



VT-0049

006

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CWH

## LNG Tank General Troubleshooting (non-fuel gauge) USDOT

### OVERVIEW

Chart LNG tanks provide years of dependable service but do require some general maintenance from time to time. This service bulletin will provide general instructions on the diagnosis and testing of Chart LNG tanks. Proper service will insure the tank is safe and functional before being returned to service.

**Note:** Fuel gauge troubleshooting will not be covered in this bulletin.

### TOOLS NEEDED

- Leak Detector Solution
- Nickel Impregnated Tape
- Wire Brush/Brushes Internal & External
- Economizer Test Tool
- High Pressure Nitrogen Bottle
- Assorted Wrenches Adjustable & Open End
- Flaretite Seals
- Chart LNG Service bulletins (VT-00XX)
- Appropriate PPE

## Troubleshooting Chart LNG Tanks



**This procedure is intended for use by trained technicians with experience on systems using LNG. Review all applicable safety documents before beginning this procedure.**



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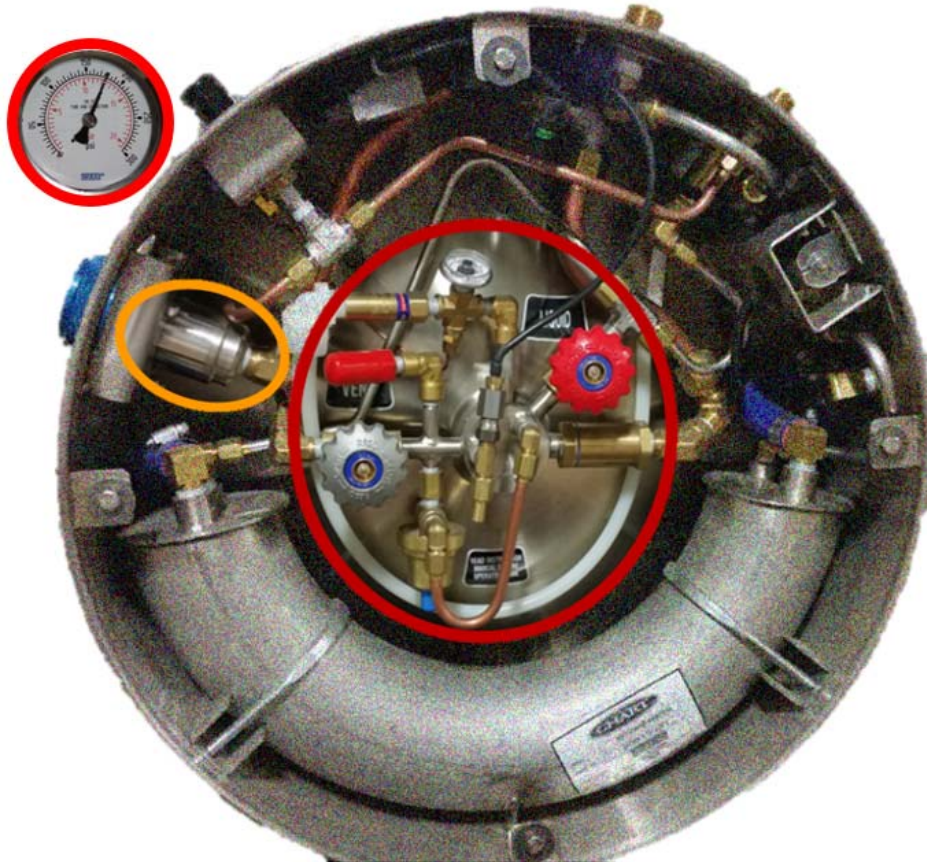
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### Is De-fueling Needed for Repairs?



De-fueling is **REQUIRED** for all component and plumbing repairs within the **RED** circled areas.

De-fueling is recommended by Chart Industries for component repairs within the **ORANGE** circled area and its plumbing up to the fill check valve.

All other components will require closing both valves and depressurizing the component's plumbing prior to repairs.

For de-fueling and depressurizing procedures refer to VT-0017

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### Low Pressure



#### Causes of low-pressure issues with Chart LNG tanks:

**Faulty Economizer** – If the economizer is stuck in the open position it will allow the vapor pressure to continue to flow to the engine after the economizer is supposed to be closed.

Testing the economizer:


1. Using Chart's Economizer Test Tool (P/N: 20837106) & following the instructions in VT-0014 will determine if the economizer is operating at the proper set point or operating properly.
2. Once set point is determined, the economizer can be tested for leak by. With tank pressures minimum 25 psi below economizer set point & tank plumbing de-iced the economizers can be tested one at a time (if dual tanks). Close the red handled valve on one tank (if dual tank, if single tank system keep red valve open). Start truck and allow to idle while observing economizer tube for frost pattern. With tank pressure below the economizer set point there should be no flow through the economizer.

If within the first few minutes of running, with tank pressures minimum 25 psi below economizer set point, a frost pattern is observed flowing through the economizer towards the red handled valve, then an open economizer condition exists and should be replaced. Refer to VT-0011 for economizer replacement.



**Note: After several minutes of operation frost will begin appearing throughout the plumbing due to radiant cooling and liquid settling to low points in the plumbing.**

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**Excess Flow Valve (EFV) Issues** – a tripped EFV, a blockage in the EFV, or faulty EFV can prevent regular tank pressures from passing through continually. Close red handled valve for ~5minutes. Slowly re-open red handled valve. See Fuel Flow Issues section for resetting the EFV.

**Shut-off Solenoid (S.O.S.) Issues** – voltage, wiring, &/or ground issues can prevent the valve from opening properly. Additionally, valve orientation or a blockage in the EFV can prevent regular tank pressures from passing through continually.

**Overpressure Regulator Issues** – An improperly adjusted, damaged, or faulty over pressure regulator (OPR) can prevent regular tank pressures from passing to the engine. Refer to VT-0031 for proper adjusting procedures. Replace as necessary.

**Vapor Leaks** – Leaks on the vapor side of the plumbing circuit will allow the vapor pressure inside the tank to escape, lowering the tank pressure/de-saturating the tank.


1. Vapor leaks can be at plumbing connections, vent QDV, primary & secondary relief vales, and other components.
2. To find vapor leaks, open the red handled (liquid) valve, turn the key to the ON position, and apply leak detector to components & plumbing connections. If bubbles indicate an unacceptable leak. Repair as needed.
3. Do not put leak detector into the relief valves, a latex glove or similar can be clamped around the valve and allowed to sit for some time to see if the glove inflates indicating a leak. Repair as needed.
4. Test for leaks again before returning to service.

**Cold Fuel** – Seldom an issue, but a fuel station may deliver cold (de-saturated) fuel during the fueling process. This can be caused by issues with the fuel station, or possibly fueling your truck during the time the station is getting a fuel delivery if the station has a single tank. Cold (de-saturated) fuel most commonly can be caused by leaks in the vapor circuit, leaking relief valve(s), bad economizer(s), & improper de-fueling.

Cold fuel can be resolved a few ways:

1. Repair leaks & replace faulty parts as needed. (defueling prior to repairs may be needed, see de-fueling section above)
2. Allow the fuel in the liquid to warm on its own. Generally, this not acceptable due to a pressure rise of only 7-10 psi per day.
3. If cold fuel issue was caused by an improperly de-fueled tank, i.e. de-fueled through the grey vent valve, adding fuel from a fueling station should create enough pressure to de-fuel the tank. Additionally, a false head pressure can be created by putting **nitrogen gas only** into the tank as needed to de-fuel the de-saturated fuel prior to refilling.
4. De-fueling the tank and refilling with properly saturated fuel. For de-fueling procedures, refer to [VT-0017](#)

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## High Pressure



**Note:** If high tank pressures are present (above PRV set-point), determine primary cause of increased pressure and repair before returning truck to service.

### Causes of high-pressure issues with Chart LNG tanks:

**Overpressure Regulator Issues** – An improperly adjusted, damaged, or faulty over pressure regulator (OPR) can allow regular tank pressures (up to PRV set point) that are above the desired pressure level to pass to the engine. Refer to [VT-0031](#) for proper adjusting procedures. Replace as necessary.


**Long Park Times** – Due to the extremely low boiling temperature of LNG it will naturally boil inside of the tank. With long periods of non-use, the tank pressure will continue to rise to the opening point of the primary relief valve. Operating the truck will consume the vapor pressure in the tank, and if operated to the economizer set-point, will reset the hold time to relief valve opening to 7-10 days.

**Filling Issues** – High tank pressures can be created through improper filling, and hot filling tanks. Follow proper filling procedures when filling a tank with LNG. Refer to [VT-0013](#) & [VT-0048](#)

**Overfilling** - During normal filling, if the start button on the fuel station is continually pressed to try to “top-off” the tank the tank will overflow. When overfilled the tank has a very small expansion space to accommodate vapor from normal liquid boil-off. This small space and liquid boil-off will create high tank pressures. Operating the truck will lower tank pressures to normal operating pressures.

**Hot filling** - Filling a hot tank (a hot tank is any tank that is being filled for the first time or has been empty of liquid for more than a few days) with extremely cold (-200°F) liquid will cause the liquid to boil rapidly. This rapid boiling will cause pressure to build rapidly. Following [VT-0013](#) will properly guide you through a hot fill procedure.

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**Faulty Economizer** – An economizer that remains closed when tank pressures fall below its set-point or has a clogged filter(s) will not allow the vapor in the tank to be consumed first as designed. This will result in tank pressures remaining high at all times even after long driving periods and most of the tanks liquid has been consumed. Refer to VT-0011 for economizer replacement.

**Faulty 2psi Knuckle Check Valve** – A 2psi knuckle check valve that is stuck open will not allow the vapor in the tank to be consumed first as designed. This will result in tank pressures remaining high at all times even after most of the tank’s liquid has been consumed. To replace the knuckle check valve the tank will need to be de-fueled per VT-0017. The knuckle check valve can be removed using P/N: 11188766 after removing the economizer J-tube and the elbow at the top end of the J-tube. When re-installing the check valve apply a single small drop of blue Loctite to the threads and tighten to just snug.

**Faulty Primary &/or Secondary Valve** – Not relieving tank pressure as it builds above the relief valve setting will result in high tank pressure.

**NOTE: A faulty relief valve can be a dangerous situation and should be repaired immediately. Severe damage and personal harm can occur if a faulty relief valve is not repaired in a timely manner.**

1. If tank pressures rise above the relief set-point the valve should relieve enough pressure to lower tank pressures to or below the set-point and then reset to close.
2. If tank pressures are above a relief valve set-point and the relief valve is not releasing pressure, the valve needs replaced.
3. Tank pressures can be raised to test valve set-points by attaching a high-pressure nitrogen gas bottle to the tank liquid port and raising the pressure to the valve set-point to test for release. To prevent having to use a large volume of nitrogen it is advised to perform this test with a ½ to ¾ tank of liquid. Refer to VT-0035
4. A general guideline is to replace both relief valves if one is bad. They are both about the same age and a faulty valve may expose the other to undue pressures.

**NOTE: Over pressurization is a dangerous situation, and any tank with pressure that has been in excess of the Secondary Relief Valve should be removed from service immediately. Contact Technical Service for assistance after removing tank from service.**

**Soft Vacuum** – Soft vacuum issues will allow heat to enter the tank at a higher than designed rate. This heat will cause the liquid to boil more rapidly causing the pressure to rise. Soft vacuum issues can cause leaking relief valve problems. High tank pressure does **not necessarily** equal soft vacuum. Proper diagnosis is important as an incorrect diagnosis could involve costly unnecessary shipping, downtime, and repairs. Visual/Touch & Pressure testing are needed to properly diagnose vacuum issues.

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**Visual/Touch Testing** – Tanks with a vacuum issue will likely have visible sweating and/or frost on the exterior of the tank. Frost and/or sweating inside of a dented area may not mean an issue with the vacuum of the tank. Although, a dent with sweating and/or frost present may need to be accessed for needed repairs (contact Chart LNG technical services). Some small frost spots on the non-plumbing end of the tank are considered normal due to mounting brackets welded in between the internal and external tanks.

After visual inspection a touch inspection will be needed. After several hours of non-use, use the palm of a bare hand to first touch the outer shell of the tank, then touch the shroud with same hand. The temperatures should be very close. If the shell of the tank is noticeably colder, a vacuum issue may exist.

Verify any possible issues found with visual/touch testing by continuing to pressure testing.

**Pressure Testing** – By comparing a rise in tank pressure over a fixed period of time, the state of vacuum integrity can be determined:

1. Follow previously listed high pressure troubleshooting steps prior to performing vacuum pressure testing. By doing so, all other issues will have been eliminated from possible causes of high-pressure issues.
2. Tank will need to be between 1/2 & 3/4 full of liquid to ensure a proper vapor expansion area exists in the tank.
3. Tank pressure will need to be at operating pressure (economizer set-point)
4. Vehicle needs to remain motionless for at 15 minutes prior to testing to insure stability
5. Record tank pressure and the time
6. Allow tank to sit undisturbed for at least 8 hours
7. Compare pressure rise to the chart below:

Rate of Pressure Rise	Recommended Service Action
Rise in 8 Hours < 20 psi	Tank is normal
Rise in 8 Hours > 20 psi but < 50 psi	Monitor tank and schedule for vacuum maintenance at next PM inspection
Rise > 50 psi	Perform vacuum maintenance as soon as possible

If both a pressure rise above the specifications listed and a cold or sweating outer shell are noted, vacuum maintenance is necessary. If pressure rise alone is noted the problem could be elsewhere in the LNG plumbing system.

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### Heat Exchanger



**Heat Exchanger** – Leaks and insufficient vaporization are issues with heat exchangers.

**External leaks** – External leaks may be on the coolant lines or the LNG lines. Coolant leaks will show visible coolant around the leak. LNG leaks may be either liquid (visible) or vapor (non-visible) depending on the location of the leak. Non-visible external leaks can be found using a leak detector solution. External leaks can be repaired by cleaning and re-tightening fittings if the leak is a thread seal leak. If the external leak is through damaged or faulty welded fittings a replacement heat exchanger will be needed.

**Internal leaks** – Internal leaks may be on the LNG lines. LNG/vapor leaks will allow natural gas to enter the coolant system causing high coolant pressures and possible alarms. Replace heat exchanger.

### Fueling Issues



**Fueling** – Fueling issues discussed will be limited to issues with Chart LNG tanks, and an assumed proper functioning fuel station. For proper fueling procedures refer to [VT-0048](#).

**Will Not Fill** – If a Chart LNG tank will not take fuel check the following:

1. Verify fuel nozzle is fully engaged to the receptacle and in the forward locked position.

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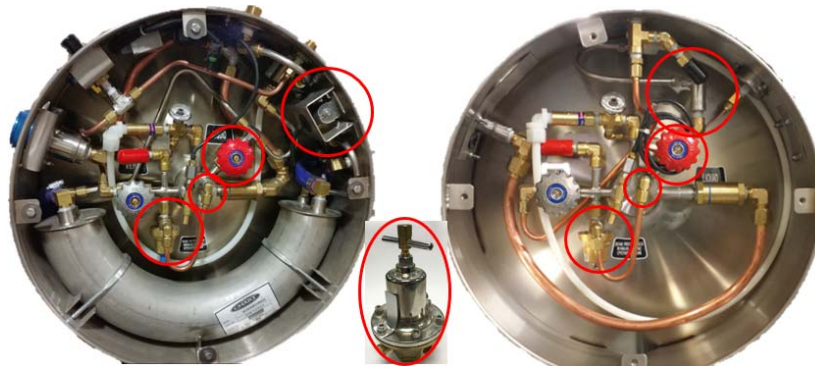
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2. Tank pressure should be below 150psi, if not, follow proper fueling procedures in [VT-0048](#).
3. Check fuel level indicated on dash gauge. Low tank pressure does not equal low fuel level.
4. Dual tank systems may fill one tank before the other will take fuel.
5. If 1 through 4 are correct, the fill check valve may be faulty and may need replaced. Follow De-Fueling [VT-0017](#) prior to repairs.

**Leaks** – Leaks may be found during filling of a Chart LNG tank.

1. Bubbling may occur for a few moments after filling as some residual LNG may sit on the valve surface but should dissipate quickly.
2. After fueling any spraying liquid or vapor in the fill receptacle indicates a leak.
3. If spraying liquid or vapor in the fill receptacle is present, or bubbling continues for an extended amount of time, the receptacle seal may have debris/ice under it or need replaced. Leaks in the receptacle seal should vent the fill tube to zero psi after a few minutes. Refer to [VT-0009](#) for seal replacement
4. If the leak continues without stopping, the fuel receptacle seal and fill check valve will need replaced. Refer to [VT-0017](#), & [VT-0009](#)
5. Leaks in the fill line connections may require de-fueling the tank prior to repairs. Follow De-Fueling [VT-0017](#) prior to repairs if needed.
6. If fuel receptacle replacement is needed refer to [VT-0018](#)

## Fuel Flow Issues



**Excess Flow** – In the event of a damaged fuel line after the heat exchanger, Chart uses an excess flow valve on standard tanks and a normally closed electric shut-off solenoid on integrated tanks to protect the heat exchanger from damage due to large flows of LNG.

1. If the excess flow valve was set due to damaged plumbing, after closing the excess flow valve for making plumbing repairs it will be reset.

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2. If the excess flow valve was set and there was no damage to the plumbing, it can be reset by closing the red handled liquid valve and waiting for several minutes for the line pressures to equalize on both sides of the excess flow valve. If in a quiet enough area there may be an audible “plink” sound from the excess flow valve resetting. Open red valve and test the operation of the truck.
3. The shut-off solenoid will be reset automatically when power is re-applied to the valve. Open red valve and test the operation of the truck.

**Low Flow** – Several components may cause low fuel flow issues.

1. Check fuel level and tank pressure to verify there is fuel and it is at adequate pressure levels to operate the truck.
2. Check to ensure red handled liquid valve is open fully (minus 1/8 turn off seat to prevent sticking).
3. Key is in the “ON” position
4. Check that the shut-off solenoid is operating properly: voltage issues, resistance issue, wiring issues, damage, clogs/debris, or ground issues
5. Reset the excess flow valve if necessary. See above section.
6. Check tank plumbing & truck fuel line plumbing for leaks or signs of damage or kinks.
7. Check for proper coolant flow through the heat exchanger and possible frosting on its outlet side. If frost is present, check for closed coolant valves on the truck or coolant lines for damage or kinks. Replace heat exchanger or coolant lines as needed.
8. Check outlet pressure of OPR. Outlet pressure should be at tank pressure, or at maximum the preset level of OPR/approximately 25psi over economizer set point. If adjustment is needed refer to [VT-0031](#) or replace as needed.
9. If all items listed above are normal, and tank pressures are below the economizer set-point, the 2psi knuckle check may be clogged or faulty. Refer to [Faulty 2psi Knuckle Check Valve](#) section from earlier in this document.

## Low Temp Issues



**Low Temperature Alarm** – Cold fuel making it past the heat exchanger can cause damage to multiple components. An active “Low Fuel Temp” alarm indicates cold fuel has passed through the heat exchanger.

1. Check engine for proper coolant levels
2. Check for closed coolant valves on the truck

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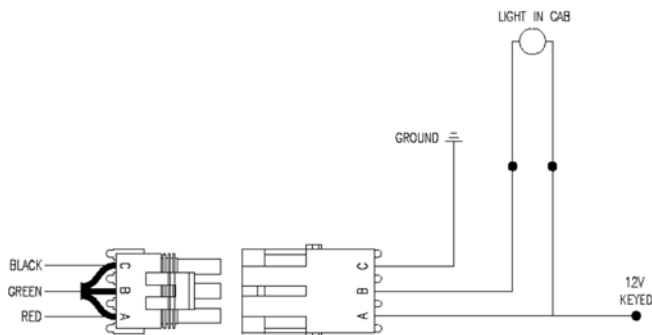
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3. Check coolant lines for damage or kinks, and flow - Coolant flow should be minimum 1GPM per 50Hp. Replace heat exchanger as needed
4. Verify functionality of sensor – refer to VT-0036
5. Verify proper wiring of sensor:



6. Replace sensor as needed.

## Damage



**Damaged Plumbing** – Plumbing that has been damaged may be able to be repaired in the field according to the components damaged. To determine if damage can be repaired in the field, contact Chart LNG Technical Services (contact info on last page) with pictures of damage.

**Dents** – Dents on a Chart LNG fuel tank may or may not affect the performance of the tanks depending to their size. To determine if a dent will affect performance, refer to VT-0006 or contact Chart LNG Technical Services (contact info on last page) with pictures of damage.

**Fire** – Tanks exposed to fire damage must be removed from service due to unseen possible damage to welds & inner tank.

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## General Component Part Numbers

General components on the most common tanks are listed below. For assistance in locating other part numbers/variances of them or questions please contact Technical Service, refer to the contacts on the last page of this document.

10557574 QDV RECEPTACLE WITHOUT FLATS



13843015 QDV RECEPTACLE WITH FLATS



20813355 SHROUD GAUGE no LIQ FILL  
20592558S SHROUD GAUGE KIT no LIQ FILL; INCLUDES HARDWARE



21217567 SHROUD GAUGE with LIQ Fill  
21217566S SHROUD GAUGE KIT with LIQ FILL; INCLUDES HARDWARE

Assembly:13841298 RECEPTACLE S/A FUELING LNG



**Receptacle Parts:**

- 11787970 RECEPTACLE FUELING LNG
- 14636405 BSHMS SS 1/4-20 1"LG 18-8
- 2914071 LOCKNUT SS 1/4-20 W/NYL INSERT
- 14777460 DUST CAP LNG FUEL RECEPTACLE
- 20954085 RECEPTACLE CAP REPAIR KIT:

Includes one spring & O-rings

11732240 LOW TEMP SWITCH



11208974 230PSI



10624239 GAUGE



11209011 350PSI



20809620 RED CAP - SILICONE



11673251 CASH VENT VALVE KIT



9715759 REGO VENT VALVE KIT



SENDING UNIT - Contact Technical Services (see last page)



20977526 CORD PATCH 15"W/BOOT 2.0-R110  
20598805 CORD PATCH 10" BNC TO 37D



21267955 15in Feed Through Kit  
Includes Flaretite seals, heat shrink, red feed through cap, and 15in cable with BNC connector R110



11548178 CHECK VALVE



SOLENOID, TANK & RAIL MOUNTED - Contact Technical Services (see last page)



13500901 REGO VALVE REPAIR KIT



11673278 CASH VALVE REPAIR KIT



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1013356 ELBOW NYL  
90D WHITE 1/2ODX3/8



Flaretite Seals are used at all  
flared connections

11751571 3/4ODT  
FLARETITE SEAL



20619633 1/2ODT  
FLARETITE SEAL



11751555 3/8 ODT  
Flaretite Seal

10576775 Solder Joint  
Heat Shrink 3/16" OD



11502575 4 in. BNC  
Connection Heat Shrink



10614480 EXCESS  
FLOW CHECK VALVE



21017010 27" CORD  
PATCH 2.0-R110



21267956

27in Feed Through Kit  
Includes Flaretite seals,  
heat shrinks, red feed  
through cap, and 27in cable  
with BNC connector R110



21334967 HLNG TUBE  
PIPEAWAY KIT

21335176 2PSI  
KNUCKLE CHECK  
VALVE



ECONOMIZER - Contact  
Technical Services (see  
last page)



20615331 450HP  
INTEGRATED HEAT  
EXCHANGER



20698805 HOSE  
COOLANT 90DEG ELBOW



21147927 12MM WIDE  
HOSE CLAMP




20845025 FILL CHECK  
VALVE



10668725 450HP HEAT  
EXCHANGER - RAIL MOUNT

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## **For Technical Assistance & Part Numbers Contact:**

**Bruce Keneagy – Technical Service Manager**

Office: 770-721-7635

[bruce.Keneagy@chartindustries.com](mailto:bruce.Keneagy@chartindustries.com)

**Clifford Herr – Field Service Technician**

Office: 770-721-7649

Cell: 678-935-8899

[cliff.herr@chartindustries.com](mailto:cliff.herr@chartindustries.com)

**Ed Kern – Business Development Manager**

Office: 770-721-7605

Cell: 404-229-3973

[ed.kern@chartindustries.com](mailto:ed.kern@chartindustries.com)

## **For Parts Ordering & Pricing:**

**Eddie Polk – LNG Customer Service Representative**

Office: 770-721-7677

[eddie.polk@chartindustries.com](mailto:eddie.polk@chartindustries.com)

Parts Can Also Be Ordered Through:

**ChartParts.com**

Follow the LNG link on the left side of the page

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