

Water Injection Kit

by: Responder Training Enterprises, LLC



Version 1.3

Provisional Patent Application No.: 62/538,141

Assembly

&

Operating
Guide



RESPONDERTRAINING.COM

Responder Training Enterprises

11/24/2018

Thank you for purchasing our Water Injection Kit. My intention in creating and producing this product was to provide response organizations with a quality tool that would exceed anything else currently on the market and last the owner for years to come.



As a career and volunteer firefighter, I know how important it is to respond with the tools you need to get the job done quickly and safely. When an incident occurs and you're faced with an uncontrollable liquid propane leak you have very few options. In some situations, it may be possible to inject water into the container and replace the leaking propane with water. To accomplish this task, you'll need the proper tools and the training for a successful outcome. Our Water Injection Kit is designed to provide you with those tools. With the addition of our basic connector kit you'll be able to connect to small containers all the way up to MC331's and bulk storage facilities.

If I can be of any help, you have any questions, concerns or comments please contact me.

Be safe brothers and sisters

Ronald D. Huffman
Owner, Responder Training Enterprises, LLC
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READ AND FOLLOW ALL SAFETY INFORMATION

IF YOU ARE UNSURE STOP!

REREAD THE INSTRUCTIONS OR

CONTACT THE MANUFACTURER OR YOUR SALES

REPRESENTATIVE FOR ASSISTANCE

Specifications

Name: Water Injection Kit
SKU: EWIK-1

Water Injection Valve Assembly

Inlet: 1 1/2" F-NH
Outlet: 1 3/4" F-ACME

Vapor Valve Assembly

Inlet: 1 3/4" F-ACME
Outlet: 1 1/2" F-NH

Products: Water and LPG

Use with any other material voids all warranties expressed or implied.

Highlighted text: Indicates special attention should be applied to the information provided

IMPORTANT: Prior to operating the Water Injection Kit and any of its accessories you must fully read, understand and follow the information in this document. IF YOU ARE UNSURE OF HOW TO CONDUCT ANY FUNCTION OR OPERATION "STOP", CONSULT THIS DOCUMENT OR CONTACT RESPONDER TRAINING ENTERPRISES, LLC OR YOUR DEALER FOR CLARIFICATION.

WATER INJECTION OPERATIONS ARE INHERENTLY DANGEROUS. Failure to follow the appropriate safety measures could result in serious injury or death. In addition to this product literature all appropriate local, State and Federal codes, regulations and guidelines must be identified and followed at all times.

Only personnel that have received proper training and understand the proper use of this product(s) and associated equipment should operate the R.T.E., LLC. **WATER INJECTION KIT** and/or any of its accessories during training or incident response.

WEAR APPROVED/APPROPRIATE PPE INCLUDING: GLOVES, BODY, HAND, EYE and RESPIRATORY PROTECTION DURING SET-UP AND OPERATIONS

A copy of this document should be kept with the kit at all times

Warranty, liability and additional special information can be found at the end of this document

Water Injection

Water injection is the process of forcing water into a tank or cylinder using a water supply capable of producing more pressure than the propane tank's static pressure. Propane exists in a pressure vessel in one of two states, liquid and/or gas. Liquid propane weighs 4.24 pounds per gallon and will remain in the lowest area of the tank regardless of the tanks orientation. This area is commonly known as the wetted space while the vapor space or tank surface area above the liquid is known as the dry or non-wetted space. If a leak occurs in the vapor space, vapor is released and conversely if a leak occurs in the wetted space, liquid propane is released.

Water weighs 8.34 pounds per gallon (approximately 2 times the weight of propane) and when injected into a propane tank the water will sink below the liquid propane lifting and replacing it at the bottom of the tank. Once the water rises above the leak opening, the propane leak will be converted to a water leak removing the expanding hazard. As long as water is injected equal to the volume of the leak, the tank will continually leak water and not propane. Sounds simple, right? It is. Injecting water into a propane tank can provide response agencies with a capability that while useful can be dangerous if done incorrectly.

A tank that's compromised (leaking through the shell) requires special tactics to reduce the potential of failure. The addition of water will increase the internal pressure and potentially causing a catastrophic failure. Prior to injecting water, auto-refrigeration can be used to reduce the internal volume and pressure. Once water injection operations start the internal pressure must be kept below the initial internal pressure reading.

SPECIAL NOTE: This document is not intended to teach when to use water injection but only how to maintain, apply and function the kit as originally delivered. The operation of this kit must be done by persons trained by qualified instructors and have attended regularly scheduled training.

Water Injection Kit Components

1. 3 ¼" to 1 ¾" ACME adapter
 - a. Normally used to connect the liquid IN or spray fill to #2
2. Strain Relief Hose Assembly (angle connection adapter)
3. Water Injection Valve Assembly
4. Vapor Valve Assembly – Connect to flare
 - a. 1 3/4" Female ACME to 1 1/2" NH Female adapter (fire hose)
5. ACME to NH (fire thread) adapter (1 1/2" Male NH to 1 3/4" Male ACME adapter)



6. 2 1/4" to 1 3/4" ACME adapter

❖ Gasket Set

- 1 – 1 3/4" ACME
- 1 – 2 1/4" ACME
- 1 – 3 1/4" ACME

Kit Maintenance

As with all response equipment, this kit and its components must be inspected and maintained on a regular basis to insure proper performance. Prior to each use all components should be inspected and any defective items repaired or replaced. Minimum inspection items include but are not limited to:

- a. Valve handle and attachments
- b. All gaskets
- c. Inspect all welds
- d. All moving components
- e. Hose
- f. Gauges

Any identified deficiencies must be repaired as soon as possible and prior to use.

Storage

The kit must be dried and should be stored **flat**. If stored on edge the components will compress the foam dividers.

Back Check Valve Function Test

Before using this kit, you must verify that the back-check valve is functioning correctly to ensure that propane cannot flow to the water supply apparatus.

A test of the check valve should be conducted regularly to ensure that propane pressure cannot push back to the pumping apparatus. Either of the two options below are acceptable and recommended ways to test the back checks performance/operation.

Option #1

1. Connect the **Water Injection Valve Assembly (#3)** with the valve open on the propane vapor out connection.
2. Slowly open the propane supply valve and observe and listen for indications of pressure bypassing the check valve seat (site and sound).
3. If no leakage is discovered the check valve is functioning properly. If propane pressure is present do not utilize the kit.

Option #2

1. Connect **Adapter (#5)** to the Water Injection **Vapor Valve Assembly (#3)** and open the valve.
2. Using an appropriate connector/adaptor attach the assembly to a water supply.
3. Pump water to the assembly at least 150 psi and observe for leakage
4. If no leakage is observed the check valve is functioning properly and may be used as designed. If propane pressure/water is present do not utilize the kit.

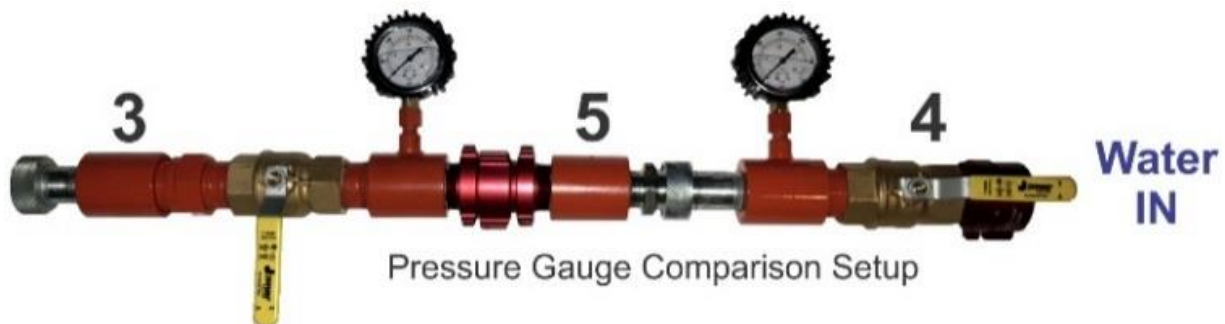


Pressure Gauge Comparison

NOTICE: Regularly you must verify the reading on both gauges to ensure that the needed pressure differential is met to allow water injection.

The pressure readings on both gauges must be compared to ensure that the static pressure inside the tank is exceeded by the pumped pressure. Gauge comparison can be accomplished by connecting the assembly to your pressure supply as pictured below or connected to a supply line.

1. Connect the ACME to NH Adapter (#5) to the Water Injection Valve Assembly (#3)
2. Connect Vapor Valve Assembly (#4) to ACME to- NH Adapter (#5)
3. Connect the water supply (from fire apparatus) to Vapor Valve Assembly (#4)
4. Close the valve on # 3 and open the valve on #4.
5. Pump water to the unit with at least 150 psi.
6. Identify and document any gauge differences
7. Shut down the water supply and disassemble #3, 4 & 5



Bulk Tanks

Bulk storage tanks typically contain multiple connections for liquid and vapor. Some utilize one line for the liquid in and liquid out while others have separate liquid lines for both. The following information provides information on how to connect to and read the tanks pressure, connect a flare to reduce the internal pressure and connect to inject water.

Kit Application

1. Attach the appropriate **Adapter #1** to the liquid in connection (commonly labeled as Liquid or Spray Fill)
2. Connect the **Strain Relief Hose (#2)** to the tank/adapter
3. Attach the **Water Injection Valve Assembly (#3)** to the **Strain Relief Hose (#2)**
4. Attach a water supply to the **Water Injection Valve Assembly (#3)**



5. Attach the appropriate adapter to the tanks vapor out connector.
 - a. Attach the **Vapor Valve Assembly (#4)** to the tank "Vapor Out" connection (use the appropriate adapter)



6. Close the valve on the **Vapor Valve Assembly (#4)** and open the vapor valve on the tank.



7. Read the tank pressure using the Vapor Valve Assembly (#4) and compare it to the reading on the tanks pressure gauge.



Vapor Out Connection Options

If required set up a flare (a 1-inch flare is recommended on tanks larger than 500 gallons)

Connect the tanks vapor out connection to the flare using one of the options below.

Connection Option #1 – 1” Propane hose with 1 3/4” ACME ends

1. Connect the **Vapor Valve Assembly (#4)** to the “Vapor Out” of the propane tank (use the appropriate connector/adaptor)

Propane
Supply
Vapor Out



Vapor
OUT to
Flare

2. Connect **Adapter #5** (NH to ACME) to the vapor Valve Assembly
3. Connect to the flare using a 1-inch propane hose with 1 3/4” ACME connections

Connection Option #2 - Fire Hose Usage (Emergency Only)

1. Connect the **Vapor Valve Assembly (#4)** to the “Vapor Out” of the propane tank (use the appropriate connector/adaptor)
2. Connect a length of approved fire hose to the Vapor Valve Assembly (#4)
3. Connect the ACME - NH **Adapter (#5)** to a 1” Flare and the fire hose to it.



NOTE: Do not flow propane liquid through fire hose. This vapor option must only be conducted with hose that has been approved by the manufacture and tested prior to on scene operations.

No matter which option you use initiate flare operations as soon as possible to reduce the tanks internal pressure or liquid volume.

Flaring Vapor

Once a flare is connected to the supply, flaring operations may be initiated. Flaring vapor is essential to reducing internal pressure and reducing the hazard. The use of a large bore flare provides flow volumes necessary for larger systems.

- Set up a flare in a safe location and in accordance with the manufactures recommendations.
- Connect to the tanks vapor out connection and initiate flaring operations as soon as possible.
- Continue flaring operations throughout the response
- It is possible to blow the flame out due to extreme pressure. If this happens only open the valve to the point that the flame continues until the tank pressure has been reduced to the point that full valve opening is achievable.

Tank liquid Volume

Prior to adding water, you must verify the tanks liquid volume. If the tanks gauge is nonfunctional **EXTREME CAUTION** must be used. The addition of water should only be undertaken if the tanks volume will not exceed 90% or if the internal pressure is reduced to as safe level. If the tanks volume is 90% or more reduce the tanks volume and pressure using a 1-inch flare and manage the addition of water with **EXTREME CAUTION**.



During operations if liquid propane is discharged from the vapor line stop adding water to the tank and continue flaring operations until the tanks liquid level is below 90% unless done intentionally.

Adding Water to the Tank using pressure gauge readings

- Using the chart set your pump pressure at the minimum pressure indicated at current ambient pressure.
- Pump to the **Water Injection Valve Assembly (#3)**.
- With the propane tanks valve closed, open the valve on the **Water Injection Valve Assembly (#3)**.
- Slowly open the valve on the tank (normally the Spray Fill on bobtails and tankers). Monitor the liquid leak and tank volume.
- Add enough water to the system to compensate for the propane leak that is occurring.
- Continually manage the addition of water to match the volume of the leak.

Product Temperature	Approximate Pressure (psi)	Minimum Pump pressure
-10	16	50
0	23	50
10	31	50
20	40	70
30	51	70
40	63	100
50	77	100
60	95	150
70	109	150
80	128	150
90	149	170
100	172	200
110	197	220
120	225	250

Adding Water to the Tank using ambient temperature

To reduce the time it takes to initiate water injection, identify the ambient temperature (round up) and increase initial pump pressure to match the identified chart minimum pump pressure.

Once the kit is applied a quick look at the actual tank pressure should identify that the minimum 20 psi over has been met.

Injection can be initiated immediately.

Product Temp	Minimum Pump pressure
-10 F	50 psi
0 F	50 psi
10 F	50 psi
20 F	70 psi
30 F	70 psi
40 F	100 psi
50 F	100 psi
60 F	150 psi
70 F	150 psi
80 F	150 psi
90 F	170 psi
100 F	200 psi
110 F	220 psi
120 F	250 psi

Single Valve Tanks

Tanks with a single valve are limited to only one access point for pressure readings / flaring and water injection. The following kit information provides information on how to connect to and read the tanks pressure, connect a flare to reduce the internal pressure and then connect to inject water.



Kit Application

1. Attach the appropriate adapter for the valve.

To read tank pressure or flare only

2. Connect the **Vapor Valve Assembly (#4)** to the adapter
 - a. Close the valve on the Assembly (#4) open the tank valve and record the internal pressure on the gauge. Connect a flare and start reducing the pressure and tanks volume if appropriate.



NOTE: Compromised cylinders/tanks MUST have their internal pressure reduced prior to water injection.

To inject water

3. Remove the **Vapor Valve Assembly (#4)** and connect the **Stress Reliver Hose (#2)** to the attached tank adapter.

NOTE: Do not skip this step. The water Injection Kits static weight should be not be supported by the tank adapter only.

4. Connect the **Vapor Valve Assembly (#4)** to the **Stress Reliver Hose (#2)**.
 - a. Close the valve on the Assembly (#4) open the tank valve and record the internal pressure. Connect a flare and start reducing the pressure and tanks volume.
5. Once the tanks pressure and or volume is at the appropriate reading attach the kits **Adapter (#5)** to the **Vapor Valve Assembly (#4)**
6. Attach the **Water Injection Valve Assembly (#3)** to the **Adapter (#5)**. Attach a water supply to the adapter.



Optional Gauge Assembly

The optional gauge and hose assembly provides a lighter flexible connection that includes a gauge, hydrostat relief, valve and hose section.

- a. **Optional Gauge Assembly** - Attach a gauge assembly to the tank adapter and then connect the **Water Injection Valve Assembly (#3)**
- b. Attach the water supply or flare to the **Water Injection Valve Assembly (#3)**

Monitor Tank Volume and Pressure

The Water Injection Kit utilizes a check valve to restrict propane from being able to flow back to the water supply. While this does add a restriction in the system we believe that it is a necessary safety precaution. Our kit has a custom machined coupling unlike any others that increases it's flow capabilities beyond a standard coupling.

Table #1 aids in identifying the remaining volume based on the tanks volume gauge reading.

1. Identify the tank size (Black)
2. identify the tank gauge reading (left side White)
3. Identify the amount in gallons between 80 and 100% (RED)

As you can see, with a piece of fire apparatus capable of producing hundreds to thousands of gallons per minute it would be very easy to overfill a tank.

It's imperative that on scene personnel continuously monitor the tanks volume and pressure to ensure that the volume does not exceed a safe volume.

Tank Size by Gallon		Tank Size							
		120	250	325	500	1000	2000	10000	18000
Gallons to 100% from 80%		24	50	65	100	200	400	2000	3600
Gauge Reading	80%	96	200	260	400	800	1600	8000	14400
	70%	84	175	227	350	700	1400	7000	12600
	60%	72	150	195	300	600	1200	6000	6000
	50%	60	125	162	250	500	1000	5000	9000
	40%	48	100	130	200	400	800	4000	7200
	30%	36	75	98	150	300	600	3000	5400
	20%	24	50	65	100	200	400	2000	3600
	10%	12	25	33	50	100	200	1000	1800
	5%	6	13	16	25	50	100	500	900

Table 1

Repeated SPECIAL NOTE: This document is not intended to teach when to use water injection but only how to maintain, apply and function the kit as originally delivered. The operation of this kit must be done by persons trained by qualified instructors and have attended regularly scheduled training.

Warranty: This warranty and use of the product(s) applies to the original purchaser. The manufacturer guarantees all components against failures in materials and/or workmanship for a period of **1 year** from the date of purchase. If any part of the purchased system fails due to materials and/or workmanship the purchaser must contact Responder Training Enterprises LLC (RTE) for repairs, replacement or refund of the original purchase price of the defective component at the discretion of RTE. RTE may require that the defective component be returned for inspection and repairs. The purchaser must contact Responder Training Enterprises to obtain a Return Goods Authorization number (RGA) prior to returning any component of the system. If the damaged item is deemed to be the result of improper use or neglect, RTE reserves the right to charge for service and/or repairs including shipping to and from RTE.

Do not ship items to anyone other than Responder Training Enterprises, LLC.

This warranty does not cover consequential damages resulting from the use of the product, including damage caused by flames or heat created during operations, loss of service availability and/or time involved due to warranty issues.

Manufacturer Liability Limitation: Failure to use this product in any manner or purpose other than intended by the manufacturer and/or for products other than identified or described and/or servicing the equipment by anyone other than Responder Trainings Enterprises LLC's employees or persons trained by Responder Trainings Enterprises LLC to conduct service on the equipment and/or applying or installing unapproved alterations to any part of the system voids the warranty and releases the manufacturer from all liabilities including damages to equipment, property, injuries and/or death caused by the use of the product and any of its accessories.

NOTE: Retailers are not responsible for this product in anyway other than supplying the products as promised. Retailers, persons, agencies, companies and/or corporations providing advertising may not be held liable for manufacturer defects in materials and/or workmanship, improper training unless the training was provided by the aforementioned and/or use of the equipment by the end user for statements and/or advertising made available by Responder Training Enterprises LLC in any way.

If for any reason the equipment fails to function as intended please contact Responder Training Enterprises LLC immediately so that we can help you.

Thank you for purchasing this quality product.

Ronald D. Huffman

Owner, Responder Training Enterprises

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Optional Accessories

Basic connection kit

- 1 - 3 1/4" Female X 1 3/4" Male ACME
 - 1 - 2 1/4" Female X 1 3/4" M ACME
 - 1 - 1 1/4" ACME Tank Connection)
 - 1 - Full Flow P.O.L.
 - 1 - 1-5/16" QCC/OPD Regulator Connector
 - 1 - Reserve Cylinder Adapter, Disposable Cyl.
 - 1 - Fork Truck Safety Connector
 - 1 - Gasket Set
- SKU# BCK-001



10-foot x 1/2 inch valve assembly

- 1 - 1/2" Stainless Steel 1000psi Ball Valve
 - 1 - 1/4" Hydrostatic Relief Valve
 - 1 - 400 psi Gauge
 - 1 - Gauge protector
 - 1 - 10 Foot Propane Hose
- SKU# GA-1.5-wHose



25-foot 1-inch supply line with valve

50-foot 1-inch supply line with valve

SKU# 25ft_WV

SKU# 50ft_WV



25-foot 1-inch supply line with 1 3/4" ACME connections

50-foot 1-inch supply line with 1 3/4" ACME connections

SKU# 25-1LPCA

SKU# 50-1LPCA



1-inch Responder Flare aka "the Dragon Slayer"

SKU# FLARE-SSRF1



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