others closing and latching the door with personnel inside. Make sure all personnel are out of enclosures prior to closing and latching access doors. Keep access doors closed except when making repairs or adjustments.
- In case of injury, seek medical assistance immediately.

### 7.1.3 Electrical Safety Guidelines

- To minimize the possibility of accidental start-up or operation while attempting repairs or adjustments, whenever possible, disconnect and lock out all power at source and verify that all circuits are de-energized before working on equipment. This is especially important when working on remotely controlled equipment.



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General Combustion Corporation

**Figure 7-1: Electrical Safety Guidelines**

- Keep grounded and/or conductive objects such as tools away from exposed live electrical parts such as terminals to avoid arcing which might serve as a source of ignition.
- Keep all parts of the body away from exposed live parts of the electrical system. Maintain dry footing, stand on insulated surfaces and do not contact any other portion of equipment when making adjustments or repairs to exposed live parts of the electrical system. Make all such adjustments or repairs with one hand only, so as to minimize the possibility of creating a current path through the heart.
- DO NOT leave equipment unattended with open electrical enclosures. If necessary to do so, disconnect, lock out, and tag all power at source so others do not inadvertently restore power.
- Replace any wiring that has cracked, cut, abraded, or otherwise degraded insulation. Replace terminals that are worn, discolored, or corroded. Keep all terminals and pressure connectors clean and tight.

## 7.2 General Monthly Maintenance

- Before initial start-up and at least once each year thereafter, check that all wiring connections are secure.
- Promptly repair any damage to insulation on the tank or pipes to prevent the surrounding insulation from deteriorating.
- Test the solenoid by adjusting the indicating needle above and below the set point. Listen to verify that the solenoid is opening and closing.
- At start-up, verify that the indicating needle moves as the product temperature rises.
- Verify that the float ball is moving freely and indicating the proper level. (Optional)

## 7.3 Lubrication Section

### 7.3.1 Lubrication Schedule

To insure the CTT Tank operates properly, make sure the required lubrication schedules as indicated in the table below is performed as indicated on a regular schedule. Refer to Figure 7-3: page 68 for lubrication points.

| # | Identification  | # of Points | Interval Hours                | Lube Type      | Remarks  |
|---|-----------------|-------------|-------------------------------|----------------|--|
| 1 | Unloading Pump  |             |                               |                | Refer to the Unloading Pump Manual supplied with the tank. |
| 2 | Electric Motor  | 1           | Annually                      |                | Refer to manufacturer's recommendation.                    |
| 3 | Axle Bearings   | 4           | 12,000<br>or<br>12 months     |                | Refer to manufacturer's recommendation.                    |
| 4 | Jack Screw Legs | 10          | Each time Tank is re-located. | Anti Seize Lub |  |
| 5 | Landing Gear    | 2           | Monthly                       |                |  |

**MPG** = Lithium complex grease for long life, temperature up to 410°F (210°C).

Figure 7-2: Lubrication Schedule



**WHEN APPLYING GREASE VERIFY THAT THE SPECIFICATIONS OF ALL GREASE USED IS EQUIVALENT. MIXING DIFFERENT GREASES TOGETHER IS NOT ADVISABLE AND CAN LEAD TO PREMATURE FAILURE OF LUBRICATED COMPONENTS. IT IS VERY IMPORTANT ALL GREASE USED IS A HIGH TEMPERATURE RATED GREASE.**



**NEVER USE A POWER-OPERATED GREASE GUN ON ANY ANTI-FRICTION BEARINGS.**



**CARE MUST BE TAKEN WHEN GREASING BEARINGS TO KEEP ALL DIRT OUT OF THE AREA. WIPE ALL FITTINGS COMPLETELY CLEAN AND USE CLEAN EQUIPMENT. MORE BEARING FAILURES RESULT FROM IMPURITIES INTRODUCED INTO THE BEARING CAVITY DURING GREASING OPERATIONS THAN FROM INSUFFICIENT GREASE.**

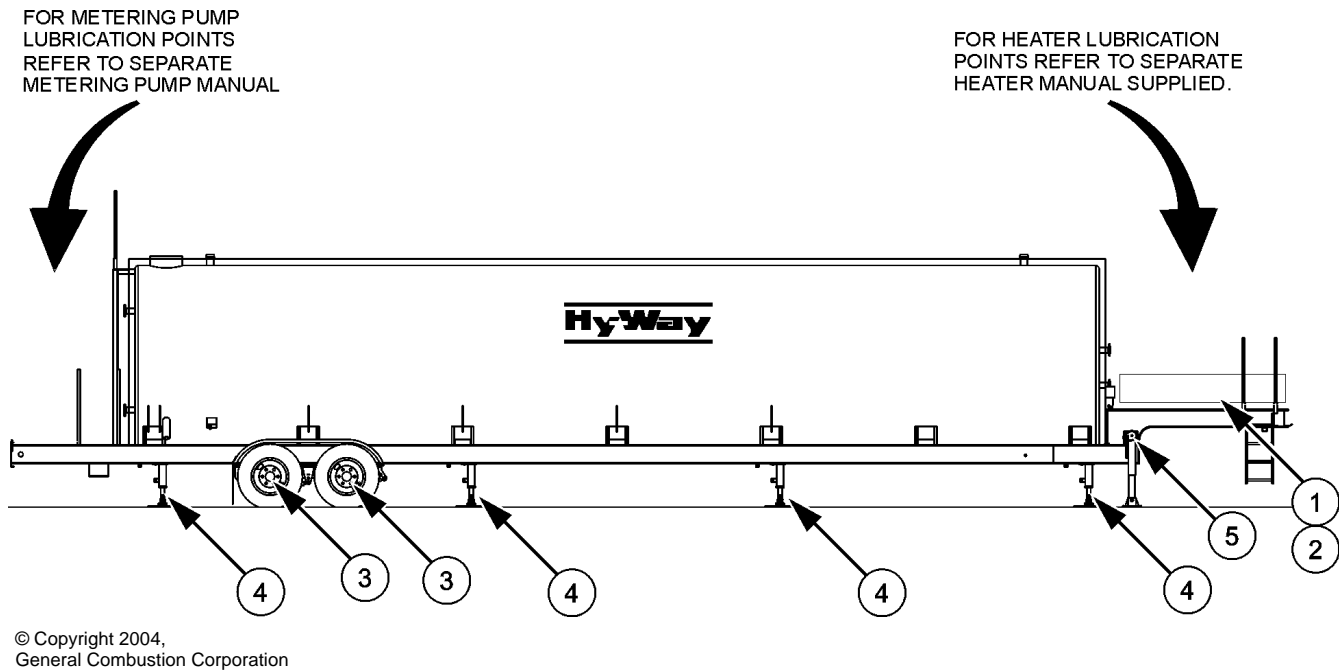


Figure 7-3: Lubrication Points

## 7.4 Unloading Pump

Performing a few preventative maintenance procedures will extend the life of your pump. Lubricate with a NLGI #2 grease for normal operations, for hot or cold operations refer to the pumps Operation & Maintenance manual in Appendix A. Refer to the pump manual in Appendix A for complete maintenance information on your unloading pump.

## 7.5 Electric Motor Lubrication

All electric motors are pre-lubricated with sufficient grease to last indefinitely in normal service. When the motor is used constantly in dirty, wet, or corrosive atmospheres, the manufacturer advises adding 1/4 oz. of grease per bearing annually, using a good quality rust-inhibitive polyurea base grease. Refer to Appendix A for information on the specific motors on your CTT Tank.

## 7.6 Axle Bearing Lubrication

Grease should be replaced every 12,000 miles or 12 months. Prior to repacking bearings, all old grease should be removed from the wheel hub cavity and bearings. Bearings should be packed by machine if possible. If a machine is unavailable, packing by hand method is acceptable. The method to pack bearing cones is as follows:

1. Place a quantity of grease onto the palm of your hand.
2. Press a section of the widest end of bearing into the outer edge of the grease pile closest to the thumb forcing grease into the interior of the bearing between two adjacent rollers.
3. Repeat this while rotating the bearing from roller to roller.
4. Continue this process until you have the entire bearing completely filled with grease. Before reinstalling, apply a light coat of grease onto the bearing cup mating surface.



**DO NOT MIX LITHIUM, CALCIUM, SODIUM OR BARIUM COMPLEX GREASES DUE TO POSSIBLE COMPATIBILITY PROBLEMS. WHEN CHANGING FROM ONE TYPE OF GREASE TO ANOTHER, IT IS NECESSARY TO INSURE ALL THE OLD GREASE HAS BEEN REMOVED.**

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# Section 8 - Troubleshooting

## 8.1 Troubleshooting Procedures

The tables below are broken into sections. Refer to the section for the specific item to troubleshoot on your unit. Appendix A contains selected Manufacturers information, should the item you need information on not be listed below refer to the Manufacturers information in Appendix A for further assistance.

### 8.1.1 Temperature Controller

| SYMPTOM                         | POSSIBLE CAUSE   | REMEDY   |
|---------------------------------|--|--|
| No temperature reading.         | Temperature bulb not inserted properly in the thermowell.<br><br>Kinked or broken capillary. | Ensure that the bulb is correctly inserted into the thermowell.<br><br>Replace the capillary.  |
| Inaccurate temperature reading. | Temperature controller not working.  | Refer to Appendix A: Manufacturer's Data regarding temperature controller. Replace temperature Controller.   |
| Indicator stuck                 | Kinked capillary.<br><br>Indicator mechanism rusted or frozen.                               | Replace capillary.<br><br>Free, lubricate, or replace indicator mechanism.   |
| Product will not heat.          | Hot oil heater not operating properly.<br><br>Solenoid valve stuck.                          | Check for proper operation of hot oil heater.<br><br>Check for proper operation of solenoid valve. Refer Appendix A: Manufacturer's Data regarding solenoid valve. |
| Tank overheats.                 | Temperature controller malfunction.<br><br>Solenoid valve stuck open.                        | Repeat steps above.<br><br>Check for proper operation of solenoid valve. Refer Appendix A: Manufacturer's Data regarding solenoid valve.                           |

## 8.1.2 Three Phased Electric Motors

| SYMPTON   | POSSIBLE CAUSE  | REMEDY  |
|---|---|---|
| A. High input current (all three phases).   | 1. Inaccurate ammeter reading.  | 1. Carefully check voltage across each phase at the motor terminals with good, properly calibrated volt-meter.  |
| B. Running Idle.  | 1. High line voltage 5% to 10% over nameplate.  | 1. Consult power company to possibly decrease voltage by using transformer tap.   |
| C. Running loaded.  | 1. Motor overloaded.<br><br>Motor voltage rating does not match power system voltage.   | 1. Replace motor with one of correct voltage rating.<br><br>Replace motor with one of correct voltage.<br><br>Consult power company to possibly correct the problem by using a different transformer tap.   |
| D. Imbalanced input current. (5% or more deviation from the average input current).<br><br><b>NOTE:</b> A small voltage imbalance will produce a large current imbalance. Depending of the magnitude of imbalance and the size of the load, the input current in one or more of the motor input lines may greatly exceed the current rating of the motor. | 1. Imbalanced line voltage due to:<br>A. Power supply.<br>B. Imbalanced system loading.<br>C. High resistance connection.<br>D. . Undersized supply lines.<br><br>2. Defective motor. | 1. Carefully check voltage across each phase at the motor terminals with good, properly calibrated volt-meter.<br><br><br><br><br><br><br><br><br><br><br>2. If there is doubt as to whether the trouble lies with the power supply or the motor, check the following:<br><br>Rotate all three input power lines to the motor by one position. For example: Move line #1 to line # 2 lead and line #3 to #1 motor lead.<br><br>If the imbalanced current pattern follows the input power lines, the problem is in the power supply. |



| SYMPTON  | POSSIBLE CAUSE   | REMEDY  |
|--|--|---|
|  |  | <p>3. If the imbalanced current follows the motor leads, the problem is in the motor.</p> <p>Correct the voltage imbalance of the power supply or replace the motor, depending on the results of the above test.</p>  |
| E. Excessive voltage drop (more than 2% or 3% or nominal supply voltage).          | <p>1. Excessive starting or running load.</p> <p>2. Inadequate power supply.</p> <p>3. Undersized supply lines.</p> <p>4. High resistance connections.</p> <p>5. Phase leads in separate conduits.</p> | <p>1. Reduce load.</p> <p>2. Consult power company</p> <p>3. Increase line sizes.</p> <p>4. Check motor leads and eliminate poor connections.</p> <p>5. All three-phase leads must be in a single conduit, per National Electrical Code. (This applies only to metal conduit with magnetic properties.)</p> |
| F. Overload relays tripping upon starting (also seek slow starting which follows). | <p>1. Slow starting (10 to 15 seconds or more) due to high inertia load.</p> <p>2. Low voltage at motor terminals</p>  | <p>1. Reduce starting load. Increase motor size, if necessary.</p> <p>2. Improve power supply and/or increase line size.</p>  |
| G. Overload relays tripping/running loaded.  | <p>1. Overload.</p> <p>2. Imbalanced input current.</p> <p>3. Single-phasing.</p> <p>4. Excessive voltage drop.</p> <p>5. Too frequent starting of intermittent overloading</p>                        | <p>1. Reduce load increase motor size.</p> <p>2. Balance supply voltage (see D regarding Imbalanced Input Current).</p> <p>3. Eliminate single phase condition.</p> <p>4. Eliminate</p> <p>5. Reduce frequency of starts and overloading, or increase motor size.</p>                                       |

| SYMPTON                                      | POSSIBLE CAUSE  | REMEDY  |
|--|---|---|
|  | 6. Wrong size relays.   | 6. Correct size per name-plate current of motor. Relays have built-in allowances for service factor current. Refer to National Electrical Code.   |
| H. Motor runs excessively hot.               | 1. Overloaded<br><br>2. Blocked ventilation.<br><br>3. High ambient temperature over 40°C (104°F).<br><br>4. Imbalanced input current.<br><br>5. Single-phased. | 1. Reduce load or load peaks and number or starts in cycle, or increase motor size (also see C, regarding Running Loaded).<br><br>2. Clean external ventilation system/check fan. Blow out internal ventilation. Eliminate external interference to motor ventilation.<br><br>3. Reduce ambient temperature or provide outside source of cooler air.<br><br>4. Balance supply voltage. Check motor leads for tightness. Also see G, regarding Overload Relays Tripping/Running Loaded<br><br>5. Eliminate single-phase condition. |
| I. Motor will not start (hums and heats up). | 1. Single phased.<br><br>2. Rotor or bearings locked.   | 1. Shut off power. Eliminate single-phasing. Check leads for tightness.<br><br>2. Shut off power. Check shaft for freeness of rotation.<br><br>3. Make sure proper size overload relays are in each of the three phases of the starter. Refer to National Electrical code.  |

| SYMPTON  | POSSIBLE CAUSE   | REMEDY   |
|--|--|--|
| J. Runs noisy under load<br>(excessive electrical noise or chatter under load).  | 1. Single-phased.  | 1. Shut off power. If motor cannot be restarted, it is single-phased. Eliminate single-phasing.<br><br>Make sure proper size overload relays are in each of the three phases of the starter. Refer to National Electrical code.  |
| K. Slow starting (10 or more seconds on the small motors - 15 or more seconds on the large motors:<br><br>Across the line<br><br><br><br><br><br><br><br><br><br>Reduced voltage start | 1. Excessive voltage drop.<br>(5% to 10% voltage drop causes 10% to 20% or more drop in torque).<br><br>2. High inertia load.<br><br>1. Excessive voltage drop.<br>Loss of starting torque<br><br>2. Starting torque has been reduced. | 1. Consult power company to check system. Eliminate voltage drop (see system E - Excessive Voltage Drop).<br><br>2. Reduce starting load or increase motor size.<br><br>1. Check and eliminate (refer to E, Excessive Voltage Drop)<br><br>2. Reduce starting load or increase motor size. Choose type of starter with higher starting torque. Reduce time delay between 1st and 2nd step on starter (get motor across the line sooner.)<br><br>Refer to the Original Equipment Manufacturer's manual located in the Motor Control Panel Door. |

| SYMPTON   | POSSIBLE CAUSE   | REMEDY  |
|---|--|---|
| L. Load speed below name plate speed.   | 1. Overload; excessively low voltage.<br><br>2. Inaccurate method of measuring rpm.                            | 1. Reduce load or increase voltage.<br><br><b>NOTE:</b> A reasonable overload or voltage drop of 10% -15% will reduce speed only 1% to 2%. A report of any greater drop would be questionable.<br><br>2. Check meter using another device or method.  |
| M. Noisy bearings<br><br>High whine:<br><br>Low rumble:<br><br>Rough clatter: | 1. Internal fit of bearing too tight.<br><br>2. Internal fit of bearing too loose.<br><br>3. Bearing destroyed | 1. Replace bearing. Check fit.<br><br>2. Replace bearing. Check fit.<br><br>3. Replace bearing. Avoid:<br><br>A. Mechanical damage<br>B. Excessive greasing.<br>C. Wrong grease.<br>D. Solid contaminants.<br>E. Water running into motor.<br>F. Misalignment on close-coupled application.<br>G. Excessive belt tension. |

| SYMPTON                             | POSSIBLE CAUSE   | REMEDY   |
|-------------------------------------|--|--|
| N. Excessive vibration (mechanical) | 1. Out of balance.<br><br>A. Motor mounting.<br><br>B. Load<br><br>C. Sheaves or coupling.<br><br>D. Motor.<br><br>E. Misalignment on close coupled application. | 1. Correction:<br><br>A. Make sure motor mounting is tight and solid.<br><br>B. Disconnect belt or coupling. Restart motor. If vibration stops, the imbalance was in the load.<br><br>C. Remove sheave or coupling. Securely tape 1/2 key in shaft keyway and restart motor. If vibration stops the imbalance was in the sheave or coupling.<br><br>D. If vibration does not stop after checking a, b, and c above, the imbalance is in the motor. Replace the motor.<br><br>E. Check and realign the motor to the driven machine. |
| O. Mechanical noise.                | 1. Driven machine or motor noise.<br><br>2. Motor noise amplified by resonant mounting.<br><br>3. Driven machine noise transmitted to motor through drive.       | 1. Isolate motor from driven machine. Check difference in noise level.<br><br>2. Cushion motor mounting or dampen source of resonance.<br><br>3. Reduce noise of driven machine or dampen transmission of noise to motor.  |

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# Appendix A - Manufacturer Data

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## Selected Vendors

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# MAGNATROL SOLENOID VALVE F-35L46-0

## Type L Full Port - Normally Closed

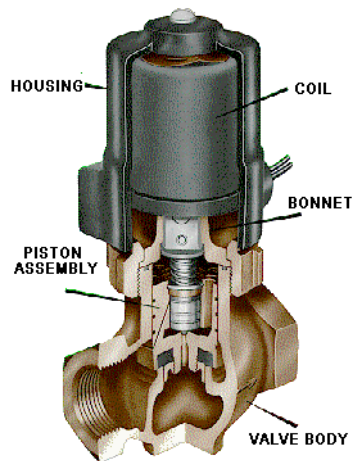
Internal Pilot Operated

**Operation:** Valve opens when energized and closes when de-energized.

**Pipe Size:** 1/2 in. to 3 in.

**Max. Fluid Temp.:** 400 deg. F

**Max. Static Pressure:** 300 psi, Except valves listed for 500 PSI diff.



## Construction:

\*Valve Body - Cast Bronze, Globe Pattern

\*Piston - Cast Bronze

Coil Enclosure - Malleable or Cast Iron

\*Plunger - 430 Stainless Steel

\*Pilot Valve - 303 Stainless Steel

\*Bonnet Tube - 304 Stainless Steel

\*Spring - Inconel

\*Body Seal - Non Asbestos Gasket

\*Orifice Seal - Glass Filled Teflon

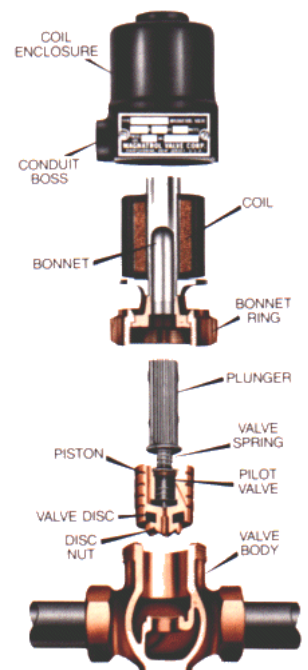
\*AC Shading Coil - Copper

\*Stem Pin - Inconel

Coil - Encapsulated, Class H, 18" Leads

\* Wetted parts in contact with fluid

**Application:** To control the flow of hot liquids, hot gases, cryogenics and any other fluids not reactive with construction materials and free of sediment. Cryogenic fluids include liquid oxygen (-297 deg. F), liquid argon (-303 deg. F), and liquid nitrogen (-320 deg. F). Cryogenic valves are degreased and cleaned to keep them free of moisture. Oxygen valves are "black light" tested. Valve operates from zero to maximum differential pressure indicated in table. Valve must be mounted in horizontal pipe with solenoid enclosure vertical and on top



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# **SINGLE SWITCH INDICATING MECHANICAL TEMPERATURE CONTROLLER**

This single switch indicating temperature controller operates fuel valves or relays which start and stop heating or cooling systems in a wide variety of applications. It is the smallest and most compact of the indicating mechanical instruments. It derives its simplicity and efficiency from the Piston-Pak filled systems sensing element.



**Partlow**

**QUALITY INSTRUMENTATION DESIGNED & MANUFACTURED IN THE USA**

Form Number 3000  
Published Jan. 1992  
Third Edition

ISO 9002 REGISTERED

**SPECIFICATIONS  
INSTALLATION  
OPERATION**

# AVT79

## Note:

**It is strongly recommended that Partlow equipped applications incorporate a high or low limit protective device which will shut down the equipment at a preset temperature condition in order to preclude possible damage to property or product.**

**This document should accompany the instrument to its final installation in order to provide operational and service assistance to the end user.**

## MF79 PRODUCT SPECIFICATIONS

|                       |  |
|-----------------------|--|
| Dimensions            | 6 3/4" W X 6 5/16" H X 4" D.   |
| Wall Mounting         | Brackets supplied with instrument.   |
| Panel Mount Cutout    | 5 1/4 inches wide X 5 15/16 inches high.   |
| Switch Type           | Three wire single pole double throw.   |
| Switch Sensitivities  | Normal 1% of range (Factory standard #79 Switch).<br>Super Sensitive 1/2% of element range (Optional #73 Switch).  |
| Electrical Hookup     | Terminal block accessible through top cover hatch.   |
| Conduit Openings      | One 7/8 inch diameter hole on each side of the case for 1/2 inch conduit fitting; drill guide hole spotted in the rear of the case showing operational rear opening locations. |
| Electrical Rating     | 50VA, inductive; 500VA, non inductive; 250V maximum AC only.   |
| Agency Approvals      | Underwriters Laboratories and Canadian Standards   |
| Approx. Net Weight*   | 5 lbs  |
| Approx. Ship. Weight* | 8 lbs  |

\* Weight may vary depending on element length.

## MF79 ORDER MATRIX



**MF79\***  
(Requires L-Type element plunger).

### ACCESSORIES

- 1 None
- 2 237A Weather Resistant\*\*
- 3 266 Fungus Proofing

\* The standard switch on an MF79 is a #79 and offers an accuracy of 1% of span. Accuracy of 0.5% of span may be achieved by specifying a #73 Switch. However, a #73 Switch must be ordered individually and will be shipped separate. User must remove the factory standard #79 switch and install the #73 Switch. (See SWITCH REPLACEMENT section in this document, page 4). To order the #73 Switch specify part #64403018.

\*\* Requires an inverted dial scale. Check with factory on availability.

### PISTON-PAK THERMAL SENSING ELEMENT

A Piston-Pak Thermal Sensing Element must be specified for each MF79. Use Partlow Form Number 3028 "Mechanical Products Cross Reference and Pricing Guide" to configure the matrix number for the sensing element.

## INSTALLATION AND WIRING

### LOCATION

The element head assembly is subject to ambient temperature limitations of -30°F to 125°F (-35°C to 52°C) for low temperature head assemblies, and 32°F to 150°F (0°C to 66°C) for high temperature head assemblies. These temperature limitations must be considered when determining the instrument location. It should be located in an area as free from vibration as possible.

### MOUNTING

The instrument(s) may be surface or flush mounted. For flush mounting proceed as follows: Cut the panel opening to the sizes illustrated in Figure 1 (at right). Then drill 7/32 inch clearance holes where indicated in Figure 1 and if desired, tap for # 10 flat head screws.

### WIRING

The conduit hole should be used to make all electrical connections through. Make necessary electrical connections using short sections of flexible cable or conduit according to applicable electrical codes, ordinances and regulations regarding the use of conduit, etc. Next, access the connection terminal block by unscrewing the two screws on the top and removing the top cover hatch. The terminal block is labeled H, C and L (See Figure 2, below). H represents normally-open, C common and L-normally closed. Make your necessary electrical connections using Figure 2 as a guide.

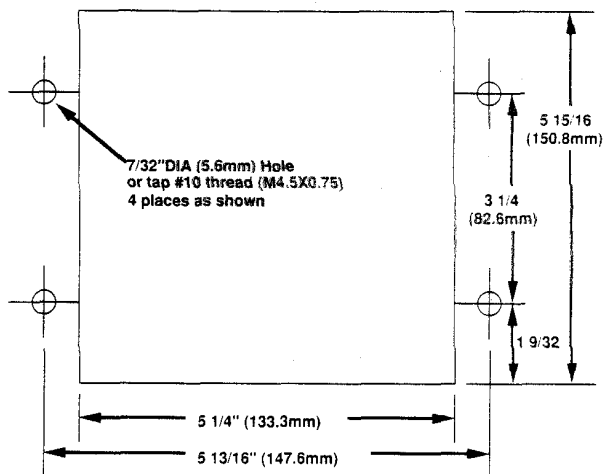
### PLACING THE THERMAL SENSING ELEMENT

Locate the thermal sensing bulb in the most agitated part of the medium to be measured and completely immerse it. (When U and Y-type bulbs are used note separation coupling between bulb and capillary). Be sure to immerse the element up to the coupling for correct temperature indication. Do not bend capillary to less than 1/2 inch radius and never bend it too close to the element bulb or element head. Pencil type bulbs must never be bent as this will affect instrument accuracy. U and Y-type bulbs may be bent, but never to less than a two inch radius. Anchor the excess capillary securely to prevent vibration damage. These bulbs may be elevated up to 40 feet above the instrument without affecting calibration. For elevations over 40 feet consult with your local Partlow Representative, Distributor or the Factory.

### STUFFING BOX INSTALLATION (IF APPLICABLE)

Overtightening of 21-T-105 steel or stainless steel stuffing boxes can damage the thermal element by restricting the capillary bore. To prevent damage, the stuffing box gland nut should be turned 1/2 to 3/4 of a revolution from a finger-tight position. This is equivalent to a torque of 65 to 100 inch pounds for steel and 130 to 180 inch-pounds for stainless steel.

Figure 1 - Panel Cutout Illustration (in inches)



## INSTRUMENT OPERATION

Prior to putting the instrument into service check it against an accurate test thermometer. As with any precision instrument minor adjustments may be necessary after shipment and installation. If you are unfamiliar with how to perform this check refer to the CHECKING TEMPERATURE and RE-ZEROING section of this document.

Control temperature is established by turning the knob on the front cover. The knob moves the red set pointer along the scale to the desired setting. This positions a single snap-acting switch in at the control point. The black indicating pointer moves up or downscale in response to the Piston-Pak thermal sensing element. When the indicating pointer moves in line with the red setpointer, the snap-acting switch is actuated and opens or closes the circuit controlling the heating or cooling input to the application.

## MAINTAINING YOUR MF79

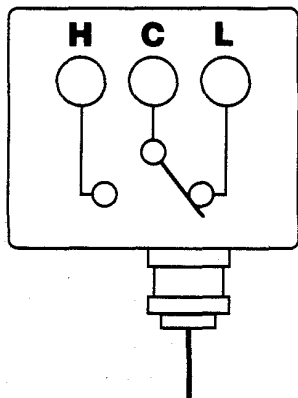
### CHECKING TEMPERATURE

When checking and verifying your temperature be sure to use a test thermometer of known accuracy. Position the test thermometer sensing bulb or probe adjacent to the thermal sensing bulb from the MF79. Turn the red set pointer on the MF79 to the desired process temperature or above. Wait for the temperature to stabilize, then compare the test thermometer reading with that of the MF79 (Black indicating pointer). If the two readings do not agree, the MF79 should be re-zeroed.

### RE-ZEROING YOUR MFS

Be sure that the process temperature is stable. Move the red set pointer to the temperature indicated by the test thermometer. Remove the setting knob on the instrument cover (See exploded view illustration, page 6). Loosen the set screw S (Figure 3, below) and using the 3/16 inch wrench provided with the MF79 turn shaft J until the black indicating pointer reading matches the test thermometer reading. Tighten the set screw S. Check the adjustment by allowing the temperature to stabilize and compare the readings. Repeat these steps if necessary.

Figure 2 - 3 Wire Switch



**NOTE:** Illustration shows switch condition below set point C to H will be continuous above set point.

### SWITCH REPLACEMENT & #73 SWITCH INSTALLATION

Turn the power to the MF79 off. Remove the setting knob and cover (See exploded view illustration, page 6) and remove the two screws holding the switch to the switch arm. Take out the existing switch and remove the wires. Re-connect the wires to the replacement switch one wire at a time to avoid confusion. (When installing a #73 switch re-connect the wires to the same respective terminals as on the #79 switch). Then re-assemble the switch in the mechanism, replace the MF79 front cover and knob. Then turn on the power. **Note: After replacing the switch it may be necessary to make an adjustment to the switch actuation screw E (Figure 4, below). If, during normal process temperature cycling, the black indicating pointer registers a constant differential over or under the red set pointer adjust the actuation screw E to correct. Lengthening the screw lowers the temperature while shortening it raises the temperature.**

### BRAKE TIGHTENING

Periodically the setting shaft brake may require tightening. If the brake is too loose, the overtravel movement of the black indicating pointer will tend to drag the red set pointer upscale from its set position. To tighten the brake, turn the adjustment screw U clockwise (Figure 5, below). **Do not over-tighten.**

Figure 3 - Re-Zeroing

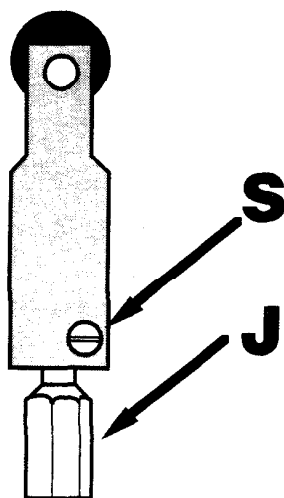


Figure 4 Switch Replacement

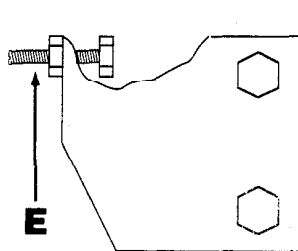
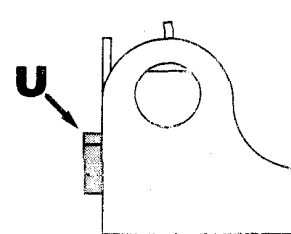


Figure 5 - Brake Tightening



### PISTON-PAK THERMAL SENSING ELEMENT IDENTIFICATION

An element designation number is stamped on the bottom of the element head. This is a coded description of the element specifications and should be used whenever a replacement element is ordered. The number appearing on the side of the element head (Figure 6, below) is the element age code, which may be required in establishing warranty.

### ORDERING/SPECIFYING THE PISTON-PAK SENSING ELEMENT

The sensing element is ordered separately from the MF79 and requires its own matrix number. To determine the correct sensing element configuration for your instrument(s) and application see Partlow Form 3028 "Mechanical Products Cross Reference and Pricing Guide."

### ELEMENT REPLACEMENT

To change a thermal sensing element start by removing screws D (Figure 7, below) and withdrawing the element from the instrument body. Then remove the element bulb from the medium. Install the new element and replace screws D. Insert the new element bulb into the medium being measured.

**Note:** After the element has been replaced, check the temperature setting, re-zeroing may be necessary. If so, see the CHECKING TEMPERATURE section.

**Caution:** The inside mechanism(s), particularly the inside of the element housing, should never be oiled. However, if the instrument is subject to corrosion or gunking conditions, the mechanical linkage should be sprayed periodically with corrosion inhibiting CRC 2-26, 3-36, or 5-56. Use only CRC 2-26, 3-36, or 5-56 as other lubricants may cause build up and sticking of internal parts. CRC 2-26 may be purchased from Partlow in a 15 oz. container (part #63600401). CRC 5-56 may be purchased locally from any hardware or automotive store.

Figure 6 - Element ID

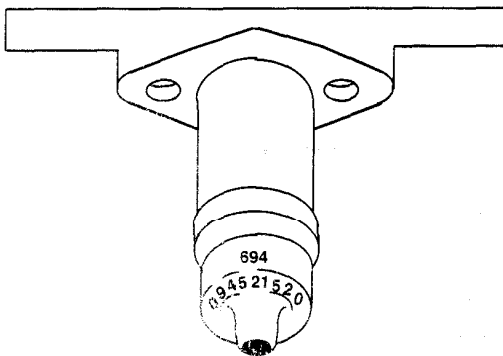
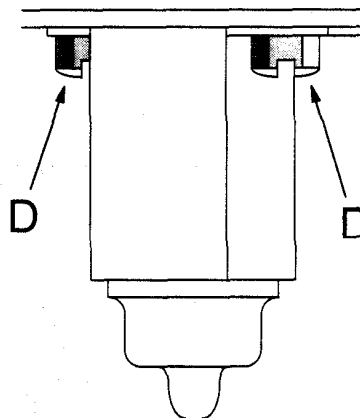


Figure 7 - Replacing Element



## DIMENSIONAL DRAWING

Figure 8 - Dimensional Drawing

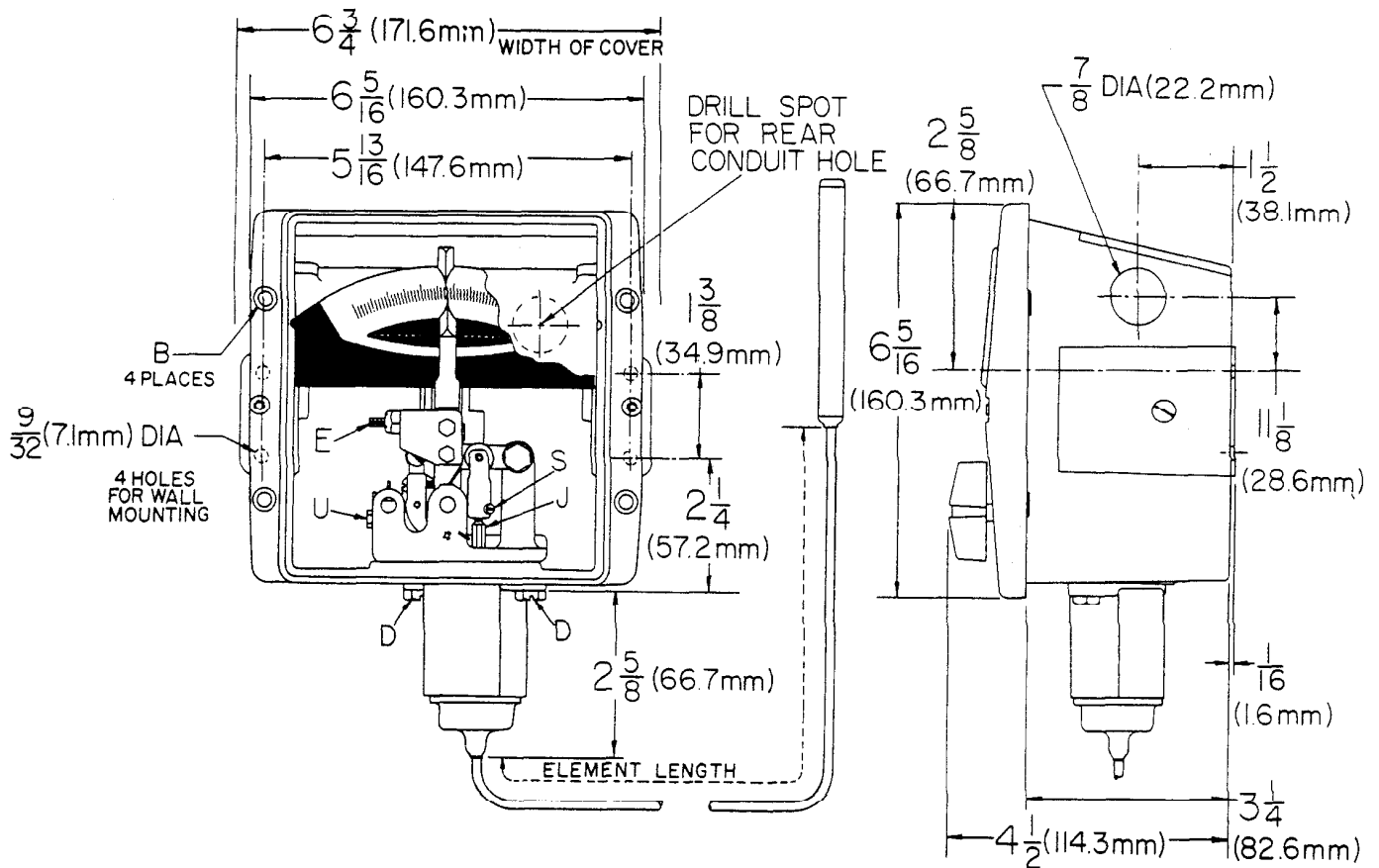
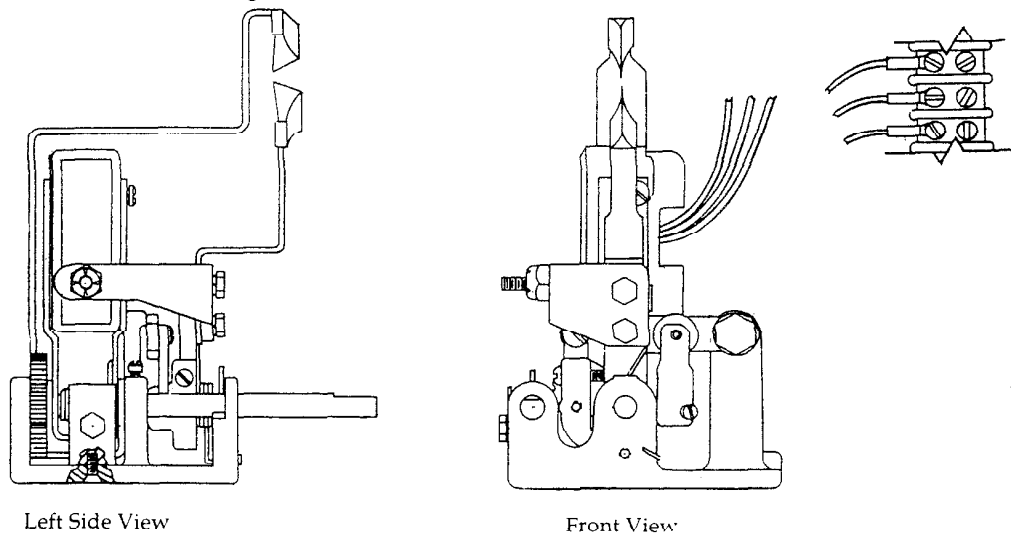


Figure 9 - Mechanism Drawing





## Exploded Illustration and Parts List

### 1. Cover Assembly

Includes: Cover, Cover Glass, Cover Screws

64415801

### 2. Knob Assembly

Includes: Knob, Set Screw

64410401

### 3. Mechanism Assembly

Includes: Micro Switch (#79), Wiring and Terminal Block, Push Rod.

10074014

### 4. Main Lever Assembly

Includes: Main Lever with Push Rod Cap, Push Rod, Set Screw.

64415901

### 5. Micro Switch Kit

Includes Terminal Screws

#73  
#79

64403018

64403021

### 6. Case

Includes: Case, Top Plate, Terminal Block Mounting Brackets and Screws, Mounting Brackets with Screws.

64416001

### 7. Mounting Brackets

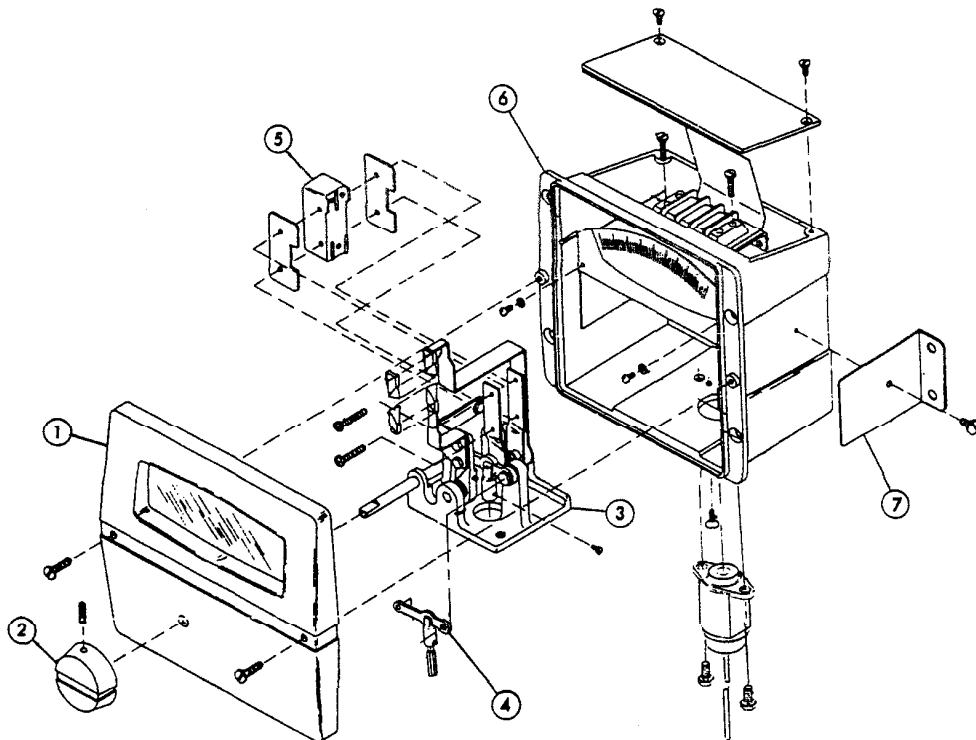
64402002

### 8. Fastener Kit (Not Shown)

64416101

Includes:

Cover Screws (2)  
Switch Screws (2)  
Dial Screws (2)  
Terminal Block Screws (2)  
Mechanism Holding Screw (1)  
Mounting Bracket Screws (2)  
Push Rod Set Screw (1)  
Top Plate Screws (2)



## Warranty

These products are sold by The Partlow Corporation ("Partlow") under the warranties set forth in the following paragraph. Such warranties are extended only with respect to a purchase of these products, as new merchandise, directly from Partlow or from a Partlow distributor, representative or reseller, and are extended only to the first buyer thereof who purchases them other than for the purpose of resale.

These products are warranted to be free from functional defects in materials and workmanship at the time the products leave the Partlow factory, and to conform at that same time to the specifications set forth in the relevant Partlow instrumentation sheet, sheets, manual or manuals for such products.

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 **Partlow**

**Form Number 3000  
Published Jan. 1992  
Second Edition**

Represented/Distributed by:

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## GENERAL

Before installation is started a few items of a general nature should be considered.

1. Location - always locate the pump as close as possible to the supply of liquid to be pumped. Locate it below the liquid supply if at all practical. Viking pumps are self priming but the better the suction conditions the better the performance.
2. Accessibility - the pump should be located where it is accessible for inspection, maintenance, and repair. For large pumps, allow room to remove the rotor and shaft without removing the pump from the base.
3. Port Arrangement - since the pumps have different port arrangements depending on the model, port location should be checked before starting the installation. The ports may be upright, opposite or at right angles to each other, see Figure 1. The right angle ports are normally right-hand, see Figure 2; some models are available with left-hand arrangements; still other models are available with the right angle ports located in any one of eight positions including right-hand and left-hand.



FIGURE 1

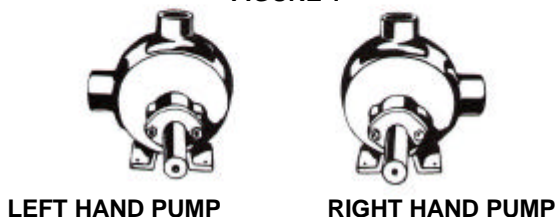


FIGURE 2

4. Suction/Discharge - shaft rotation will determine which port is suction and which discharge. A look at Figure 3 will show how rotation determines which port is which; as the pumping elements (gears) come out of mesh, point "A" on Figure 3, liquid is drawn into the suction port; as the gears come into mesh, point "B", the liquid is forced out the discharge port. Reversing the rotation reverses the flow through the pump. When determining shaft rotation, always look from the shaft end of the pump. Unless otherwise specified, rotation is assumed to be clockwise (CW), which makes the suction port on the right side of the pump. The idler pin, which is offset in the pump head, should be properly positioned toward and an equal distance between the port connections.

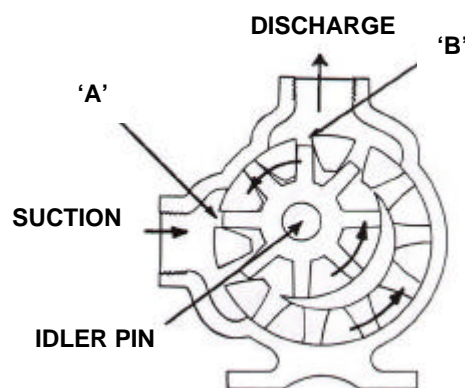
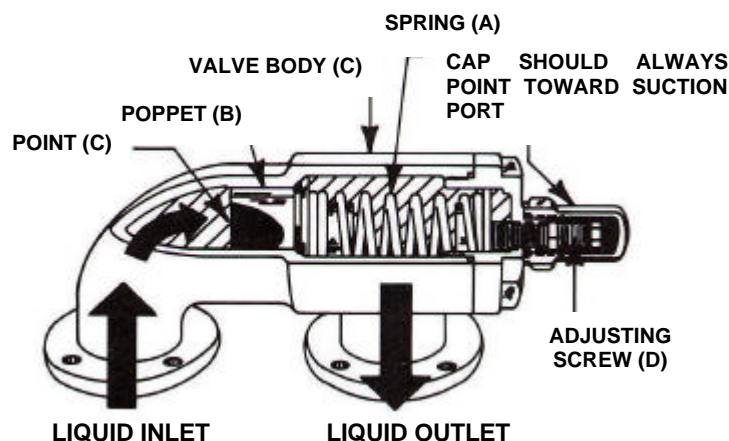


FIGURE 3

5. Pressure Protection - Viking pumps are positive displacement. This means that when the pump is rotated, liquid will be delivered to the discharge side of the pump. If there is no place for this liquid to go - discharge line is blocked or closed - pressure can build up until the motor stalls, the drive equipment fails, a pump part breaks or ruptures, or the piping bursts. Because of this, some form of pressure protection must be used with a positive displacement pump. This may be relief valve mounted directly on the pump, an inline relief valve, a torque limiting device or a rupture disk.

The pressure relief valve mounted on Viking pumps and most in-line valves are of the spring loaded poppet design See Figure 4. The spring (A) holds poppet (B) against the seat in the valve body (C) with a given force determined by the spring size and by how tightly it is compressed by the adjusting screw (D). The pump discharge pressure pushes against the underside of the poppet at point (E). When the force exerted by the liquid under the poppet exceeds that exerted by the spring, the poppet lifts and liquid starts to flow through the valve.



CUT-AWAY OF VIKING INTERNAL RELIEF VALVE FIGURE 4

### CAUTION

INTERNAL TYPE RELIEF VALVES MOUNTED ON VIKING PUMPS SHOULD ALWAYS HAVE THE CAP OR BONNET POINTED TOWARD THE SUCTION SIDE OF THE PUMP. RETURN-TO-TANK-TYPE RELIEF VALVES SHOULD ALWAYS BE MOUNTED ON THE DISCHARGE SIDE OF THE PUMP. IF PUMP ROTATION IS REVERSED, CHANGE THE RELIEF VALVE. TURN THE INTERNAL TYPE END FOR END; MOVE THE RETURN-TO-TANK TYPE TO THE OTHER PORT. IF, ON A PARTICULAR INSTALLATION ROTATION IS REVERSED, e.g., USING ONE PUMP TO FILL A TANK AND THEN BY USE OF A REVERSING SWITCH OR OTHER MEANS CHANGING THE ROTATION TO PERMIT THE SAME PUMP TO CIRCULATE THE LIQUID THROUGH A HEATER OR TO LOAD OUT) THEN PRESSURE PROTECTION MUST BE PROVIDED ON BOTH SIDES OF THE PUMP OR FOR BOTH ROTATIONS. THIS MAY BE A COMBINATION OF RELIEF VALVES, TORQUE LIMITING DEVICES OR RUPTURE DISKS.

PUMPS OR SYSTEMS WITHOUT RELIEF VALVES SHOULD HAVE SOME FORM OF PRESSURE PROTECTION, E.G., TORQUE LIMITING DEVICES OR RUPTURE DISKS.

Viking pumps can be furnished with either an internal relief valve - one which directs the flow from the valve back to the suction side of the pump - or a return-to-tank valve which directs the flow through piping back to the supply tank. See Figure 5. An inline relief valve mounted in the discharge piping also directs the flow back to the supply tank. This type of valve should be mounted close to the pump so that the pressure drop through the piping between the pump and the valve is at a minimum. Be sure there are no shutoff valves between the pump and relief valve. Piping from a return-to-tank or an in-line valve to the supply tank should also be as short and large as possible.

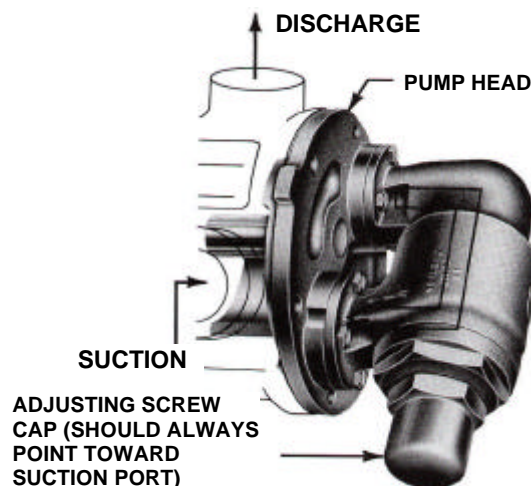


FIGURE 5A  
INTERNAL RELIEF VALVE

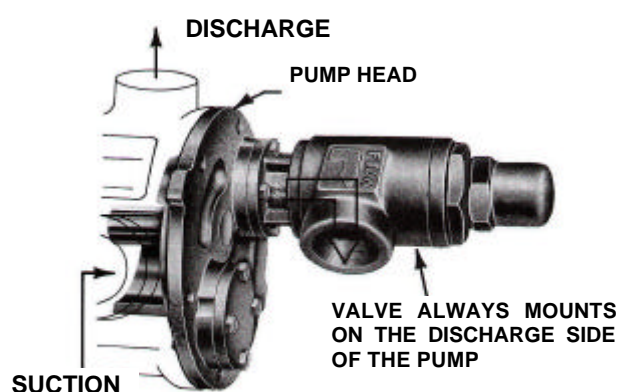


FIGURE 5B  
RETURN-TO-TANK RELIEF VALVE

**NOTE:** on some models the relief valve is mounted on the pump casing instead of the pump head.

The spring loaded poppet-type valve is strictly a differential valve, sensing only those pressures on each side of the poppet. It should **not** be used as a pressure or flow control device. **It is intended strictly as a relief valve.**

The pressure at which either the return-to-tank or internal relief valve bypasses can be changed by turning the adjusting screw. Do not back the adjusting screw all the way out. Stop when spring tension is off the screw (the screw starts to turn easily).

For details on maintenance of the relief valve see Technical Service Manual covering your model series.

6. Motor - follow local electrical codes when booking up motors.

## FOUNDATION

Every pump should have a solid foundation. It may be any structure sufficiently strong to hold the pump rigid and to absorb any strain or shock that may be encountered.

A certified print of the pumping unit should be used in preparing the foundation. If a separate foundation is provided, make it at least four inches wider and longer than the base of the unit.

When the unit is placed on the foundation it should be leveled and checked for position against the piping layout and then fastened down.

## ALIGNMENT

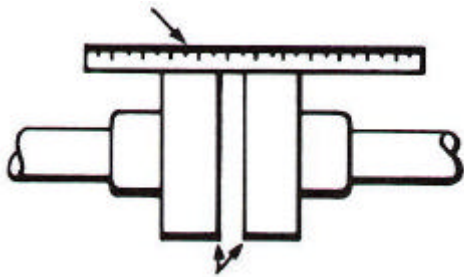
### CHECK ALIGNMENT AFTER MOUNTING

For detailed coupling alignment procedures see Viking service bulletin ESB-61.

The pump, drive, and motor were properly aligned at the time they were assembled. During shipping and mounting the alignment is often disturbed. **BE SURE TO RECHECK ALIGNMENT AFTER THE PUMP UNIT IS INSTALLED!**

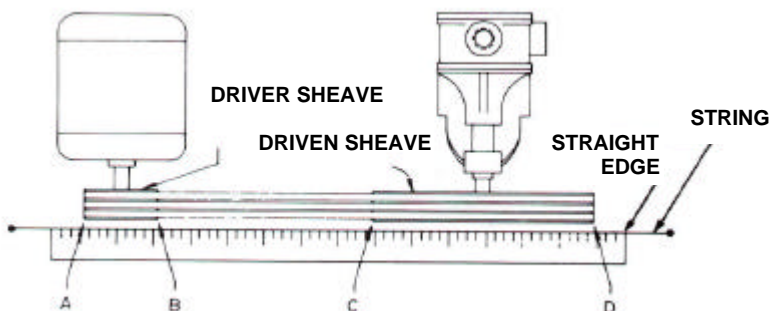
1. Check pump ports to be sure they are square and in proper position; shim or move pump as required. Do not force piping to line up with the ports.
2. If the pump is driven by a flexible coupling(s) either direct connected to the motor or through a reducer, remove any coupling guards or covers and check alignment of the coupling halves. A straightedge (a piece of key stock works nicely) across the coupling must rest evenly on both rims at the top, bottom, and sides. See Figure 6.
3. If the pump is driven by V-belts, check the alignment by using a long straightedge or tightly drawn string across the face of the sheaves. See Figure 6A.
4. Make a final check on alignment after piping is hooked up.  
See item 13 under "Installation - Piping".  
Figures 7, 8, and 9 show typical units - direct, gear reducer and V-belt drive.
5. For high temperature applications (those above 300°F) allow pump to reach operating temperature, then recheck alignment.

USE A STRAIGHT EDGE. THESE SURFACES MUST BE PARALLEL.



CHECK WIDTH BETWEEN THESE SURFACES WITH INSIDE CALIPERS TO BE CERTAIN THE FACES ARE EQUAL DISTANCE APART AND PARALLEL.

FIGURE 6



WHEN SHEAVES PROPERLY ALIGNED ALL POINTS A, B, C, D WILL TOUCH STRING OR STRAIGHTEDGE.

FIGURE 6A

## PIPING

The cause of many pumping problems can be traced to suction piping. It should always be as large and short as practical. For help in selecting the proper size piping, both suction and discharge, refer to Viking General Catalog Section 510.

Before starting layout and installation of your piping system, consider the following points:

1. Never use piping smaller than the pump port connections.
2. Be sure the inside of the pipe is clean before booking it up.
3. Foot valve - When pumping a light liquid with a suction lift, a foot valve at the end of the suction piping or a check valve in the first horizontal run will hold the liquid in the line and make it easier for the pump to prime. Be sure the foot or check valve is big enough so that it doesn't cause excessive line loss.

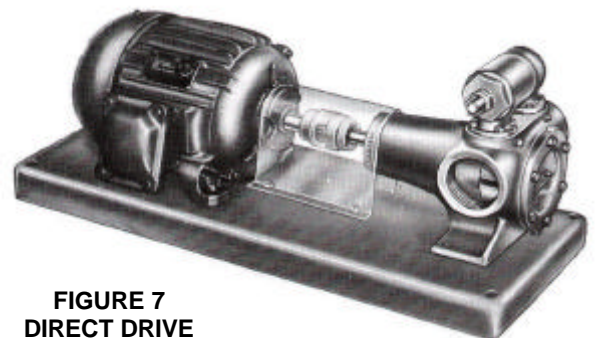


FIGURE 7  
DIRECT DRIVE

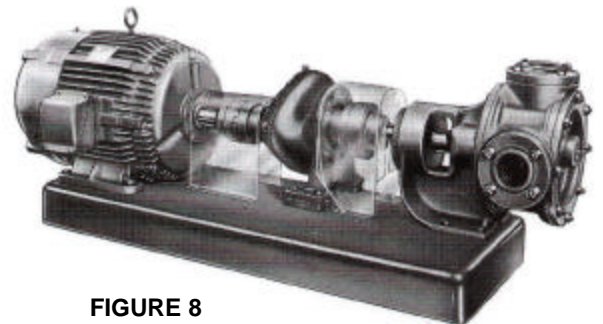


FIGURE 8  
GEAR REDUCER DRIVE

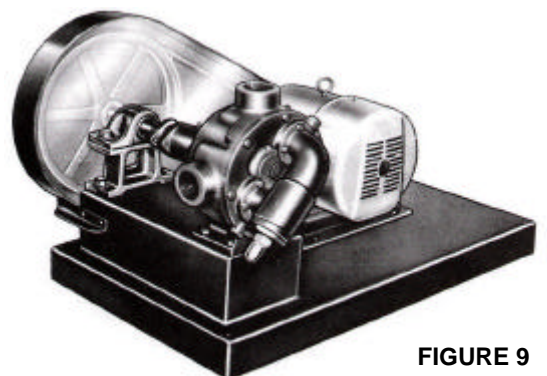


FIGURE 9  
V-BELT DRIVE



4. When approaching an obstacle in the suction or discharge line, go around the obstacle instead of over it. Going over it creates an air pocket. See Figure 10.

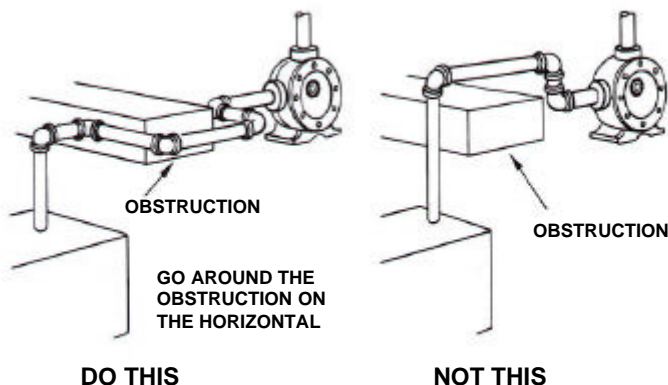


FIGURE 10

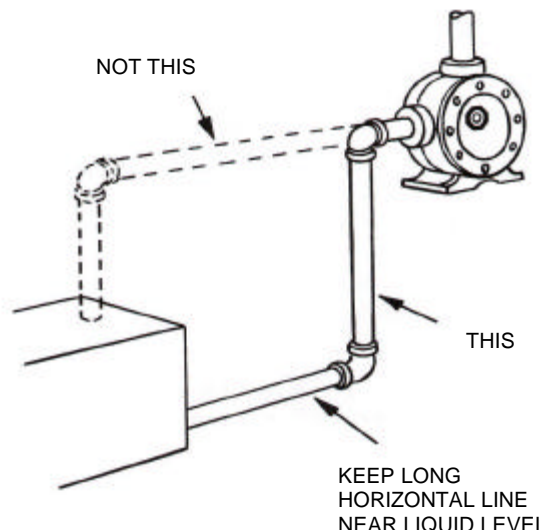


FIGURE 11

5. Where practical, slope the piping so no air or liquid pockets will be formed. Air pockets in the suction line make it hard for the pump to prime.
6. For a suction line with a long horizontal run keep the horizontal portion below the liquid level if possible. This keeps the pipe full so the pump does not have to remove so much air when starting; this is most helpful when there is no foot valve. See Figure 11.
7. When piping a hot or cold system (liquid being handled is at a temperature different from the air surrounding the pump), be sure allowance is made for expansion and contraction of the piping. Loops, expansion joints, or unsecured (this does not mean unsupported) runs should be used so the pump casing is not distorted or put into a bind.
8. **STRAINER** - It is always good practice to consider a strainer on the suction side of a positive displacement pump. The strainer will keep foreign objects from going into the pump; without a strainer some would go through; others would cause a jammed pump, a broken part, or a torn up drive. The strainer basket mesh or perforation size should be big enough so that it does not cause excessive pressure drop, but it should be fine enough to protect the pump. When in doubt as to the proper size, check with the manufacturer, giving him pipe size, flow rate, and viscosity involved. Provision should be made for cleaning the strainer. If the pump operates continuously, a bypass should be built around the strainer or two strainers should be put in parallel with proper valving so they can be isolated for cleaning. Use of a strainer is particularly important at start up to help clean the system of weld beads, pipe scale, and other foreign objects. For additional information, refer to TSM640. If the pump is not equipped with a relief valve, consideration should be given to mounting one in the discharge line. See discussion on relief valves under START UP.
10. The pump should not be used to support the piping. The weight of the pipe should be carried by hangers, supports, stands, etc.
11. When fastening the piping to the pump it should not be necessary to impose any strain on the pump casing. "Springing" or "drawing" the piping up to the pump will cause distortion, possible misalignment, and probable rapid wear of the pump. Do not use the pump to correct errors in piping layout or assembly.
12. All joints of the piping system should be tight; pipe sealer or teflon tape will help assure leak-free threaded joints. Leaks in the suction line permitting air to be drawn in may cause a noisy pump, or a reduction in capacity.
13. **ALIGNMENT** - Check the alignment of the drive after the piping is hooked up. As a final check on pump alignment remove the head of the pump and with a feeler gauge determine if there is clearance all the way around between the rotor and casing. Because of manufacturing tolerances, bushing clearances, etc., the rotor may not be centered in the casing, but it should not drag; dragging would indicate unit misalignment or casing distortion from piping strain. Making this check is most desirable on installations involving Q, M and N size standard duty pumps.
14. The auxiliary piping hooked to jackets, glands, etc. for heating, cooling, quenching, or for other purposes should receive the same attention as the piping handling the liquid pumped.
15. Provide a relief device in any part of a pump and piping system that can be valved off and, thus, completely isolated. This is particularly important:
  - a). When handling a cold liquid such as refrigeration ammonia that can warm up to ambient temperatures when the pump is shut off or
  - b). When handling a liquid such as asphalt or molasses that has to be heated before it can be pumped. The rise in temperature causes the liquid to expand; if there is no provision for pressure relief in the closed off section, there is a chance that the pump or piping will rupture.

## START UP

Before pushing the "start" button, check the following:

1. Are there vacuum and pressure gauges on or near the pump? These gauges are the quickest and most accurate way of finding out what is happening in the pump.

2. Check alignment - See suggestions under "Installation - Alignment" in this manual.
3. Check piping to be sure there is no strain on the pump casing.
4. Rotate the pump shaft by hand to be sure it turns freely. **MAKE SURE THE PUMP DRIVER IS LOCKED OUT OR CANNOT BE ENERGIZED BEFORE DOING THIS.**
5. Jog motor to be sure it is turning in the right direction; see discussion on pump rotation under "Installation - General" item 4 in this manual.
6. Check any relief valves to be sure they are installed correctly. See discussion on relief valves under "Installation - General".
7. Check suction piping to be sure (a) it is all connected and tight, (b) valves are open, and (c) end of pipe is below liquid level.
8. Check discharge piping to be sure (a) it is connected and tight, (b) valves are open, and (c) there is a place for the liquid to go.
9. Lubricate any grease fitting on the pump using a good, general purpose #2 ball bearing grease. Check any gear reducer, motor, coupling, etc. for instructions and lubricate as recommended. See Engineering Service Bulletin ESB-515.
10. For packed pumps, loosen packing gland nuts so gland can be moved slightly by hand. Adjust gland to reduce leakage only after pump has run long enough to reach constant temperature. Packing should weep a little to keep it cool and lubricated.
11. Do **not** use the Viking pump to flush, pressure test or prove the system with water. Either remove the pump or run piping around it while flushing or testing. Pumping water, dirty or otherwise, can do more damage in a few minutes than months of normal service.
12. Check to be sure all guards are in place.
13. Now you are ready to push the "start" button - gently.

If the pump begins to deliver liquid within 60 seconds, you're in business. If it does not, push the "stop" button. Do **not** run the pump longer than one minute without liquid in it; you may damage it. Review the steps just outlined, consider what the suction and discharge gauges indicate, see page 6; if everything appears to be in order, put some liquid in the pump, a lubricating liquid is best. This will help it prime.

Push the "start" button again. If nothing is flowing within two minutes, stop the pump. The pump is not a compressor, it will not build up much air pressure; it may be necessary to vent the discharge line until liquid begins to flow.

If the pump still does not deliver, the cause may be one or more of the following:

1. Suction line air leaks; vacuum gauge reading should help determine if this is the problem.
2. End of suction pipe not submerged deep enough in liquid.
3. Suction lift is too great or the suction piping is too small.
4. Liquid is vaporizing in the suction line before it gets to the pump.

**If after consideration of these points it still does not pump, suggest you review again all points given under START UP; read through Troubleshooting in this manual and try again. If it still does not pump, contact your Viking representative.**

## TROUBLESHOOTING

A Viking pump that is properly installed and maintained will give long and satisfactory performance.

**NOTE:** Before making any pump adjustment or opening the pump liquid chamber in any manner, make sure that:

- 1) any pressure in the pumping chamber has been vented through the suction or discharge lines or other openings provided for this purpose,
- 2) the driver has been "locked out" so that it cannot inadvertently be started while work is being done on the pump and
- 3) the pump has been allowed to cool down to the point where there is no chance of anyone being burned.

If trouble does develop, one of the first steps toward finding the difficulty is to *install a vacuum gauge in the suction port and a pressure gauge in the discharge port*. Readings on these gauges often will give a clue as to where to start looking for the trouble.

### Vacuum Gauge - Suction Port

#### 1. High reading would indicate -

- a). Suction line blocked - foot valve stuck, gate valve closed, strainer plugged.
- b). Liquid too viscous to flow through the piping.
- c). Lift too high.
- d). Line too small.

#### 2. Low reading would indicate -

- a). Air leak in suction line.
- b). End of pipe not in liquid.
- c). Pump is worn.
- d). Pump is dry - should be primed.

#### 3. Fluttering, jumping, or erratic reading -

- a). Liquid vaporizing.
- b). Liquid coming to pump in slugs, possibly an air leak insufficient liquid above the end of the suction pipe.
- c). Vibrating from cavitation, misalignment, or damage parts.

### Pressure Gauge - Discharge Port

#### 1. High reading would indicate -

- a). High viscosity and small and/or long discharge line.
- b). Gate valve partially closed.
- c). Filter plugged.
- d). Vertical head did not consider a high specific gravity liquid.
- e). Line partially plugged from build up on inside of pipe.
- f). Liquid in pipe not up to temperature.
- g). Liquid in pipe has undergone a chemical reaction and has solidified.
- h). Relief Valve set too high.

#### 2. Low reading would indicate -

- a). Relief valve set too low.

- b). Relief valve poppet not seating properly.
  - c). Bypass around the pump partially open.
  - d). Too much extra clearance.
  - e). Pump worn.
3. Fluttering, jumping, or erratic reading -
- a). Cavitation.
  - b). Liquid coming to pump in slugs.
  - c). Air leak in suction line.
  - d). Vibrating from misalignment or mechanical problems.

Some of the following may also help pinpoint the problem:

**A). Pump does not pump.**

1. Lost its prime - air leak, low level in tank, foot valve stuck.
2. Suction lift too high.
3. Rotating in wrong direction.
4. Motor does not come up to speed.
5. Suction and discharge valves not open.
6. Strainer clogged.
7. Bypass valve open, relief valve set too low, relief valve poppet stuck open.
8. Pump worn out.
9. Any changes in the liquid system, or operation that would help explain the trouble, e.g. new source of supply, added more lines, inexperienced operators, etc.
10. Too much end clearance.
11. Head position incorrect. See Fig. 3.

**B). Pump starts, then loses its prime.**

1. Supply tank empty.
2. Liquid vaporizing in the suction line.
3. Air leaks or air pockets in the suction line; leaking air through packing or mechanical seal.
4. Worn out.

**C). Pump is noisy.**

1. Pump is being starved (heavy liquid cannot get to pump fast enough). Increase suction pipe size or reduce length.
2. Pump is cavitating (liquid vaporizing in the suction line). Increase suction pipe size or reduce length; if pump is above the liquid, raise the liquid level closer to the pump; if the liquid is above the pump, increase the head of liquid.
3. Check alignment.
4. May have a bent shaft or rotor tooth. Straighten or replace.
5. Relief valve chatter; increase pressure setting.
6. May have to anchor base or piping to eliminate or reduce vibration.
7. May be a foreign object trying to get into the pump through the suction port.

**D). Pump not up to capacity.**

1. Starving or cavitating - increase suction pipe size or reduce length.
2. Strainer partially clogged.
3. Air leak in suction piping or along pump shaft.
4. Running too slowly; is motor the correct speed and is it wired up correctly.
5. Bypass line around pump partially open.
6. Relief valve set too low or stuck open.
7. Pump worn out.
8. Too much end clearance.
9. Head position incorrect. See Fig. 3.

**E). Pump takes too much power.**

1. Running too fast - Is correct motor speed, reducer ratio, sheave size, etc. being used?
2. Is liquid more viscous than unit sized to handle; heat the liquid, increase the pipe size, slow the pump down, or get a bigger motor.
3. Discharge pressure higher than calculated, check with pressure gauge. Increase size or reduce length of pipe, reduce speed (capacity), or get bigger motor.
4. Packing gland drawn down too tight.
5. Pump misaligned.
6. Extra clearance on pumping elements may not be sufficient for operating conditions. Check parts for evidence of drag or contact in pump and increase clearance where necessary.

**F). Rapid Wear.**

On most applications the pump will operate for many months or years before it gradually loses its ability to deliver capacity or pressure. Examination of such a pump would show a smooth wear pattern on all parts. Rapid wear, occurring in a few minutes, hours or days, shows up as heavy grooving, galling, twisting, breaking or similar severe signs of trouble. SEE CHART PAGE 7.

## PREVENTATIVE MAINTENANCE

Performing a few preventative maintenance procedures will extend the life of your pump and reduce the overall cost of ownership.

**A). Lubrication** - Grease all grease nipples after every 500 hours of operation or after 60 days, whichever occurs first. If service is severe, grease more often. Do it gently with a hand gun. Use a NLGI #2 grease for normal applications. For hot or cold applications use appropriate grease. See Engineering Service Bulletin ESB-515.

**B). Packing Adjustment** - Occasional packing adjustment may be required to keep leakage to a slight weep; if impossible to reduce leakage by gentle tightening, replace packing or use different type. See Technical Service Manual on particular model series for details on repacking.

**C). End Clearance Adjustment** - After long service the running clearance between the end of the rotor teeth and the head may have increased through wear to the point where the pump is losing capacity or pressure. Resetting end clearance will normally improve pump performance. See TSM on particular model series for procedure on adjusting end clearance for pump involved.

**D). Examine Internal Parts** - Periodically remove the head, examine idler and bushing and head and pin for wear. Replacing a relatively inexpensive idler bushing and idler pin after only moderate wear will eliminate the need to replace more expensive parts at a later date. See TSM on particular model series for procedure in removing head of the pump. Be sure idler does not slide off idler pin as head is removed and drop and hurt someone or damage the part.

**E). Cleaning the Pump** - A clean pump is easier to inspect, lubricate, adjust, and runs cooler; plus, it looks better.

**F). Storage** - If pump is to be stored, or not used for six months or more, pump must be drained and a light coat of non-detergent SAE 30 weight oil must be applied to all internal pump parts. Lubricate fittings and apply grease to pump shaft extension. Viking suggests rotating pump shaft by hand one complete revolution every 30 days to circulate the oil. Retighten all gasketed joints before using the pump.



## RAPID WEAR

| <b>CAUSE</b> |                                     | <b>EVIDENCE</b>   | <b>POSSIBLE SOLUTION</b>  |
|--------------|-------------------------------------|---|---|
| 1.           | <b>ABRASIVES</b>                    | Gouges or marks made by large, hard particles; a rapid wearing away of bushings from very small abrasives similar to pumice; or anything in between.  | Flush the system with the pump removed. Install strainer in suction line. Oftentimes after a system has run for a few cycles or a few days the dirt is pretty well cleaned out and if the pump is rebuilt into good condition it will then last for a long time.  |
| 2.           | <b>CORROSION</b>                    | Rust, pitting or metal appears to be "eaten" away.  | Check the Viking General Catalog Liquid List for materials of construction recommendation. Consider whether all of the materials used in pump construction were attacked; consider other materials used in the system to determine how they resisted the liquid. Check to see whether or not the liquid has been contaminated to make it more corrosive than anticipated. |
| 3.           | <b>EXCEEDING OPERATING LIMITS</b>   | Noisy operation, broken bushings, twisted shaft, parts show evidence of high heat (discoloration).  | Review General Catalog for operating limits on particular model involved.   |
| 4.           | <b>INSUFFICIENT EXTRA CLEARANCE</b> | Pump may stall. Evidence of heavy contact between end of rotor teeth and head or other parts.   | Increase end clearance and/or contact your distributor or the factory with details of the application so that information regarding proper extra clearance may be provided.   |
| 5.           | <b>LACK OF LUBRICATION</b>          | Noisy bearings, localized heating at bearings or lip seal, smoke, rapid bushing wear.   | Be sure all grease fittings are greased before starting and instructions for lubrication of drive equipment are followed; consider use of auxiliary lubricating equipment.  |
| 6.           | <b>MISALIGNMENT</b>                 | Wear on only one part of a surface, e.g., one side of the casing, one side of the packing gland, only a portion of the face of the head.  | Double check alignment of drive equipment and piping. Check the alignment under conditions as close to operating conditions as possible.  |
| 7.           | <b>RUN DRY</b>                      | Pump stalls because parts have uneven expansion caused by frictional heat; galling between surfaces having relative motion; seal seats and idler pins changing colour because of high heat. | Be sure there is liquid in the system at the time of start up. Provide some kind of automatic alarm or shut-off if supply tank runs dry.  |

## DO'S AND DON'TS -

Do's and Don'ts for installation, operation, and maintenance of Viking pumps to assure safe, long, trouble-free operation.

### INSTALLATION -

1. Do install pump as close to supply tank as possible.
2. Do leave working space around the pumping unit.
3. Do use large, short, and straight suction piping.
4. Do install a strainer in the suction line.
5. Do double check alignment after the unit is mounted and piping is hooked up.
6. Do provide a pressure relief valve for the discharge side of the pump.
7. Do cut out the center of gaskets used as port covers on flanged port pumps.
8. Do record pump model number and serial number and file for future reference.

### OPERATION -

1. Don't run pump at speeds faster than shown in the catalog for your model.
2. Don't require pump to develop pressures higher than those shown in the catalog for your model.
3. Don't operate pumps at temperatures above or below limits shown in the catalog for your pump.
4. Don't operate pumps without all guards being in place.
5. Don't operate pump without a relief valve on the pump or in the discharge piping; be sure valve is mounted and set correctly.
6. Don't exceed catalog limits for temperature and pressures of fluids in jacketed areas of pump.
7. Don't use the pump in a system, which includes a steam blow or an air or vapour blow or purge **without** provision for over-speed shutdown in case the pump starts to act as a turbine and over-speeds the drive.
8. Don't operate the pump with all of the liquid bypassing through a pump mounted internal type relief valve or without any flow of liquid going through the pump for more than a couple of minutes. Operation under either of these conditions may result in a heat build-up in the pump, which could cause hazardous conditions or happenings.

### MAINTENANCE -

1. Do make sure any pump that has residual system pressure in it or that has handled high vapour pressure liquids, e.g., LP-gas, ammonia, Freons, etc. has been vented through the suction or discharge lines or other openings provided for this purpose.
2. Do make sure that if the pump is still hooked to the driver while maintenance is being performed that the driver has been "locked out" so that it cannot be inadvertently started while work is being done on the pump.
3. Do make sure any pump that has handled a corrosive, flammable, hot, or toxic liquid has been drained, flushed, vented and/or cooled before it is disassembled.
4. Don't drop parts during disassembly, e.g., idler can slip from the pin as the head is removed from the pump; it may drop on your foot, plus, it may get nicked or gouged.
5. Don't stick fingers in the ports of a pump! Serious injury may result.
6. Don't spin the idler on the idler pin! Fingers may be jammed between teeth and crescent.
7. Do remember that a few simple preventative maintenance procedures such as periodic lubrication, adjustment of end clearance, examination of internal parts, etc., will extend the service life of your pump.
8. Do **obtain**, read and keep maintenance instructions furnished with your pump.
9. Do have spare parts, pumps or standby units available, particularly if the pump is an essential part of a key operation or process.



# TECHNICAL SERVICE MANUAL

INSTALLATION, START-UP, TROUBLESHOOTING,  
PREVENTATIVE MAINTENANCE, DO'S AND DO'NTS

SECTION TSM 000  
PAGE 9 of 9  
ISSUE D



## WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, FOB. Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources which are incorporated into any Viking product are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

**THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

No officer or employee of IDEX Corporation or Viking Pump, Inc. is authorized to alter this warranty.



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| Special Information | 2 |
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## INTRODUCTION

The illustrations used in this manual are for identification purposes only and should not be used for ordering parts. Secure a parts list from the factory or a Viking representative. Always give complete name of part, part number and material with the model and serial number of the pump when ordering repair parts.

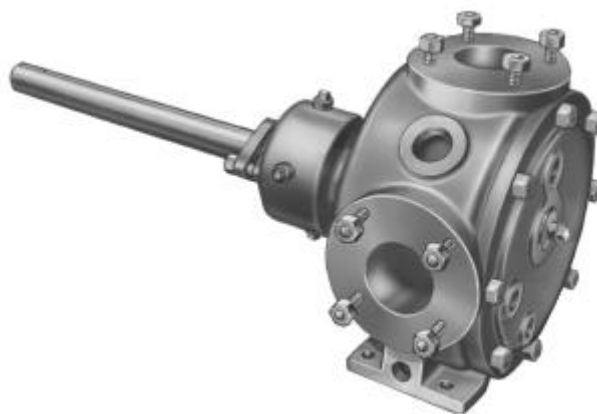


FIGURE 1  
ILLUSTRATION OF SERIES 34  
JACKETED PUMP

| UNMOUNTED PUMP |            | UNITS   |
|----------------|------------|---|
| PACKED         | MECH. SEAL |   |
| HL34           | HL434      | Units are designated by the unmounted pump model numbers followed by a letter indicating drive style. |
| KK34           | KK434      |   |
| LQ34           | LQ434      |   |
| Q34            | Q434       |   |
| M34            | M434       |   |
| N34            | N434       |   |
|                |            | V = V-Belt  |

*This manual deals exclusively with series 34 and 434 Jacketed General Purpose Pumps. Refer to Figure 1 through 11 for general configuration and nomenclature used in this manual.*

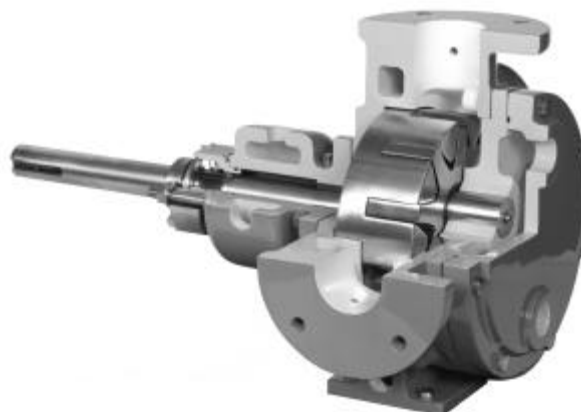


FIGURE 2  
CUT-AWAY VIEW OF THE JACKETED  
SERIES 434 PUMP

## SPECIAL INFORMATION

### DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, RELIEF VALVE ADJUSTING CAP FITTING ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.
3. THAT YOU KNOW WHAT LIQUID THE PUMP HAS BEEN HANDLING AND THE PRECAUTIONS NECESSARY TO SAFELY HANDLE THE LIQUID. OBTAIN A MATERIAL SAFETY DATA SHEET (MSDS) FOR THE LIQUID TO BE SURE THESE PRECAUTIONS ARE UNDERSTOOD.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

**ROTATION:** Viking pumps operate equally well in a clockwise or counter clockwise rotation. Shaft rotation determines which port is suction and which is discharge. Port in area where pumping elements (gear teeth) come out of mesh is suction port.

#### PRESSURE RELIEF VALVES:

1. Viking pumps are positive placement pumps and must be provided with some sort of pressure protection. This may be a relief valve mounted directly on the pump, an inline pressure relief valve, a torque limiting device or a rupture disk.
2. There are relief valve options available on these pumps. Options may include a plain or a jacketed relief valve depending on the pump size. Pumps equipped with a jacketed head plate are generally not available with a relief valve.
3. If pump rotation is to be reversed during operation, pressure protection must be provided on *both* sides of pump.
4. Relief valve adjusting screw cap must always point towards suction side of pump. If pump rotation is reversed, remove pressure relief valve and turn end for end.
5. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure.

For additional information on pressure relief valves, **Refer to Technical Service Manual TSM000 and Engineering Service Bulletin ESB-31.**

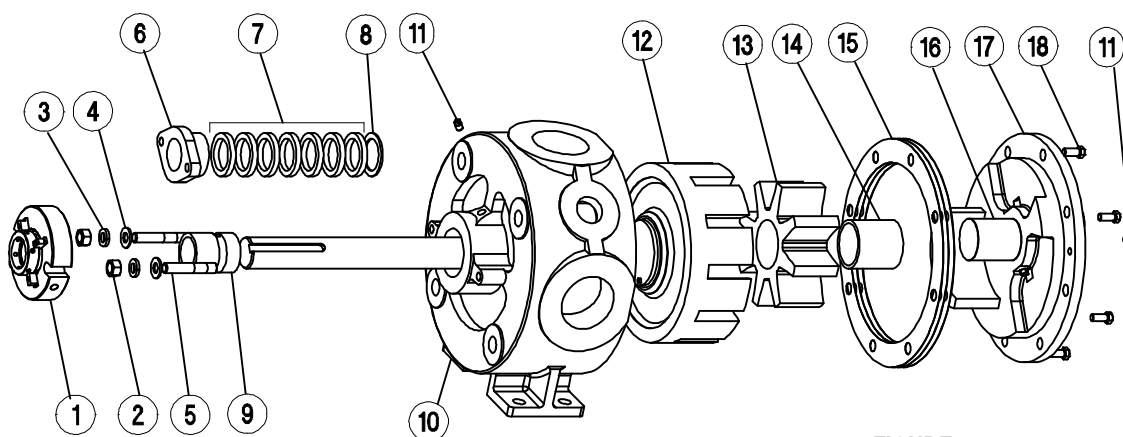
## MAINTENANCE

Series 34 and 434 jacketed pumps are designed for long, trouble-free service life under a wide variety of application conditions with a minimum of maintenance, however, the following should be considered.

1. **LUBRICATION:** External lubrication must be applied slowly with a handgun to all lubrication fittings every 500 hours of operation with multi-purpose grease, NLGI # 2. Do not over-grease. Applications involving very high or low temperatures will require other types of lubrication. **Refer to Engineering Service Bulletin ESB-515.** Consult factory with specific lubrication questions.
2. **PACKING ADJUSTMENT:** New packed pumps generally require some initial packing adjustment to control leakage as packing "runs-in". Make initial packing adjustments carefully and do not over-tighten the packing gland. After initial adjustment occasional inspection will reveal the need for packing gland adjustment and/or replacement of the packing. See instructions in disassembly and reassembly regarding re-packing the pump.
3. **END CLEARANCE ADJUSTMENT:** After long term operation it is sometimes possible to improve the performance of the pump, without major repair, through adjustment of end clearance of the pump. **Refer to instructions under Step 3 of Assembly.**
4. **CLEANING PUMP:** It is good practice to keep the pump as clean as possible. This will facilitate inspection, adjustment and repair work and help prevent omission of lubrication to fittings covered or hidden with dirt.
5. **STORAGE:** If pump is to be stored, or not used for any appreciable length of time it should be drained and a light coat of lubricating and preservative oil should be applied to the internal parts. Lubricate all fittings. Be sure to drain all steam jacket chambers to prevent freezing during cold weather. Tighten all assembly bolts before the pump is put into service after being stored.

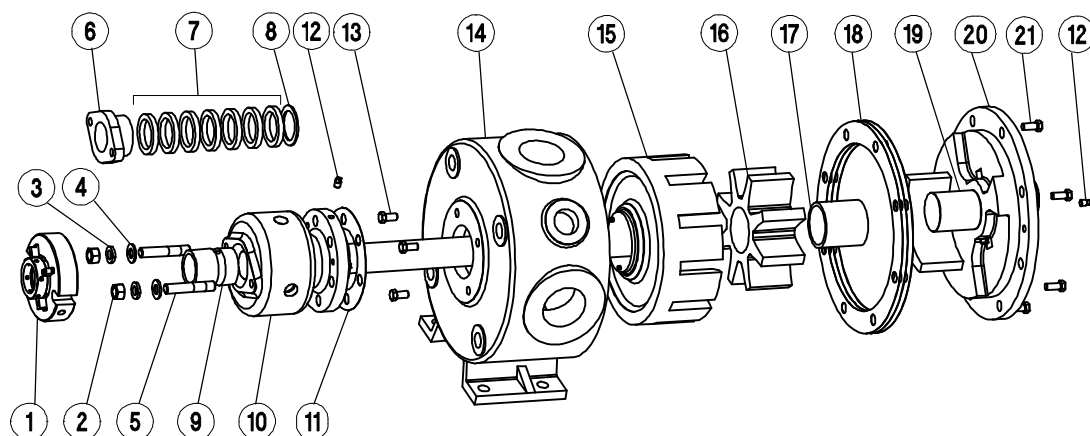
**SUGGESTED REPAIR TOOLS:** The following tools must be available to properly repair Series 34 and 434 pumps. These tools are in addition to standard mechanics' tools such as open end wrenches, pliers, screwdrivers etc. Most of the items can be obtained from an industrial supply house.

1. Soft Headed Hammer
2. Packing hooks, flexible (packed pumps)  
Large for 0.375 inch and up cross section packing
3. Arbor Press
4. Allen wrenches (for mechanical seals)
5. Feeler gage set (for mechanical seals)



**FIGURE 3**  
**EXPLODED VIEW HL34 AND 434 PUMPS**

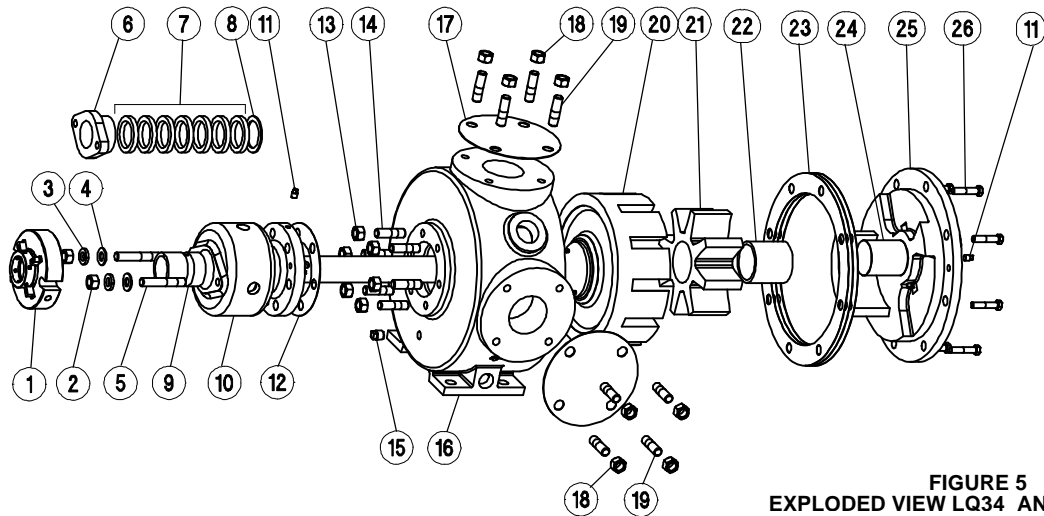
| ITEM | NAME OF PART            | ITEM       | NAME OF PART                  |
|------|-------------------------|------------|-------------------------------|
| 1    | Mechanical Seal         | 12         | Rotor and Shaft               |
| 2    | Nut                     | 13         | Idler and Bushing             |
| 3    | Lockwasher              | 14         | Idler Bushing                 |
| 4    | Flat Washer             | 15         | Head Gasket Set               |
| 5    | Stud                    | 16         | Idler Pin                     |
| 6    | Packing Gland           | 17         | Head (Jacketed) and Idler Pin |
| 7    | Packing                 | 18         | Capscrew                      |
| 8    | Packing Retainer Washer | Not Illus. | Relief Valve                  |
| 9    | Casing Bushing          | Not Illus. | Relief Valve Gasket           |
| 10   | Casing Jacketed)        | Not Illus. | Relief Valve Capscrews        |
| 11   | Pipe Plug               |            |                               |



**FIGURE 4**  
**EXPLODED VIEW KK34 AND 434 PUMPS**

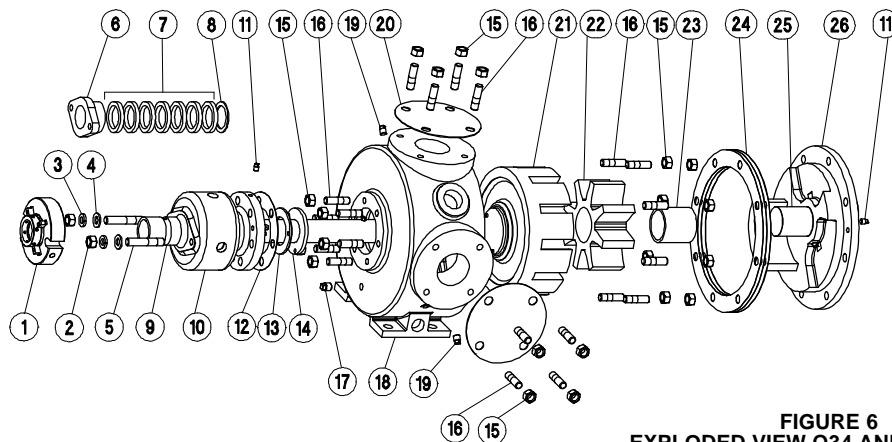
| ITEM | NAME OF PART                 | ITEM       | NAME OF PART                  |
|------|------------------------------|------------|-------------------------------|
| 1    | Mechanical Seal              | 13         | Capscrew                      |
| 2    | Nut                          | 14         | Casing (Jacketed)             |
| 3    | Lockwasher                   | 15         | Rotor and Shaft               |
| 4    | Flat Washer                  | 16         | Idler and Bushing             |
| 5    | Stud                         | 17         | Idler Bushing                 |
| 6    | Packing Gland                | 18         | Head Gasket Set               |
| 7    | Packing                      | 19         | Idler Pin                     |
| 8    | Packing Retainer Washer      | 20         | Head (Jacketed) and Idler Pin |
| 9    | Rotor Bearing Sleeve Bushing | 21         | Capscrew                      |
| 10   | Rotor Bearing Sleeve         | Not Illus. | Relief Valve                  |
| 11   | Gasket                       | Not Illus. | Relief Valve Gasket           |
| 12   | Pipe Plug                    | Not Illus. | Relief Valve Capscrews        |





**FIGURE 5**  
**EXPLODED VIEW LQ34 AND 434 PUMPS**

| ITEM | NAME OF PART                 | ITEM       | NAME OF PART                   |
|------|------------------------------|------------|--------------------------------|
| 1    | Mechanical Seal              | 16         | Casing (Jacketed)              |
| 2    | Nut                          | 17         | Gasket                         |
| 3    | Lockwasher                   | 18         | Nut                            |
| 4    | Flat Washer                  | 19         | Stud                           |
| 5    | Stud                         | 20         | Rotor and Shaft                |
| 6    | Packing Gland                | 21         | Idler and Bushing              |
| 7    | Packing                      | 22         | Idler Bushing                  |
| 8    | Packing Retainer Washer      | 23         | Head Gasket Set                |
| 9    | Rotor Bearing Sleeve Bushing | 24         | Idler Pin                      |
| 10   | Rotor Bearing Sleeve         | 25         | Head (Jacketed ) and idler pin |
| 11   | Pipe Plug                    | 26         | Capscrew                       |
| 12   | Gasket                       | Not Illus. | Relief Valve                   |
| 13   | Nut                          | Not Illus. | Relief Valve Gasket            |
| 14   | Stud                         | Not Illus. | Relief Valve Capscrews         |
| 15   | Pipe Plug                    |            |                                |



**FIGURE 6**  
**EXPLODED VIEW Q34 AND 434 PUMPS**

| ITEM | NAME OF PART                        | ITEM       | NAME OF PART                  |
|------|-------------------------------------|------------|-------------------------------|
| 1    | Mechanical Seal                     | 16         | Stud                          |
| 2    | Nut                                 | 17         | Pipe Plug                     |
| 3    | Lockwasher                          | 18         | Casing (Jacketed)             |
| 4    | Flat Washer                         | 19         | Pipe Plug                     |
| 5    | Stud                                | 20         | Gasket                        |
| 6    | Packing Gland                       | 21         | Rotor and Shaft               |
| 7    | Packing                             | 22         | Idler and Bushing             |
| 8    | Packing Retainer Washer             | 23         | Idler Bushing                 |
| 9    | Rotor Bearing Sleeve Bushing        | 24         | Head Gasket Set               |
| 10   | Rotor Bearing Sleeve                | 25         | Idler Pin                     |
| 11   | Pipe Plug                           | 26         | Head (Jacketed) and Idler Pin |
| 12   | Gasket                              | Not Illus. | Relief Valve                  |
| 13   | Thrust Washer, Rotor Bearing Sleeve | Not Illus. | Relief Valve Gasket           |
| 14   | Thrust Washer, Rotor                | Not Illus. | Relief Valve Capscrews        |
| 15   | Nut                                 |            |                               |

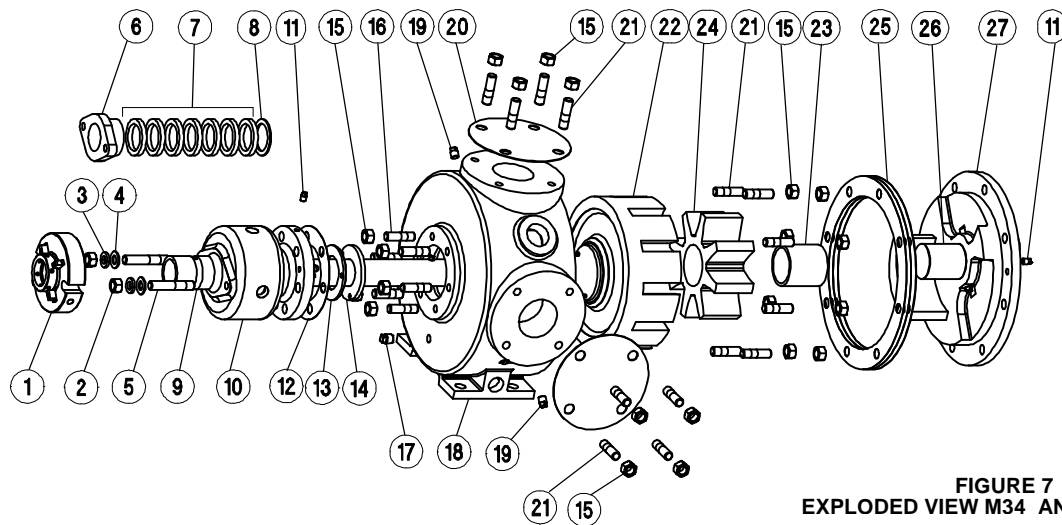


FIGURE 7  
EXPLODED VIEW M34 AND 434 PUMPS

| ITEM | NAME OF PART                        | ITEM       | NAME OF PART                  |
|------|-------------------------------------|------------|-------------------------------|
| 1    | Mechanical Seal                     | 16         | Stud                          |
| 2    | Nut                                 | 17         | Pipe Plug                     |
| 3    | Lockwasher                          | 18         | Casing (Jacketed)             |
| 4    | Flat Washer                         | 19         | Pipe Plug                     |
| 5    | Stud                                | 20         | Gasket                        |
| 6    | Packing Gland                       | 21         | Stud                          |
| 7    | Packing                             | 22         | Rotor and Shaft               |
| 8    | Packing Retainer Washer             | 23         | Idler Bushing                 |
| 9    | Rotor Bearing Sleeve Bushing        | 24         | Idler and Bushing             |
| 10   | Rotor Bearing Sleeve                | 25         | Head Gasket Set               |
| 11   | Pipe Plug                           | 26         | Idler Pin                     |
| 12   | Gasket                              | 27         | Head (Jacketed) and Idler Pin |
| 13   | Thrust Washer, Rotor Bearing Sleeve | Not Illus. | Relief Valve                  |
| 14   | Thrust Washer, Rotor                | Not Illus. | Relief Valve Gasket           |
| 15   | Nut                                 | Not Illus. | Relief Valve Capscrews        |

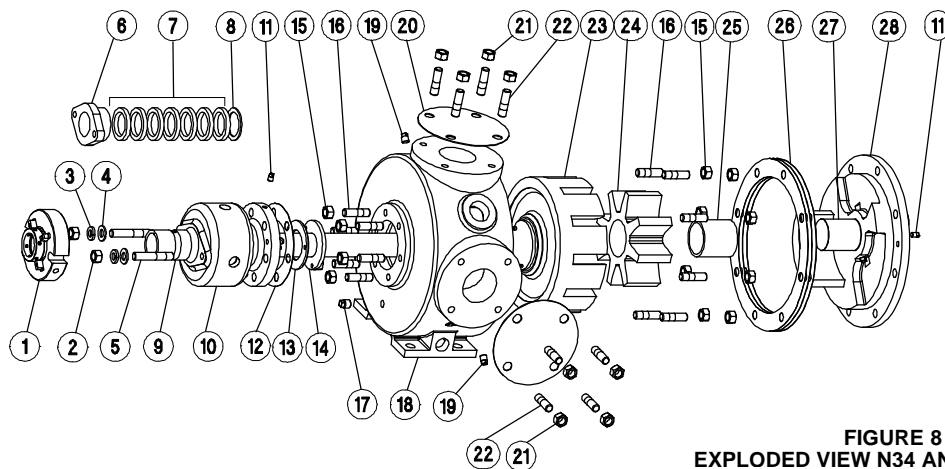


FIGURE 8  
EXPLODED VIEW N34 AND 434 PUMPS

| ITEM | NAME OF PART                        | ITEM       | NAME OF PART                  |
|------|-------------------------------------|------------|-------------------------------|
| 1    | Mechanical Seal                     | 17         | Pipe Plug                     |
| 2    | Nut                                 | 18         | Casing (Jacketed)             |
| 3    | Lockwasher                          | 19         | Pipe Plug                     |
| 4    | Flat Washer                         | 20         | Gasket                        |
| 5    | Stud                                | 21         | Nut                           |
| 6    | Packing Gland                       | 22         | Stud                          |
| 7    | Packing                             | 23         | Rotor and Shaft               |
| 8    | Packing Retainer Washer             | 24         | Idler and Bushing             |
| 9    | Rotor Bearing Sleeve Bushing        | 25         | Idler Bushing                 |
| 10   | Rotor Bearing Sleeve                | 26         | Head Gasket Set               |
| 11   | Pipe Plug                           | 27         | Idler Pin                     |
| 12   | Gasket                              | 28         | Head (Jacketed) and Idler Pin |
| 13   | Thrust Washer, Rotor Bearing Sleeve | Not Illus. | Relief Valve                  |
| 14   | Thrust Washer, Rotor                | Not Illus. | Relief Valve Gasket           |
| 15   | Nut                                 | Not Illus. | Relief Valve Capscrews        |
| 16   | Stud                                |            |                               |



## DISASSEMBLY

### DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, RELIEF VALVE ADJUSTING CAP FITTING ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.
3. THAT YOU KNOW WHAT LIQUID THE PUMP HAS BEEN HANDLING AND THE PRECAUTIONS NECESSARY TO SAFELY HANDLE THE LIQUID. OBTAIN A MATERIAL SAFETY DATA SHEET (MSDS) FOR THE LIQUID TO BE SURE THESE PRECAUTIONS ARE UNDERSTOOD.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

**NOTE:** Mark the head and casing before disassembly to insure proper reassembly. The idler pin, which is offset in pump head, should be properly positioned toward and equal distance between the port connections to allow for proper flow of liquid through the pump.

1. Allow pump to cool. Remove the head from the pump. If pump is furnished with a relief valve it need not be removed from head or disassembled at this point.

### CAUTION

DO NOT ALLOW THE IDLER TO FALL FROM THE IDLER PIN. TILTING THE HEAD UP AS IT IS REMOVED WILL PREVENT THIS OCCURRENCE. AVOID DAMAGING THE HEAD GASKET IF POSSIBLE.

2. For mechanical seal pumps, remove any flush lines going to the mechanical seal if this has not already been done.

2. For pumps with X-100 or X-200 mechanical seals, insert the setting clips back in place. For pumps with PSII® seals, rotate the installation tabs 90 degrees so they contact the sleeve. Loosen the set screws that secure the seal sleeve to the shaft.
3. Remove the nuts, washers and lockwashers holding the mechanical seal and slide the seal assembly from the shaft.
4. Carefully remove rotor and shaft from the pump.

### CAUTION

AVOID DAMAGING THE ROTOR BEARING SLEEVE BUSHING.

8. **THRUST WASHERS:** Rotor thrust washer and rotor bearing sleeve thrust washer – used in Q, M and N size pumps should be removed, examined for excessive wear and replaced if necessary. These thrust washers are located on the hub of the rotor and the casing end of rotor bearing sleeve.
9. If the rotor-bearing sleeve, casing or idler bushing shows signs of wear it should be replaced. All parts should be checked for wear before the pump is put together. When making major repairs, such as replacing a rotor and shaft, it is usually considered advisable to also install a new head and idler. When making minor repairs, where only an idler bushing and idler pin are required, other new parts are usually not necessary. When all the necessary parts are available, the pump can be assembled.

## ASSEMBLY

1. Thrust washers used in Q, M and N size pumps should be assembled on the rotor hub and rotor-bearing sleeve. Put the plain washer on the two locating pins on the rotor hub. Put the grooved face washer on the pins on the rotor-bearing sleeve with the grooved face toward the rotor.
2. Remove all burrs and rough surfaces from the rotor and shaft and assemble in the casing. Lubricate the rotor shaft with lube oil and start the shaft through the rotor bearing sleeve or casing bushing. Slowly turn the rotor and push it into the casing as far as it will go.
3. Place the head gaskets on the head. The proper amount of gaskets should be used to provide the necessary end clearance within the pump so it turns freely with no appreciable endplay. The Gasket Table (**Figure 9**) gives the normal amount of gaskets used on each pump.

| PUMP MODELS      | NORMAL AMOUNT USED | ONE SET OF GASKETS CONSISTS OF THE FOLLOWING |
|------------------|--------------------|--|
| HL 34 & 434      | .010" - .020"      | 1 - .005", 2 - .007"                         |
| KK34 & 434       | .015" - .025"      | 2 - .007", 1 - .015"                         |
| LQ 34 & 434      | .025" - .035"      | 1 - .015", 2 - .006"                         |
| Q, M, N 34 & 434 | .020" - .035"      | 2 - .015", 1 - .006"                         |

**Figure 9  
GASKET TABLE**

- Lubricate the idler pin with lube oil and place the idler and bushing assembly on the idler pin.
- The head can now be assembled on the pump. Make sure it is installed in the correct position **See Disassembly Step 1 (Note)**. Tilt the top of the head away from the pump slightly until the crescent enters the inside diameter of the rotor and rotate the idler until its teeth mesh with the rotor teeth. Do not damage the head gaskets. Tighten the head capscrews or nuts and then check the end clearance. If the pump shaft cannot be rotated, more gaskets must be added. If, however, the pump has any noticeable end play, remove enough gaskets so the pump has no appreciable end play but still turns freely.

#### **PACKED PUMPS**

- Pack the pump. It is good practice to install a set of new packing. The pump should be packed with packing suitable for the liquid being pumped.

Cut the packing into individual rings that wrap exactly around the shaft. Install and seat each ring one at a time, staggering the ring joints from one side of the shaft to the other. Lubricate the packing rings with oil, grease or graphite to aid in assembly. A length of pipe or tubing will help in seating the packing rings.

- Install the packing gland and nuts. The gland must enter the stuffing box at least one-eighth of an inch after tightening the packing gland nuts. Be sure the packing does not wedge between the stuffing box and the gland, as this may split the stuffing box.

#### **MECHANICAL SEAL PUMPS**

##### **X-100 & X-200**

- Make sure the shaft is clean and free of any nicks or burrs. Lubricate the shaft with lube oil and slide the mechanical seal in place.
- Place flat washers and lock washers on the studs then thread on the retaining nuts. Tighten the nuts evenly to secure the mechanical seal to the stuffing box face. Make sure the seal setting clips are in place and tighten the drive setscrews to the shaft. Leave the setting clips in place until after the pump is installed on the drive unit. Be sure and remove the clips before start up.

#### **PSII SEAL®**

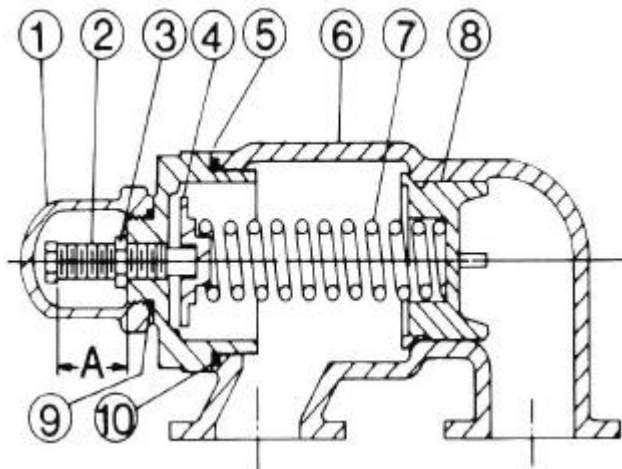
- Make sure the shaft is clean and free of any nicks or burrs. Lubricate the shaft with lube oil and slide the mechanical seal in place.
- Rotate the seal installation tabs 90 degrees so they point towards the seal sleeve. Adjust the position of the seal so the sleeve is evenly spaced between the tabs. Place flat washers and lock washers on the studs then thread on the retaining nuts. Tighten the nuts evenly to secure the seal to the stuffing box face. Tighten the drive setscrews to the shaft. Using a feeler gage, make sure there is still an equal space between the sleeve and the retaining tabs. Readjust if necessary. Leave the seal installation tabs in position until the pump is installed on the drive unit and properly aligned. Rotate the tabs 90 degrees before pump start up.

#### **MECHANICAL SEAL NOTES**

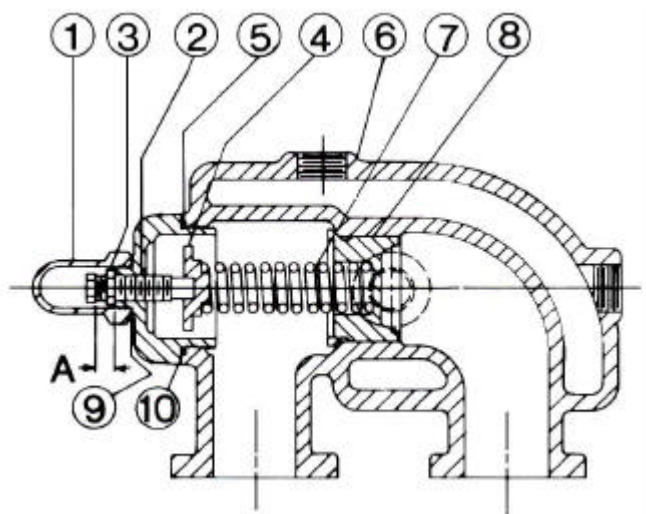
- Vent air from stuffing box before start up. The seal may fail prematurely if this is not done.
- Preheat seal prior to introducing hot product.
- Use of low pressure (2 – 4 psi) continuous flow steam quench on the atmospheric side is recommended. Failure to use a steam quench could result in premature seal failure.
- For double seals, pressurize seal chamber before startup.
- Do not start pump until it is fully heated. Mechanical seal will fail almost instantly if hard product is in the seal chamber.
- Do not use the PSII® cartridge lip seal for filled asphalt or any product containing abrasives.
- When converting an existing installation to a mechanical seal, special attention must be placed on the condition of the pump. All pumps should be inspected to make sure the rotor shaft is in good condition. Any shaft wear due to packing will result in mechanical seal leakage. In general, the rotor and shaft assembly should be replaced. N size pumps can use the same rotor bearing sleeve assembly without modification. Outboard face of this assembly will need to be cleaned to make sure there is a good surface for the mechanical seal to seal against.
- Most asphalt pumps are V-Belt driven. Packing is quite tolerant of any misalignment but mechanical seals are not. Make sure sheaves are aligned properly (see TSM 000) and that the rotor shaft is properly supported with a pillow block bearing. It is also important to make sure the mechanical seal is properly aligned with the rotor shaft. This is done at the time of seal installation. Be sure to recheck alignment when the rotor shaft is inserted in the pillow block bearing.

## VALVE INSTRUCTIONS

Series 34 and 434 jacketed pumps may be furnished with a relief valve head and a plain or jacketed relief valve as illustrated in **Figures 10 and 11**.



**FIGURE 10**  
**PLAIN VALVE**



**FIGURE 11**  
**JACKETED VALVE**

### LIST OF PARTS

- |                    |                   |
|--------------------|-------------------|
| 1. Valve Cap       | 6. Valve Body     |
| 2. Adjusting Screw | 7. Valve Spring   |
| 3. Lock Nut        | 8. Poppet         |
| 4. Spring Guide    | 9. Cap Gasket     |
| 5. Bonnet          | 10. Bonnet Gasket |

## DISASSEMBLY

### DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, RELIEF VALVE ADJUSTING CAP FITTING ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.
3. THAT YOU KNOW WHAT LIQUID THE PUMP HAS BEEN HANDLING AND THE PRECAUTIONS NECESSARY TO SAFELY HANDLE THE LIQUID. OBTAIN A MATERIAL SAFETY DATA SHEET (MSDS) FOR THE LIQUID TO BE SURE THESE PRECAUTIONS ARE UNDERSTOOD.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

## ASSEMBLY

Follow the procedure outlined under Disassembly in reverse order.

If valve is removed for repairs, be sure to replace in same position. The valve cap should point towards the suction port.



# TECHNICAL SERVICE MANUAL

JACKETED ASPHALT PUMPS  
SERIES 34 and 434  
SIZES HL, KK, LQ, Q, M, N

SECTION TSM 430  
PAGE 9 OF 9  
ISSUE C

## DANGER

BEFORE STARTING PUMP, BE SURE ALL DRIVE EQUIPMENT GUARDS ARE IN PLACE.

FAILURE TO PROPERLY MOUNT GUARDS MAY RESULT IN SERIOUS INJURY OR DEATH.

## IMPORTANT

In ordering parts for relief valve on head, always be sure to give Model and Serial Number of pump as it appears on nameplate and the name of the part wanted. When ordering springs, be sure to give the pressure setting desired.



## WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, FOB. Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources, which are incorporated into any Viking product, are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

**THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** No officer or employee of IDEX Corporation or Viking Pump, Inc. is authorized to alter this warranty.



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A Unit of IDEX Corporation

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# Appendix B - Parts Manual

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# CTT Transportable Storage Tank Parts Manual

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    Tandem Axle Assembly ..... 10

    Hot Oil Connection Piping..... 12



## SERVICE & PARTS ASSISTANCE

For service and parts assistance contact:

Service / Parts Department  
**General Combustion Corporation.**  
5201 North Orange Blossom Trail  
Orlando, FL 32810  
Phone: (407) 290-6000  
Fax: (407) 578-0577  
parts@gencor.com  
www.gencor.com

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One manual is provided to each customer. Additional manual sets are available. For more information about pricing and reordering, contact the Parts Department at (407) 290-6000.



# How to Order Parts & Model Identification

To ensure Accuracy and Promptness in Filling Your Order, the Following Must Be Given:

1. Your order number
2. Type and model number of machine for which Parts are being ordered (If ordering for more than one machine) group the Parts for each machine and give the corresponding machine serial number.)
3. YOUR MACHINE SERIAL NUMBER (See illustration below).
4. Parts Numbers.
5. Description of Parts.
6. Quantity of each item needed.
7. Name of sub-assembly where part is to be used (For example: Part of main transmission)
8. State whether to ship by freight, truck, UPS, parcel post or air.
9. Name and address of person or company to whom Parts are to be shipped.
10. Name and address of person or company to whom invoice is to be sent.
11. Shipments are collect unless otherwise specified.

To ensure accuracy and promptness in filling your order, the Serial Number illustrated below, must be given when ordering Parts.

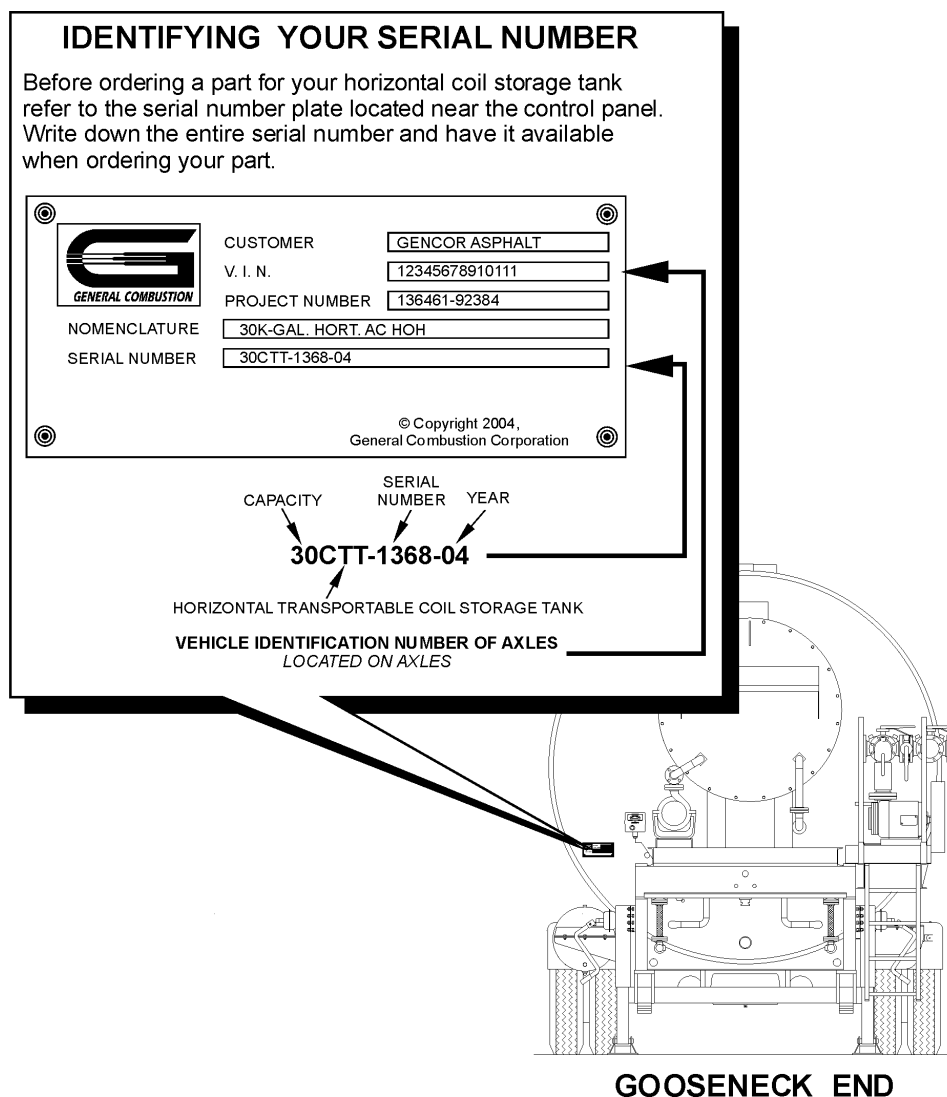


Figure 1: Model Identification

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# Terms and Condition of Sale

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## **BUYING PARTS NOT MANUFACTURED BY GENERAL COMBUSTION CORPORATION**

There are many items purchased by General Combustion that, though they look like standard market items, are manufactured to special tolerances, have special alloys, or special heat-treating. Consequently, serious problems arise when these facts are not realized and such parts are substituted unknowingly. Since we realize that in many cases it may be more convenient for you to buy stock supplier items direct, rather than through us, we have identified such items in the Parts Manuals. However, in the event of unsatisfactory performance resulting from the use of supplier items not so identified, General Combustion cannot be responsible.

## **RECEIPT OF PARTS**

Responsibility for breakage, loss, or damaged goods, ceases upon delivery of the merchandise to the transportation company from whom a receipt is received showing that the shipment was accepted by it in good condition. If any of the material listed on the bill of lading or express receipt is short, broken, or damaged, do not accept the shipment until the carrier's agent makes a notation of the shortage or damage on the expense bill. Notify the transportation company's agent at once and request an inspection. This is absolutely necessary: Unless this is done, the transportation company will not entertain a claim for loss or damage. If the agent does not make an inspection, then an affidavit should be made that he was notified (on a certain date) and failed to do so. This affidavit with papers will properly support your claim.

## **PARTS TO BE RETURNED**

Permission to return parts or equipment must be received before making shipment. When requesting permission, itemize the parts and show invoice numbers and date of original purchase. Transportation charges must be prepaid. Send request to your General Combustion distributor.

## **GENERAL MANUFACTURER'S WARRANTY**

Manufacturer warrants that, commencing with the date of shipment to first end-user and for a period of 6 months thereafter or 1000 hours of operation, whichever occurs first, all machinery and parts manufactured by Manufacturer and any installation performed by Manufacturer to be free from defects in workmanship and material. If, within such warranty period, any machinery or parts shall be proved to Manufacturer's satisfaction to be defective, it shall be repaired, or at the Manufacturer's option, replaced, f.o.b. Manufacturer's warehouse, without charge. Manufacturer's obligation hereunder shall be confined to such repair or replacement.

No warranty shall apply to used machinery nor to machinery, parts or accessories which have been furnished, repaired or altered by others so as, in Manufacturer's judgment, to affect the same adversely or which shall have been subject to negligent, accident or improper care, installation, maintenance, storage or other than normal use or service, during or after shipment. With respect to machinery, parts or accessories to Manufacturer's products which are furnished, but not manufactured by Manufacturer. Manufacturer's warranty obligation shall in all respects conform and be limited to the warranty extended to Manufacturer by its supplier or, if none, to the warranties expressed herein.

No warranty shall apply to any portion of the Manufacturer's product adversely affected, in Manufacturer's judgment, by the use or installation on any product of the Manufacturer of any part, attachment or equipment not manufactured, sold or authorized by the Manufacturer. Manufacturer further warrants that all services performed by it, including but not limited to advising services and services relating to installation or repair of machinery and parts thereof, will be performed in a good and workmanlike manner. Manufacturer's obligation and liability with respect to such warranty shall be limited to the amount received by it on account of such services or the amount reasonably allocable thereto.

The foregoing warranties are in lieu of all other warranties express or implied (except of title) including but not limited to any warranty of merchantability; and Manufacturer shall not be subject to any other obligations or liabilities whatsoever with respect to machinery, parts, accessories or services manufactured or furnished by it or any undertakings, acts or omissions relating thereto. Under no circumstances shall Manufacturer be liable for any consequential damages, expenses, losses or delays howsoever caused. There are no warranties which extend beyond the description on the face hereof.

### WARRANTY AND NOTICE PERIODS

The rights and remedies of Purchaser and General Combustion's obligations and liabilities with respect to each defect in material or workmanship are strictly conditioned upon the defect having become apparent to Purchaser and upon General Combustion's warranty administrator having received written notice of defect within six (6) months after acceptance by Purchaser.

### WEAR AND TEAR

Normal wear and tear and the need for regular maintenance and overhaul shall not constitute a defect in any Product or Part under this Warranty.

### DISCLAIMER AND RELEASE

THE WARRANTIES, OBLIGATIONS, AND LIABILITIES OF GENERAL COMBUSTION AND RIGHTS AND REMEDIES OF PURCHASER SET FORTH IN THIS WARRANTY ARE EXCLUSIVE AND IN SUBSTITUTION FOR, AND PURCHASER HEREBY WAIVES, RELEASES, AND RENOUNCES ALL OTHER PRESENT OR FUTURE WARRANTIES, OBLIGATIONS, REPRESENTATIONS, AND LIABILITIES OF GENERAL COMBUSTION. TOGETHER WITH ALL OTHER RIGHTS, CLAIMS, AND REMEDIES OF PURCHASER AGAINST GENERAL COMBUSTION, EXPRESS OR IMPLIED, ARISING BY LAW OR OTHERWISE, WITH RESPECT TO ANY NON-CONFORMANCE OR DEFECT IN ANY PRODUCT OR PART, INCLUDING BUT NOT LIMITED TO (A) ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS; (B) ANY IMPLIED WARRANTY ARISING FROM COURSE OR PERFORMANCE, COURSE OF DEALING OR USAGE OF TRADE; (C) ANY OBLIGATION, LIABILITY, RIGHT, CLAIM, OR REMEDY FOR LOSS OF OR DAMAGE TO ANY PRODUCT OR PART, FOR ANY LOSS OF USE, REVENUE, OR PROFIT WITH RESPECT TO ANY PRODUCT OR PART, FOR ANY LIABILITY OF PURCHASER TO ANY THIRD PARTY OR FOR ANY OTHER DIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. IN ADDITION AND WITHOUT LIMITATION OF THE FOREGOING, UNLESS OTHERWISE EXPRESSLY STATED ON THE FACE OF THIS ORDER, IT IS AGREED THAT GENERAL COMBUSTION MAKES ABSOLUTELY NO WARRANTY, UNDERTAKING, OR REPRESENTATION AS TO THE CONFORMITY OF ANY PRODUCT OR PART TO ANY FEDERAL, STATE, OR LOCAL POLLUTION CONTROL OR OTHER EMISSION LAWS, REGULATIONS, OR STANDARDS OF ANY KIND WHATSOEVER, NOTWITHSTANDING ANY PREVIOUS, CURRENT, OR FUTURE COMMUNICATION TO THE CONTRARY.

### EXTENDED WARRANTY TO THE ORIGINAL PURCHASER

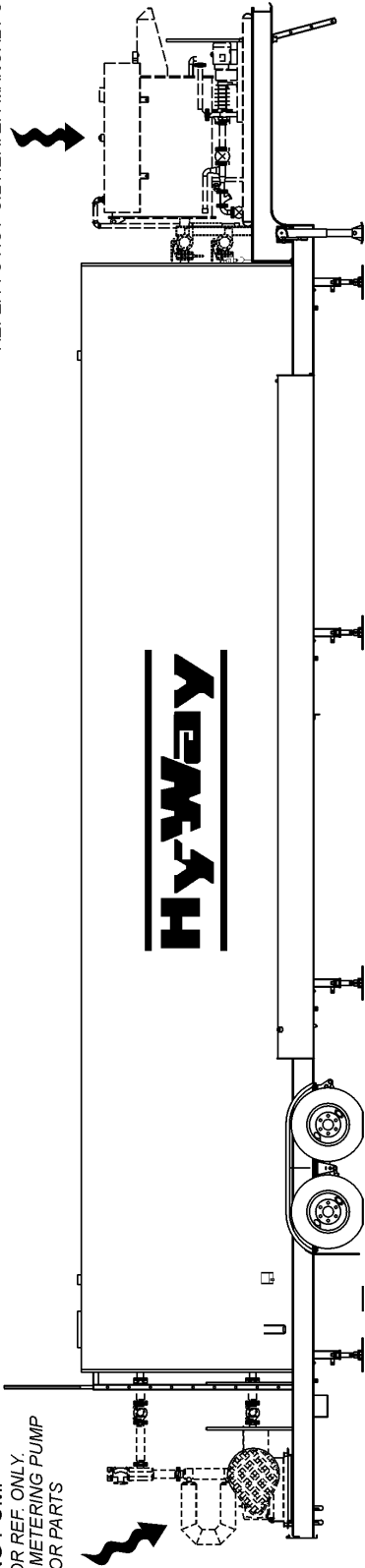
In the event the contract specifies any of the equipment listed below, General Combustion will extend the warranty on the items for the period indicated. General Combustion will repair or replace the items in the event of premature wear only, provided the Purchaser furnishes documented proof of tonnage processed. In all cases, it will be the Purchaser's responsibility to pay for any disassembly, installation, and freight, F.O.B. factory, for the replacement of such components.

- A). Standard Heavy-Duty Main Transfer Conveyor, Floor System - Three million tons or seven years, whichever occurs first, unconditional warranty on the transfer conveyor floor system. This warranty does not cover floor castings that are broken or otherwise damaged through abuse or misuse of the transfer conveyor.
- B). Standard Heavy-Duty Main Transfer Conveyor, Chain - 750,000 ton or five years, whichever occurs first, prorated warranty on a 4" pitch x 3433 chain is standard in transfers (rollers, bushings, and pins).
- C). Standard Heavy-Duty Main Transfer Conveyor, Standard Slats - One million ton **or five years, whichever occurs first**, unconditional warranty on the 3/4 in. thick slats.

# CTT Horizontal Coil Storage Tank Overview

METERING PUMP  
SHOWN FOR REF. ONLY.  
REFER TO METERING PUMP  
MANUAL FOR PARTS

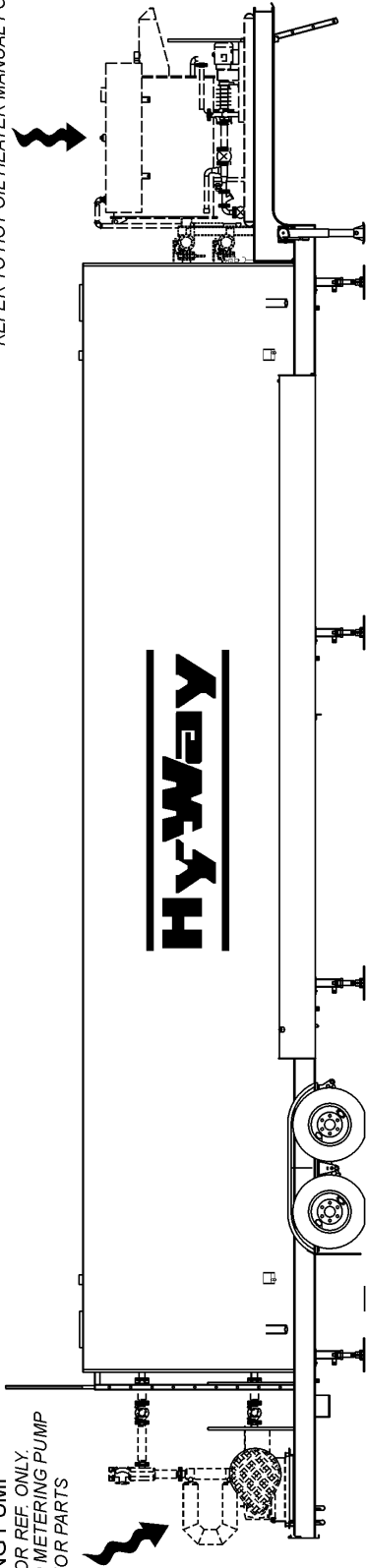
HOT OIL HEATER WITH EXP. TANK  
SHOWN FOR REF. ONLY.  
REFER TO HOT OIL HEATER MANUAL FOR PARTS.



## SINGLE COMPARTMENT

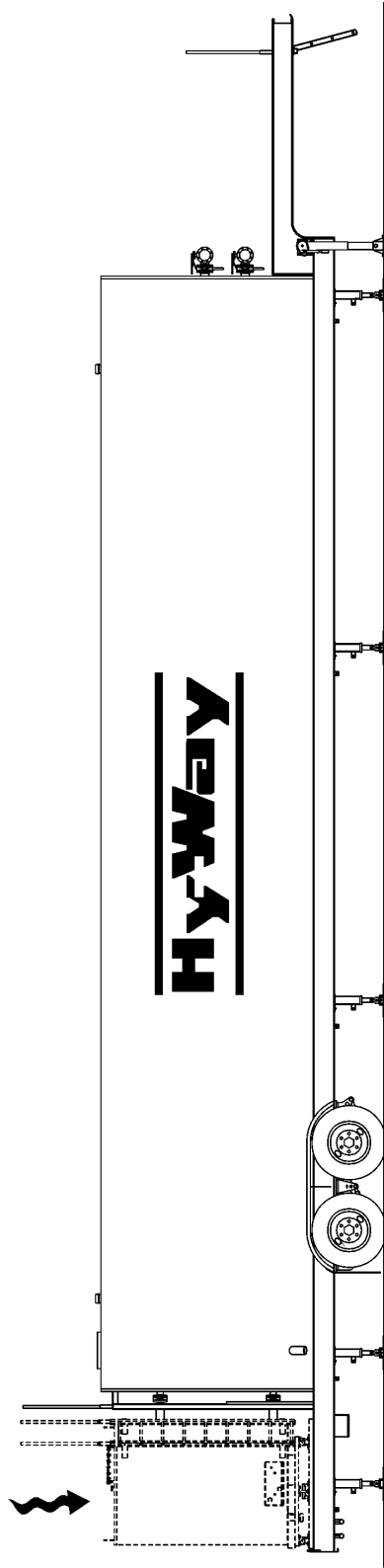
METERING PUMP  
SHOWN FOR REF. ONLY.  
REFER TO METERING PUMP  
MANUAL FOR PARTS

HOT OIL HEATER WITH EXP. TANK  
SHOWN FOR REF. ONLY.  
REFER TO HOT OIL HEATER MANUAL FOR PARTS.



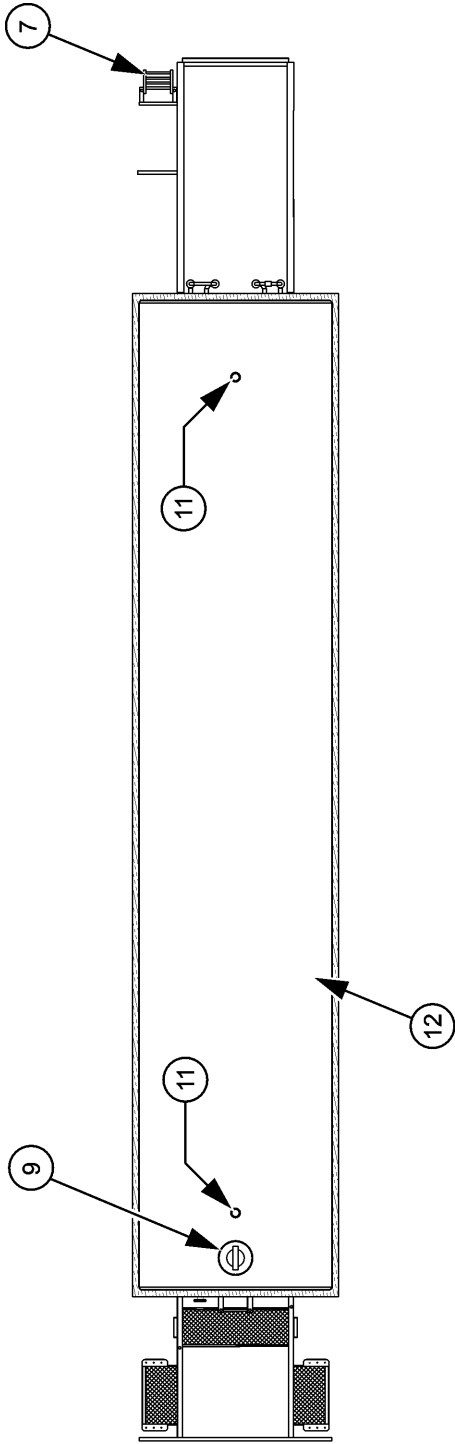
## SPLIT COMPARTMENT

CALIBRATION TANK  
SHOWN FOR REF. ONLY.  
REFER TO CALIBRATION TANK  
MANUALS FOR PARTS.

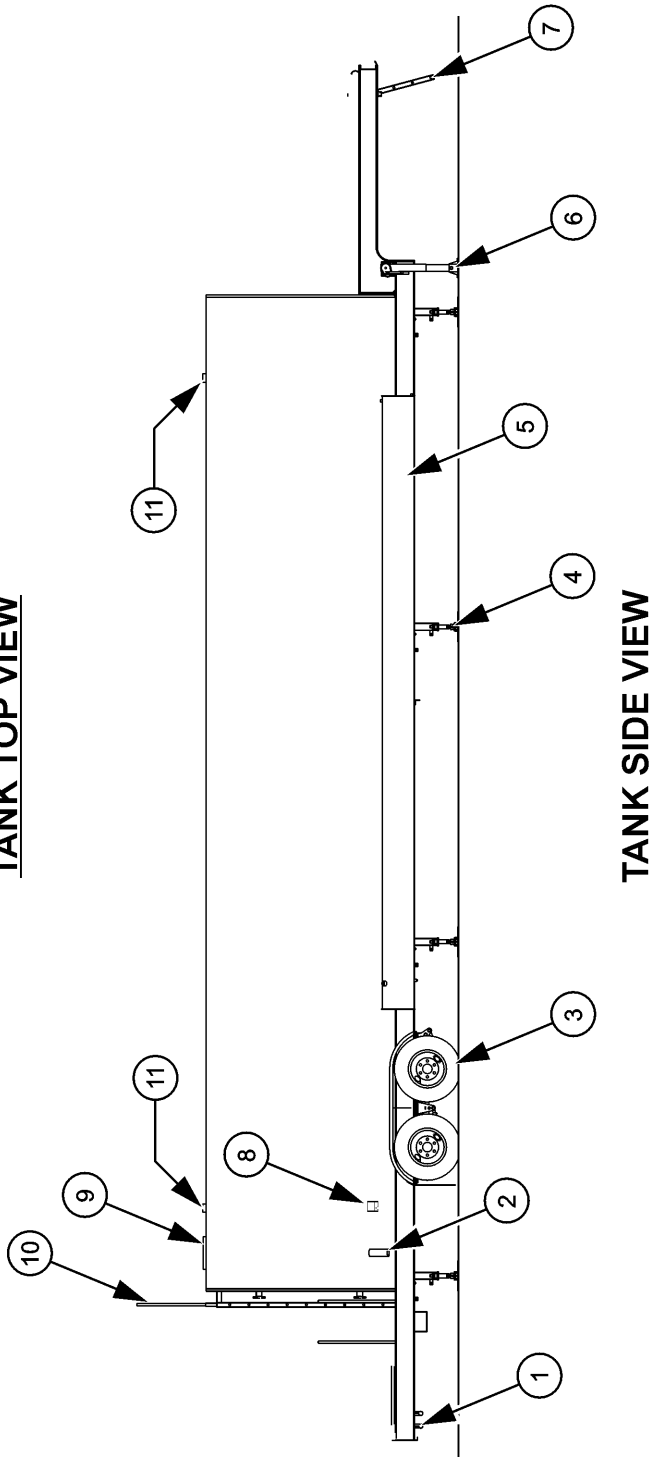


STORAGE TANK WITH OPTIONAL CALIBRATION TANK

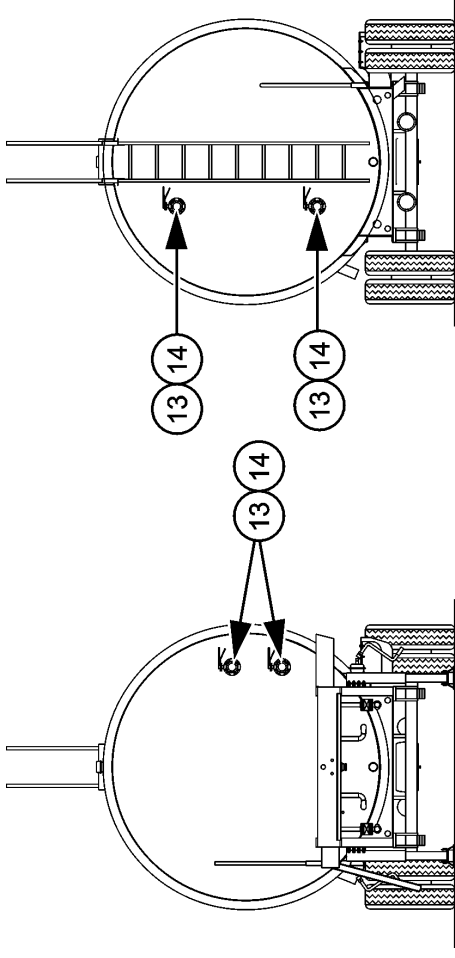
# Horizontal Coil Storage Tank Assembly - Single Compartment



TANK TOP VIEW



TANK SIDE VIEW



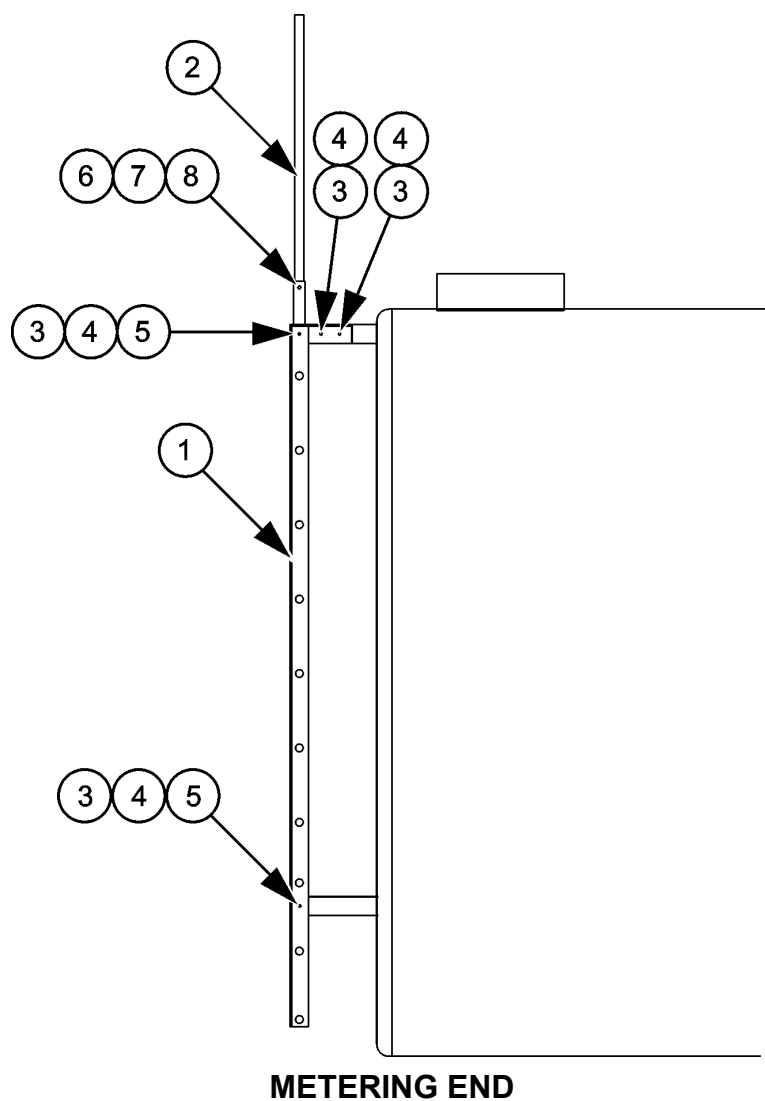
UNLOADING END

METERING END

BUMPER, FENDERS & REAR WALKWAY  
NOT SHOWN FOR CLARITY

| ITEM | QTY | Part Number | ITEM DESCRIPTION  |
|------|-----|-------------|---|
| 1    | 2   | ---         | Hot Oil Supply & Return Lines                                   |
| 2    | 1   | ---         | Overflow Pipe Single Compartment / Double for split Compartment |
| 3    | 3   | HT20939C    | Tandem Axle   |
| 4    | 8   | B2262-1     | Screw Jack & Plate (2/Set)                                      |
| 5    | 1   | ---         | 496 Gallon Heater Fuel Supply Tank                              |
| 6    | 1   | 060.68.0176 | Landing Gear  |
| 7    | 1   | BAT3B0002A  | Gooseneck Ladder with Grab Bars                                 |
| 8    | 1   | 146.05.0022 | Sample Valve Assembly   |
| 9    | 1   | 175.02.3014 | 20" Ø Manway  |
| 10   | 1   | ---         | Outside Ladder with removable grab bars                         |
| 11   | 2   | B9049-550A  | 3" Threaded Pipe Plug   |
| 12   | 1   | ---         | Horizontal Coil Storage Tank                                    |
| 13   | 4   | 054.01.3006 | 3" x 150# Flange Gasket   |
| 14   | 4   | 146.16.3001 | 3" Butterfly Valve  |

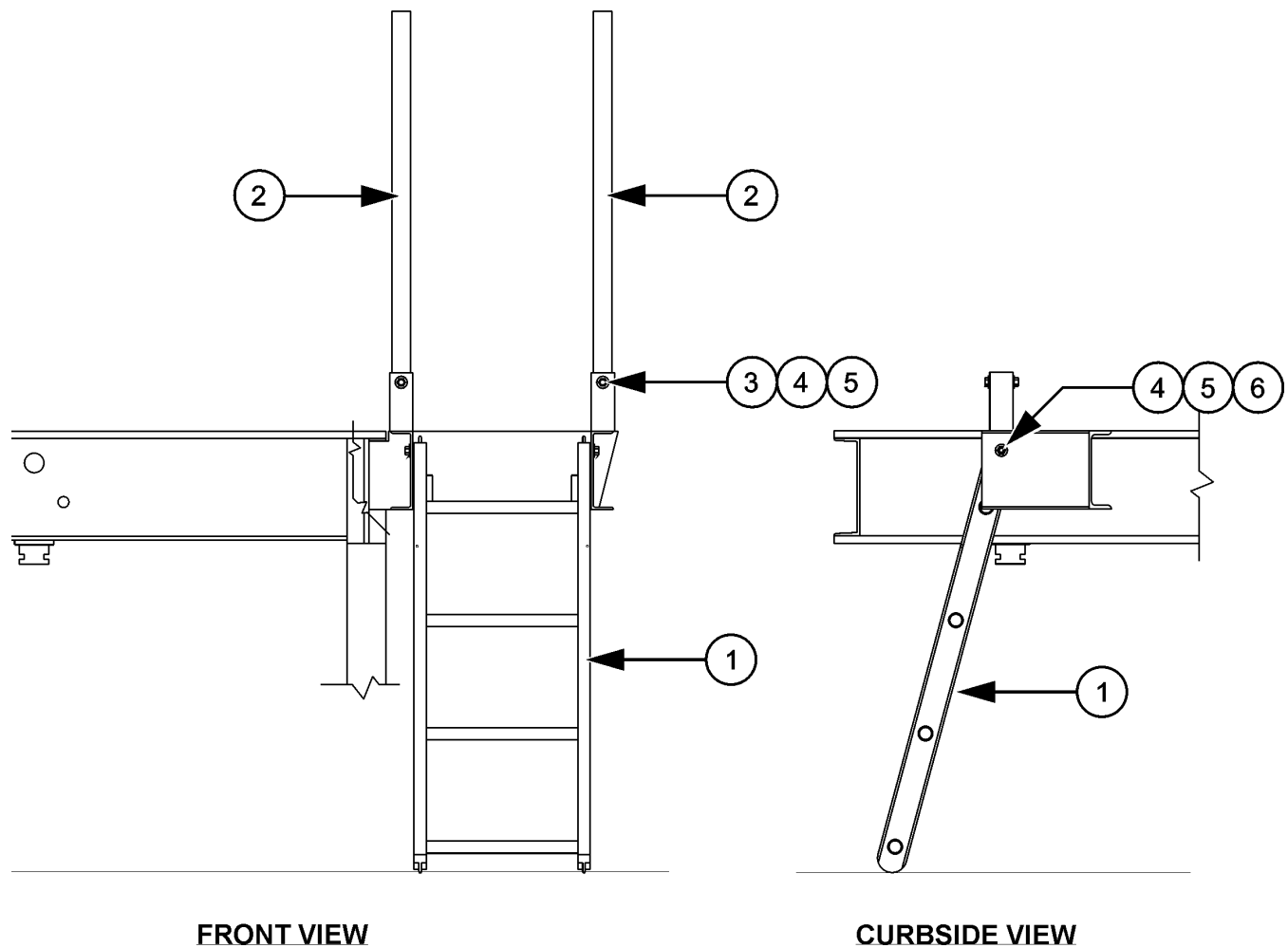
# Outside Ladder Assembly



| ITEM # | QTY | PART NUMBER | DESCRIPTION             |
|--------|-----|-------------|-------------------------|
| 1      | 1   | 400.02.7548 | Outside Ladder          |
| 2      | 2   | 400.03.7025 | Tube                    |
| 3      | 8   | 046.01.0135 | 3/8" x 1-1/2 bOLT       |
| 4      | 8   | B7145-1     | 3/8" Lock Nut           |
| 5      | 8   | 046.03.0026 | 3/8" Flat Washer        |
| 6      | 2   | 046.01.0135 | Bolt, 1/2" x 2-3/4 Bolt |
| 7      | 2   | B9090-302   | 1/2" Lock Nut           |
| 8      | 2   | 046.03.0020 | 1/2" Flat Washer        |

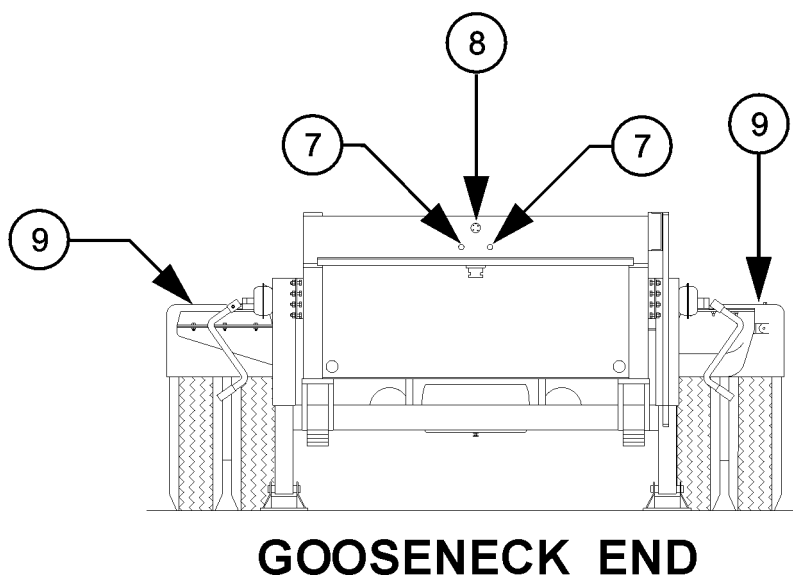
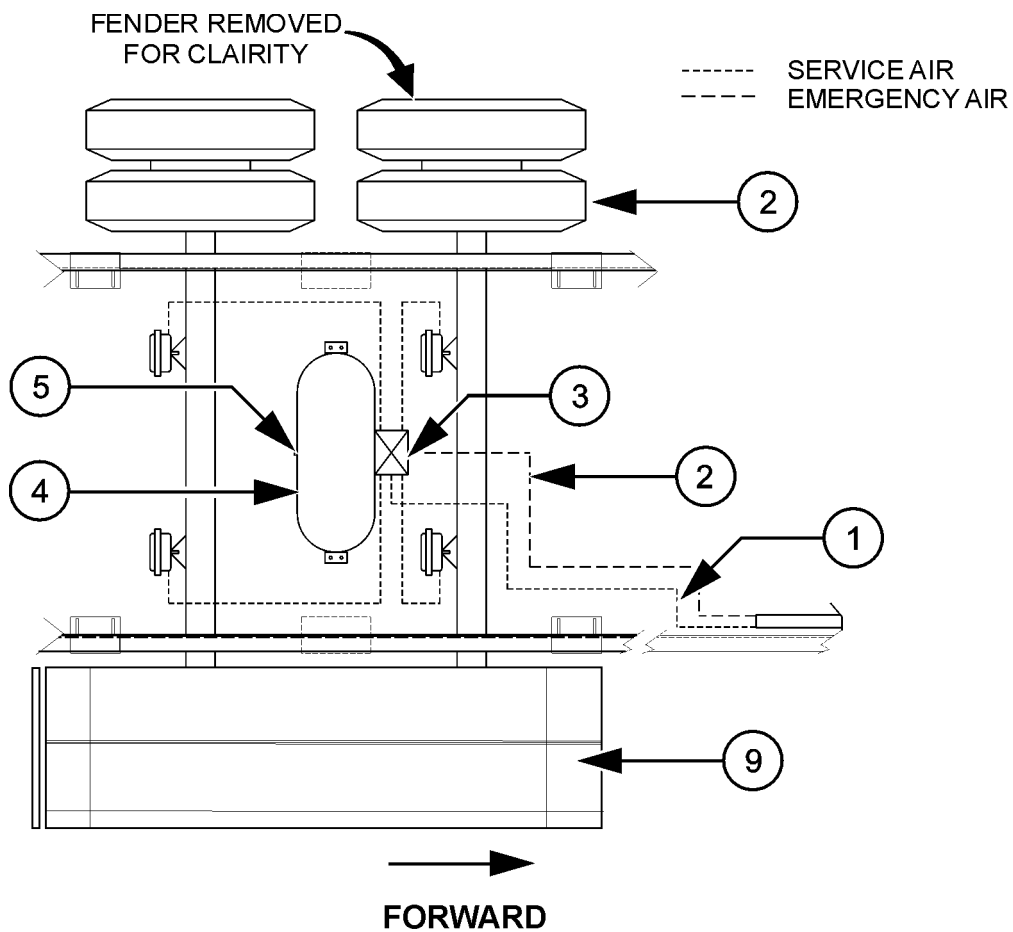


# Gooseneck Ladder Assembly



| ITEM # | QTY | PART NUMBER | DESCRIPTION          |
|--------|-----|-------------|----------------------|
| 1      | 1   | 400.02.7548 | 46" Gooseneck Ladder |
| 2      | 2   | 400.03.7025 | Tube 42" Long        |
| 3      | 2   | 046.01.0135 | 1/2" x 2-3/4" Bolt   |
| 4      | 6   | B9090-302   | 1/2" Lock Washer     |
| 5      | 8   | 046.03.0020 | 1/2" Flat Washer     |
| 6      | 2   | 046.01.0267 | Bolt, 1/2" x 1-1/2"  |

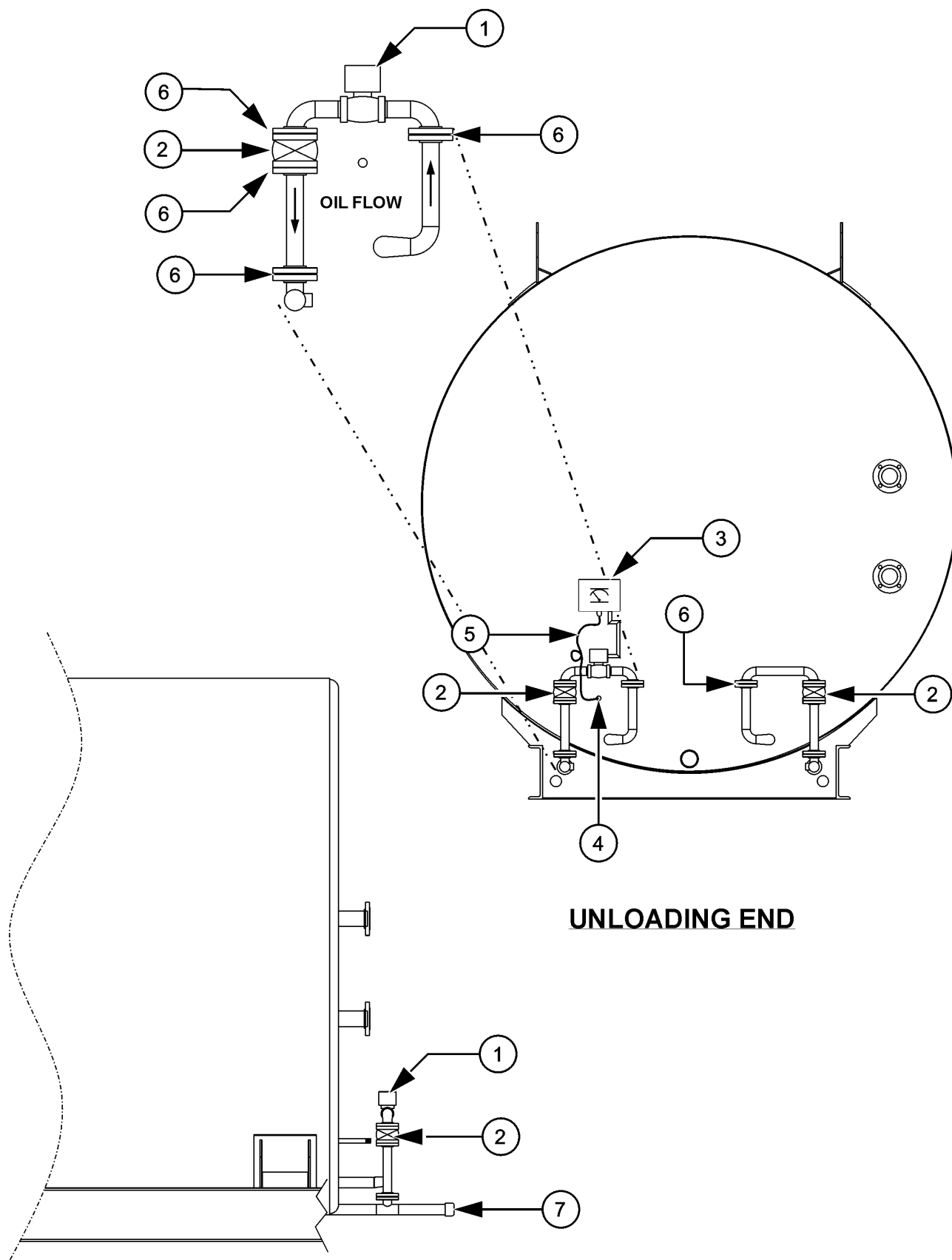
# Tandem Axle Assembly



| ITEM | QTY | DESCRIPTION               | ALL 30K     | ALL 25K     | ALL 20K     | ALL 15K     | ALL 10K     |
|------|-----|---------------------------|-------------|-------------|-------------|-------------|-------------|
| * 1  | 75' | 3/8" Blue Plastic Hose    | B3297-1     | ----        | ----        | ----        | ----        |
|      | 68' | 3/8" Blue Plastic Hose    | ----        | B3297-1     | ----        | ----        | ----        |
|      | 61' | 3/8" Blue Plastic Hose    | ----        | ----        | B3297-1     | ----        | ----        |
|      | 54' | 3/8" Blue Plastic Hose    | ----        | ----        | ----        | B3297-1     | ----        |
|      | 47' | 3/8" Blue Plastic Hose    | ----        | ----        | ----        | ----        | B3297-1     |
| * 2  | 65' | 3/8" Red Plastic Hose     | B9065-015   | ----        | ----        | ----        | ----        |
|      | 58' | 3/8" Red Plastic Hose     | ----        | B9065-015   | ----        | ----        | ----        |
|      | 51' | 3/8" Red Plastic Hose     | ----        | ----        | B9065-015   | ----        | ----        |
|      | 44' | 3/8" Red Plastic Hose     | ----        | ----        | ----        | B9065-015   | ----        |
|      | 47' | 3/8" Red Plastic Hose     | ----        | ----        | ----        | ----        | B9065-015   |
| 3    | 1   | Brake Relay Valve         | B9080-044   | B9080-044   | B9080-044   | B9080-044   | B9080-044   |
| 4    | 1   | 12" x 26.5" Air Tank      | B9080-041A  | B9080-041A  | B9080-041A  | B9080-041A  | B9080-041A  |
| 5    | 1   | 1/4" Draincock            | B9083-058   | B9083-058   | B9083-058   | B9083-058   | B9083-058   |
| 6    | 8   | Radial Tire & Wheel       | 060.68.7093 | 060.68.7093 | 060.68.7093 | 060.68.7093 | 060.68.7093 |
| 7    | 2   | Glad Hand                 | B9083-004   | B9083-004   | B9083-004   | B9083-004   | B9083-004   |
| 8    | 1   | 7-Prong Plug              | B9083-039   | B9083-039   | B9083-039   | B9083-039   | B9083-039   |
|      | 1   | 16/4 S.O. Cable           | B9090-108   | B9090-108   | B9090-108   | B9090-108   | B9090-108   |
| 9    | 2   | Aluminum Fender           | 060.68.7121 | 060.68.7121 | 060.68.7121 | 060.68.7121 | 060.68.7121 |
|      | 2   | Mudflap with Logo         | 060.68.0174 | 060.68.0174 | 060.68.0174 | 060.68.0174 | 060.68.0174 |
| 10   | 16  | 3/8" x 3/8" Brake Fitting | B9083-086   | B9083-086   | B9083-086   | B9083-086   | B9083-086   |
| 11   | 4   | 1/4" x 3/8" Brake Fitting | B9083-084   | B9083-084   | B9083-084   | B9083-084   | B9083-084   |

\* When ordering these items from the Parts Department, please specify the tank size.

# Hot Oil Connection Piping



# Hot Oil Piping Piping

## Single Compartment

| ITEM | QTY | DESCRIPTION  | Single Compartment<br>ALL 30K, 25K, 20K, 15K, 10K |
|------|-----|--|---|
| 1    | 1   | 1-1/2" Solenoid Valve                              | 146.06.3005                                       |
| 2    | 2   | 1-1/2" x 3-3/4" Long Gate Valve                    | 146.03.0054                                       |
| * 3  | 1   | Partlow Temperature Control, Single Switch         | B9090-005   |
|      |     | United Electric Temperature Control, Single Switch | 135.01.3105                                       |
| 4    | 1   | 1/2" Strain Relief                                 | B9090-421   |
| * 5  | 1   | Partlow Capulary Bulb Replacement 5'               | B9090-005A  |
|      |     | United Electric Capulary Bulb Replacement 6'       | 044.50.3085                                       |
| 6    | 8   | 1-1/2" Flange Gasket 150#                          | 054.01.3005                                       |
| 7    | 2   | 2" Cap   | 092.01.0011                                       |
| 8    | 2   | 1-1/2" x 12" Long Flex Hose - (Not Shown)          | 064.01.3098                                       |

\* Verify correct Temperature Controller installed on tank prior to calling Parts Department.

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