OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION
WASHINGTON, D.C. 20460

September 17, 2025

E. David Lewis
Lewis & Harrison, L.L.C.
Agent for Baker Petrolite, LLC
Electronic Transmittal: dlewis@lewisharrison.com

Subject: Label Amendment – Updated Precautionary Statements and Registration Review Mitigation
Product Name: Magnacide B Microbiocide
EPA Registration Number: 10707-10
Received Date: 5/20/2020
Action Case Number: 00219033

Dear E. David Lewis:

The amended label referred to above, submitted in connection with registration under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended, is acceptable. This approval does not affect any conditions that were previously imposed on this registration. You continue to be subject to existing conditions on your registration and any deadlines connected with them.

A stamped copy of your labeling is enclosed for your records. This labeling supersedes all previously accepted labeling. The next label printing of this product must use this labeling unless subsequent changes have been approved. Pursuant to 40 CFR 156.10(a)(6) you must submit one copy of the final printed labeling before you release the product for shipment with the new labeling. In accordance with 40 CFR 152.130(c), you may distribute or sell this product under the previously approved labeling for 18 months from the date of this letter. After 18 months, you may only distribute or sell this product if it bears this new revised labeling or subsequently approved labeling. “To distribute or sell” is defined under FIFRA section 2(gg) and its implementing regulation at 40 CFR 152.3.

Should you wish to add/retain a reference to the company’s website on your label, then please be aware that the website becomes labeling under FIFRA and is subject to review by the Agency. See FIFRA section 2(p)(2). If the website is false or misleading, the product would be misbranded and unlawful to sell or distribute under FIFRA section 12(a)(1)(E). 40 CFR 156.10(a)(5) lists examples of statements EPA may consider false or misleading. In addition,

regardless of whether a website is referenced on your product's label, claims made on the website may not substantially differ from those claims approved through the registration process, FIFRA section 12(a)(1)(B). Therefore, should the Agency find or if it is brought to our attention that a website contains false or misleading statements or claims substantially differing from the EPA approved registration, the website will be referred to the EPA's Office of Enforcement and Assurance.

Your release for shipment of the product constitutes acceptance of these conditions. If these conditions are not complied with, the registration will be subject to cancellation in accordance with FIFRA section 6. If you have any questions, please contact Demson Fuller via email at fuller.demson@epa.gov.

Eric Miederhoff
Chief, Reevaluation Branch
Antimicrobials Division
EPA Office of Pesticide Programs

Enclosure

RESTRICTED USE PESTICDE
DUE TO A HIGH ACUTE TOXICITY
For retail sale to and use by Certified Applicators and only for those uses covered by the Certified Applicator's certification.

THIS PRODUCT MUST BE ACCOMPANIED BY AN EPA-APPROVED PRODUCT LABEL AND THE EPA-APPROVED *'MAGNACIDE™ B MICROBIOCIDE – Acrolein Products Description and Use Manual.'* THE *MAGNACIDE™ B MICROBIOCIDE – Acrolein Products Description and Use Manual* IS LABELING. READ AND UNDERSTAND THE ENTIRE LABELING AND MANUAL PRIOR TO USE. ALL PARTS OF THE LABELING AND MANUAL ARE EQUALLY IMPORTANT FOR SAFE AND EFFECTIVE USE OF THIS PRODUCT.

ACCEPTED
09/17/2025
Under the Federal Insecticide, Fungicide and Rodenticide Act as amended, for the pesticide registered under EPA Reg. No. 10707-10

MAGNACIDE™ B MICROBIOCIDE

(Acrolein, Stabilized)

CONTENTS UNDER PRESSURE

For Use in Oilfield Water Injection Recovery Systems

ACTIVE INGREDIENT:	
Acrolein	95.0%
OTHER INGREDIENTS:	5.0%
TOTAL:	100.0%

This product contains the toxic inert ingredient hydroquinone.
(MAGNACIDE™ B Microbiocide contains 6.7 pounds of active ingredients per gallon)

KEEP OUT OF REACH OF CHILDREN

DANGER/PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail)

FIRST AID
Have the product container or label with you when calling a poison control center, doctor, or going for treatment. You may also contact 800-231-3606 for emergency medical treatment information.

IF INHALED	▪ Move person to fresh air. ▪ If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth to mouth, if possible ▪ Call a poison control center or doctor for further treatment advice.
IF ON SKIN OR CLOTHING	▪ Take off contaminated clothing. ▪ Rinse skin immediately with plenty of water for 15-20 minutes. ▪ Call a poison control center or doctor for treatment advice
IF IN EYES	▪ Hold eyes open and rinse slowly and gently with water for 15-20 minutes. ▪ Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. ▪ Call a poison control center or doctor for treatment advice
IF SWALLOWED	▪ Call a poison control center or doctor immediately for treatment advice. ▪ Have person sip a glass of water if able to swallow. ▪ Do not induce vomiting unless told to do so by the poison control center or doctor. ▪ Do not give anything by mouth to an unconscious person.

NOTE TO PHYSICIAN

Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.
WARNING SIGNS AND SYMPTOMS: Liquid MAGNACIDE™ B Microbiocide is absorbed by the skin and is particularly irritating to any lesion and to the eyes. The vapors act principally on the mucous membrane of the eyes and respiratory tract. Because of the extreme lachrymatory warning effect, the concentration tolerable by man is far below the minimum lethal concentration.
TREATMENT: Treat exposed area as a chemical burn. Thoroughly flush eyes with water and treat symptomatically. Persons exposed to MAGNACIDE™ B Microbiocide vapors may have a delayed reaction and experience irritation of the respiratory tract. In severe cases, this may progress to pulmonary edema. Therefore, it is advisable to keep persons exposed to MAGNACIDE™ B Microbiocide under observation for 24 hours following exposure.

DANGER  POISON

EPA Registration Number: 10707-10
EPA Establishment Number: xxxxxx-xxx-xxx

BAKER PETROLITE LLC
12645 W. AIRPORT BLVD.
SUGAR LAND, TX 77478

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER

Extremely flammable and irritating vapor and liquid. Fatal if swallowed, inhaled, or absorbed through skin. Do not breathe vapors or spray mist. Corrosive. Causes irreversible eye damage and skin burns. Do not get in eyes, on skin, or on clothing. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet.

When setting up and breaking down application equipment, a full-face air purifying respirator with organic vapor (OV) cartridges approved by the National Institute of Occupational Safety and Health (NIOSH) and butyl rubber gloves must be worn. For visual inspection during treatment, chemical splash goggles must be worn. If spilled on clothing, gloves, or shoes, remove them immediately and wash thoroughly with soap and water before reuse. Use with adequate ventilation.

USER SAFETY REQUIREMENTS

Users must wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
Users must remove PPE immediately after handling this product. Wash the outside of the gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.
If MAGNACIDE™ B Microbiocide is spilled or leaked on clothing, gloves, or shoes, immediately remove them and wash thoroughly with soap and water.
Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.
Discard clothing, gloves, shoes, and other absorbent materials that have come into contact with MAGNACIDE™ B Microbiocide. Do not reuse them.

PPE REQUIREMENTS

All certified applicators participating in the application during setting up and breaking down of application equipment and during visual inspection must wear:

- Coveralls or long-sleeved shirt and long pants,
- Chemical resistant footwear or shoes and socks,
- Chemical-resistant gloves made of butyl rubber, and
- A NIOSH-approved respirator with an organic vapor (OV) cartridge with a combination N, R, or P filter with NIOSH approval number prefix 84A; or NIOSH approved gas mask with an organic vapor canister with NIOSH approval number prefix TC – 14G; or a NIOSH approved powered air purifying respirator with organic vapor (OV) cartridge and combination HE filter with NIOSH approval number prefix TC 23C.

Respirator fit testing, training and medical qualification:

See OSHA's Respiratory Protection Standard for federal requirements on how to safely fit-test, train, and medically examine workers who will be using respirators.

ENGINEERING CONTROLS

Handlers must use a closed system that is designed by the manufacturer to prevent dermal and inhalation exposures. At any disconnect point, the system must be equipped with a dry disconnect or dry couple shut-off device that will limit drippage to no more than 2 ml per disconnect. The closed system must function properly and be used and maintained in accordance with the manufacturer's written operating instructions. Handlers must wear the personal protective equipment required on this labeling.

PHYSICAL AND CHEMICAL HAZARDS

DANGER: Acrolein, the active ingredient in MAGNACIDE™ B Microbiocide, is highly reactive chemically and readily forms polymers. If alkalies (such as ammonia and caustic) or strong acids are brought in contact with MAGNACIDE™ B Microbiocide in a closed system, the biocide can polymerize with sufficient violence to rupture the container. Do not apply with equipment used for acids and alkalies. Contamination of MAGNACIDE™ B Microbiocide with any foreign matter must be avoided. Clean application equipment with large amounts of water after using. Extremely flammable. Do not use or store near fire, sparks, and heated surfaces.

A supply of sodium carbonate (soda ash) and water must be readily available for neutralizing spilled MAGNACIDE™ B Microbiocide. All spills must be confined and neutralized before disposal. Running water must be readily available to wash down the area after neutralization.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

MAGNACIDE™ B Microbiocide is a water-soluble material for the control of bacteria and fungi in oilfield water injection systems. This material must only be applied in accordance with directions in the MAGNACIDE™ B Microbiocide Description and Use Manual under the supervision of trained personnel or licensed applicators.

MAGNACIDE™ B Microbiocide may only be used in the treatment of producing wells, produced water systems, disposal systems, produced water injection systems or in the treatment of water prior to oilfield use where the treated water is either disposed of in deep injection wells or re-used in oilfield operations. Holding ponds must be lined by an impermeable barrier. All production water treated with acrolein must be disposed of in deep injection wells or re-used in oilfield operations including water injection systems. Maximum application rates:

Application	Maximum application rate
Open Fracking pond	50 ppm*
Covered Fracking pond**	500 ppm
Downhole treatment on well	12,000 ppm
Batch treatment of closed production vessel or tank	1,000 ppm
Continuous injection of production vessel or tank	100 ppm

ppm= parts per million (equivalent to milligrams per liter; mg/L)
*One application of 100ppm allowed per calendar year per oil/gas lease
** Must be covered by an impermeable material that restricts offsite movement of volatilized substances.

For fracking specific operations prior to acrolein treatment of fracking pond

- Only essential personnel are allowed within 100 meters of fracking pond during acrolein treatment of the frac pond. Non-essential personnel may return to the area one hour after application of acrolein is complete. Essential personnel are those that are directly involved in or assisting with the application of acrolein.
- During application and for one-hour post treatment, all personnel within 100 meters of the fracking pond must remain upwind, and a respirator (see PPE requirements) must be worn or kept within reach in case of leak or change of the wind direction.
- Water from fracking pond may not be used until 48 hours after acrolein treatment is complete.

POSTING OF APPLICATION

- The Certified Applicator in charge of the application must post signage at all entrances to the application area. Signs must be posted 24 hours prior to the beginning of acrolein treatment, must remain legible during the entire posting period and must be removed once access to the application area is no longer restricted and no later than 3 days after treatment.
- Signage must contain the following information:
    - Skull and crossbones symbol
    - DANGER/PELIGRO
    - DO NOT ENTER/NO ENTRE
    - Acrolein treatment in progress
    - The date and start time of application
    - The estimated end time of application

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage and disposal.

PESTICIDE STORAGE

All containers of MAGNACIDE™ B Microbiocide must be stored in a secured, well-ventilated area, away from all other chemicals. No alkalis or oxidizing materials must be near. Any electrical equipment must be Class 1 – Division 2 and properly grounded.

PESTICIDE DISPOSAL

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use of according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER HANDLING

Refillable container. Refill this container with MAGNACIDE™ B Microbiocide only. Do not reuse this container for any other purpose. Return empty containers to Taft Manufacturing Company. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. For cleaning and residue removal of cylinders, follow the Standard Operating Procedure: TMC-140. For cleaning and residue removal of skids, follow the Standard Operating Procedure: TMC-141.

ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish and wildlife. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge this product to sewer systems without previously notifying the local sewage treatment authority. For guidance contact your State Water Board or Regional Office of the EPA. Do not contaminate water when disposing of equipment washwaters.

NOTICE OF WARRANTY

BAKER PETROLITE LLC MAKES NO WARRANTY OF MERCHANTABILITY FITNESS FOR ANY PURPOSE, OR OTHERWISE, EXPRESSED OR IMPLIED concerning this product or its uses which extend beyond the use of the product under normal conditions in accord with the statements made on this label

NET WEIGHT: _____ lbs.
☐Cylinder – 370 lbs. ☐ Skid Tank – 2240 lbs. ☐ Skid Tank – 2450 lbs.

REV. 08/2025 {Note to reviewer: if any non-notifiable modifications to the label, a (month/year) revision will also be shown}

Non-FIFRA related statements and graphics:
UN#, Acrolein's Proper Shipping Name, DOT diamond type labels
Company logo, additional emergency and product information telephone numbers
QR code for SDS, Bar-code.

ACCEPTED
09/17/2025
Under the Federal Insecticide, Fungicide and Rodenticide Act as amended, for the pesticide registered under EPA Reg. No. 10707-10

MAGNACIDE™ B
Microbiocide

Acrolein Products

DESCRIPTION AND USE MANUAL

Issue Date: August 2025
Supersedes: June 2023

MAGNACIDE™ B Microbiocide is a RESTRICTED USE PESTICIDE.
For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certified applicator's certification.

MAGNACIDE™ B Microbiocide: EPA Registration Number: 10707-10
EPA Establishment Number: xxxxxx-xxx-xxx

MAGNACIDE is a trademark of Baker Hughes.

MANUFACTURED BY:
BAKER PETROLITE LLC
12645 WEST AIRPORT BOULEVARD
SUGAR LAND, TX 77478

Read Product Safety Data Sheet prior to use. **PRODUCT WARRANTY, DISCLAIMER AND LIMITATION OF LIABILITY ARE FOUND on the Product Safety Data Sheet. Unless inconsistent with applicable law, use of Product signifies agreement with these provisions.**

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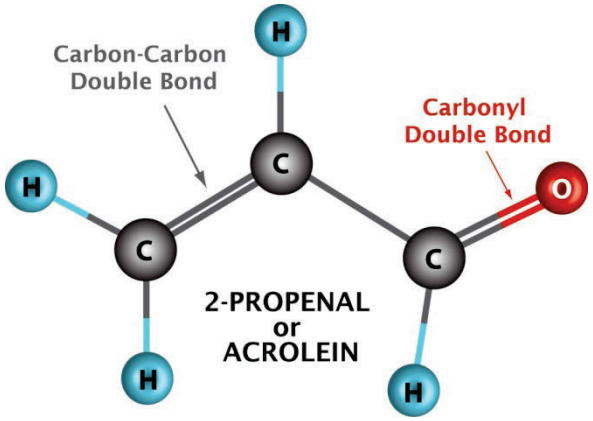
INTRODUCTION TO BAKER PETROLITE LLC ACROLEIN PRODUCTS

Overview of Acrolein Products

Acrolein is the common name for 2-propenal, a simple three carbon unsaturated aldehyde (see chemical molecule below). It is a water-soluble liquid that has physical properties similar to acetone. Acrolein is a chemical, that quite literally, has been part of our existence for thousands of years. When hydrocarbons are burned, small quantities of acrolein are formed. It was first isolated, named, and prepared by German chemists around 1830. Since the 1940's, acrolein has been commercially available and is currently produced by numerous chemical plants worldwide. All of these plants, with one exception, produce acrolein as an intermediate in the manufacture of other finished products. These finished products include methionine, acrylic acid, and glutaraldehyde.

Baker Petrolite LLC has control of all phases of the packaging, distribution, and application of the product. Baker Petrolite LLC has been supplying acrolein products to customers for over 55 years. These products are used to control bacteria, reduce corrosion, remove iron sulfide deposits and improve water injectivity.

The factor that separates acrolein from other biocides and sulfide scavengers is its high degree of chemical reactivity. This reactivity results from the presence of a ß-conjugated carbon-carbon double bond, i.e., two double bonds separated by one single bond. For applications as a biocide the reactive site is the carbon-carbon double bond and not the carbonyl double bond. How this difference in reactivity separates acrolein from other oilfield products is detailed in the sections on the product applications.



Acrolein has several other important physical properties that make it ideally suited for applications as a biocide and sulfide scavenger.

- In addition to being water soluble, acrolein is also oil soluble and allowing for penetration of oil wet biofilms and iron sulfide solids. This is a characteristic not shared by other conventional oilfield biocides, chelating agents, acids and oxidizers.
- It is not corrosive to metal; it is a hydrocarbon like acetone, or isopropyl alcohol (IPA).
- While acrolein is very reactive, at use concentrations it is usually not impacted by most other common oilfield products.

- It reacts slowly with water to form a water-soluble product that has none of the hazards of acrolein. Eventually, acrolein breaks down to carbon dioxide and water.

Baker Petrolite LLC Stewardship Programs

Acrolein is an acutely hazardous chemical, so specialized application equipment and personnel training is required to minimize the risks related to the transport and handling of the chemical.

Baker Petrolite LLC believes that all products and processes bear inherent risks. This includes the exploration and production of oil and natural gas as well as chemical programs used to aid in these processes. It is the responsibility of those involved to assess those risks and develop programs to minimize such risks. This allows the user to enjoy the benefits of the product or process without experiencing detrimental impacts. Baker Petrolite LLC has spent over 50 years enhancing and improving our stewardship programs with our acrolein products precisely so we can provide maximum benefits at minimal risk. These stewardship programs include:

1. Acrolein oilfield products are handled and applied only by Baker Petrolite LLC personnel. These personnel are thoroughly trained in the safe and effective application of these products before working with them, and on a three-year cycle thereafter. The two-day classroom training includes testing to document their understanding of key concepts. Baker Petrolite LLC has also developed refresher training materials, and safety awareness training, on our acrolein products which are provided worldwide.

2. After initial classroom training, new Baker Petrolite LLC applicators receive additional training in the field via our documented acrolein competency program. The new applicator works under the supervision of a highly qualified applicator until both parties are assured of the understanding and practical skills of the new applicator. Following the mentoring program, the applicator is evaluated by a qualified Assessor.

3. The acrolein containers are engineered for their designed use, with multiple safety components. Containers are hydro-tested upon manufacture and on a regular, mandated time schedule thereafter, at pressures far exceeding those used in our application process. There is a documented mechanical integrity program in place for the acrolein containers. All valves and fittings are routinely replaced as part of the hydro-test cycle. Our packaging operation is ISO-14001 certified.

4. Application equipment and procedures are standardized throughout the world. The equipment and procedures were developed and are periodically reviewed by a cross-functional team, including engineering, process safety, technology and field experts, and product specialists. There are redundant safety devices built in throughout the entire system, to prevent exposures or misapplications. The entire application process has been designed as a closed system; thus, exposure to the applicator, personnel in the area and the environment are minimized.

5. Acrolein has excellent warning properties; its irritant characteristics, not unlike chlorine or ammonia-containing materials, warn personnel of its presence at levels below harmful concentrations.

6. Acrolein is a liquid at ambient temperatures, not a gas. It is supplied in pressurized containers with a nitrogen blanket. The liquid products are applied through the application equipment with a low-pressure manifold using nitrogen to displace the liquid through a dip tube. This system design allows for the closed application process and allows the applicator to leak test the entire (installed) system using only nitrogen, to verify the integrity of all components and connections. No valve on the container is opened until the entire system passes this leak test.

7. Critical application equipment components are supplied by a single vendor and tested before shipment.

8. The standardized procedures require the applicator to verify the integrity of all safety components of the application equipment when installing a new system, making an application, or changing out product containers.

9. Baker Petrolite LLC has designed specialized safety programs, which we designate as acrolein safety management programs, for both the storage and application of our acrolein products. These are documented programs which evaluate both product and site-specific risks and determine whether the safeguards currently in place are sufficient to address those risks. If not, additional safeguards are incorporated into the process. For all applications, customer personnel (typically both HSE and facility operations) are an integral part of the process hazard analysis portion of these programs.

10. Baker Petrolite LLC has in place a fully staffed team of acrolein technical specialists, located in the operating regions throughout the world, who function as field support to our customers and employees in all facets of our acrolein business - safety, environmental, technical.

11. Finally, we have an acrolein safety auditing program, which acts as a check and balance to verify that what is taught in the training, and what is required by our policies, is implemented and in place out in the field. Audits are conducted on applications and storage facilities in all regions. These audits are not only a check of documentation, but also observation of the actual application process itself.

12. In all of the above stewardship activities, we strive to continuously improve all aspects of our acrolein product programs.

GENERAL INFORMATION ON BAKER PETROLITE LLC ACROLEIN PRODUCTS

The active ingredient in MAGNACIDE™ B Microbiocide is acrolein; a toxic, flammable, highly reactive chemical, that is a strong lachrymator or tearing agent. However, the process of controlling bacteria in oilfield production systems with this product can be carried out safely and effectively. Closed system application equipment permits the introduction of our acrolein products into oilfield production systems with minimal handling or exposure. These products are supplied in U.S. Department of Transportation (DOT) and UN specification pressurized containers. The cylinders and T-22 skid containers are IMDG certified for offshore use and international shipping. Using nitrogen gas, the liquid acrolein is propelled out of the container through a dip tube directly into a closed system application manifold.

Physical and Chemical Properties

MAGNACIDE B Microbiocide is a liquid formulation with a nominal concentration of 95% (by weight) acrolein as the active ingredient. Some of the typical physical and chemical properties are listed below.

Formula	CH_2=CH-CHO
Molecular weight	56.06
Appearance	colorless to light yellow liquid
Odor	aldehydic (extremely irritating)
Specific gravity at 60°F (15.5 ºC)	0.846
Boiling point (@760 mmHg)	127°F (53ºC)
Freezing point	-124°F (-87ºC)
Vapor density	1.93 (air = 1.0)
Flash point	
Tag open cup	-20°F (-29ºC) approximate
Tag closed cup	-13°F (-25ºC) approximate
Flammability limits in air	
Lower limit	2.8% (by volume)
Upper limit	31.0% (by volume)
Solubility at 68ºF (20°C)	
Acrolein in water	22% by weight
Water in acrolein	7% by weight
Completely miscible in lower alcohols, ethers, hydrocarbons, & acetone	
Vapor pressure at 100°F (38 ºC)	8.6 psia (235 mm of Hg)
Viscosity at 32°F (Abs.) (0ºC)	0.43 cps
Permissible Exposure Limit (OSHA)	0.1 ppm

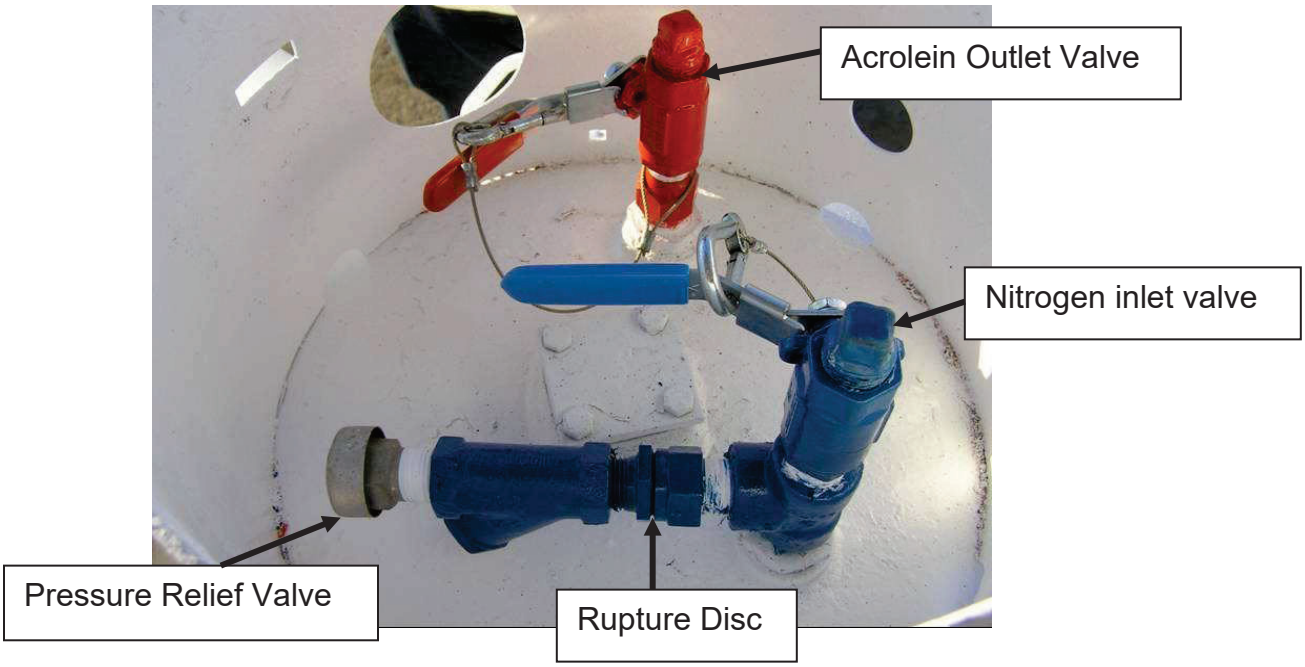
Containers

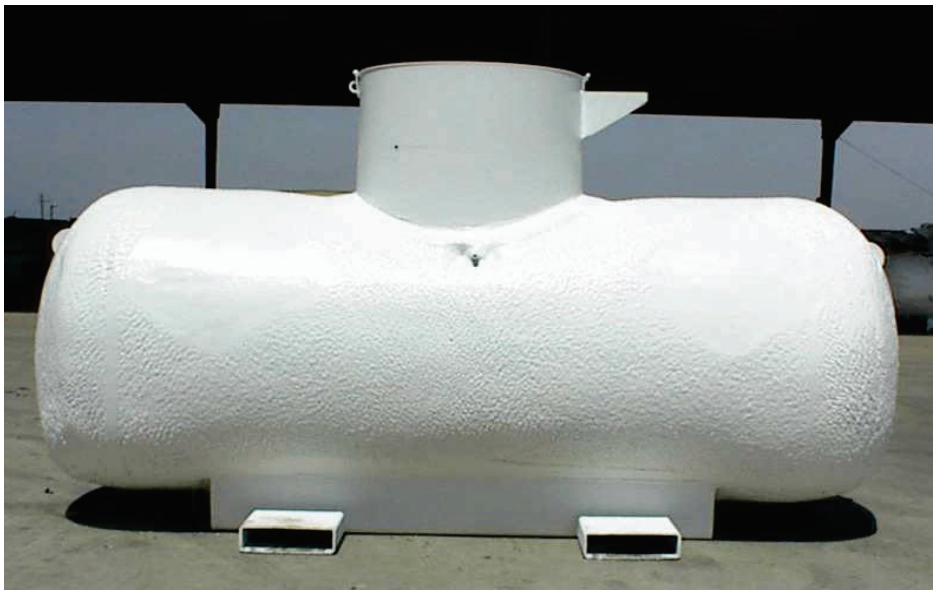
Refillable Container. Refill this container with MAGNACIDE B Microbiocide only. Do not reuse this container for any other purpose. Return empty containers to Taft Manufacturing LLC. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. For cleaning and residue removal of cylinders, follow the Standard Operating Procedure: TMC-140. For cleaning and residue removal of skids, follow the Standard Operating Procedure: TMC-141.

MAGNACIDE B Microbiocide is packaged for use in three container sizes. These containers are specifically built for use with acrolein and are owned and maintained by Baker Petrolite LLC. Containers are hydrostatically tested at manufacture and on a regular, mandated time schedule thereafter, at pressures far exceeding those used in our application process. As an extra level of safety, all acrolein containers are fitted with rupture disc and pressure relief assemblies. There is a documented mechanical integrity program in place for these containers and all attached fittings. Information on their design and construction is available. After use, they are returned to our Taft, California facility for cleaning, testing and refilling.

Container Type	Acrolein Net Weight (pounds/kilograms)	Acrolein Volume at 60ºF/15.6ºC (gallons/liters)
Cylinder	370 / 168	52 / 200
Skid DOT 51	2450 / 1110	347 / 1313
Skid T-22	2240/1089	317/1210

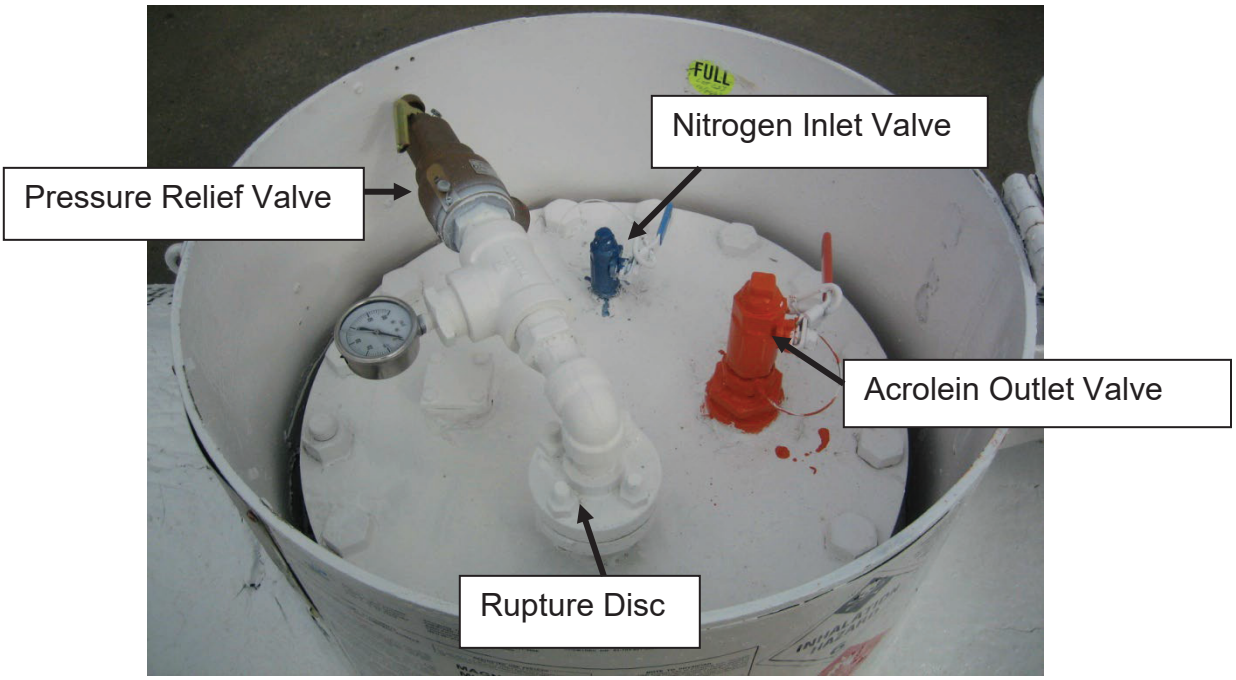
Cylinder showing dip tube. The valves are located inside protective bonnet.





Acrolein skid tank DOT 51. All valves are under protective bonnet.

T22 Skid



Application Equipment

The entire manifold system used to apply Baker Petrolite LLC acrolein products has been designed to minimize vapor and leakage. See pages 45 and 46 for examples of the manifold systems. Baker Petrolite LLC's standardized equipment and application requirements must be used in all applications. MAGNACIDE B Microbiocide treatments within recommended concentrations have not been found to affect gaskets or lubricants in the production or injection system.

Braided stainless-steel hose with a TEFLON® core is specified for tubing which contacts acrolein. Rigid stainless-steel tubing may also be used. Many elastomers and thermoplastics have been tested and found satisfactory for use in gaskets, o-rings and pump head diaphragms. TEFLON, EPR, or KALREZ® are among the preferred materials. Table 1 lists many of the tested materials which may be satisfactory. Any material not previously determined to be compatible with acrolein should be tested before its use. All installations must comply with Baker Petrolite LLC's standardized application equipment. Any exceptions to the standardized application equipment require a written authorization from the Baker Petrolite LLC Acrolein Safety group.

Table 1. Materials Suitable for Service in Acrolein Applications

Hardware or Assembly Parts	Compatible	Not Compatible
Gaskets, O-rings and tubing	Braided stainless steel hose with TEFLON core TEFLON Ethylene Propylene Rubber (EPR) KALREZ Butyl Rubber Polyethylene Polypropylene	Neoprene rubber VITON® BUNA N Polyurethane Polyvinyl Chloride (PVC) Fluorocarbon rubber
Pipe thread sealing compounds	Nickel-impregnated TEFLON tape TEFLON tape	Liquid pipe sealant
Valves	Stainless steel ball valves Mild steel ball valves	Valves with lubricants
Chemical pumps	TEFLON diaphragm type with stainless steel head, balls and seats with internal pressure relief	Plunger/piston type pumps
Fittings	Stainless steel	Galvanized metal
Check valves	Stainless steel seats or with EPR or KALREZ seats	Neoprene seats VITON seats BUNA N seats

TEFLON and KALREZ are registered trademarks of E. I. DuPont de Nemours and Company.
VITON is a registered trademark of DuPont Dow Elastomers L.L.C.

Meters, hoses, pumps, etc., used with acrolein should be cleaned by purging thoroughly with nitrogen, followed with a fresh water or methanol flush for a final rinse.

Application equipment and procedures are standardized throughout the world. There are redundant safety devices built in the entire system to prevent exposures or misapplications. The entire application process has been designed as a closed system. The application procedure includes a leak test of the entire application system (installed) using nitrogen and soap solution. No valves on the container are opened until the system passes this leak test. Using the standardized application equipment and operating procedures, there is no significant exposure to the applicator, personnel in the area, or the environment. Extensive industrial hygiene monitoring during applications confirms that the application manifold as designed is a closed system.

Storage of Containers

Do not contaminate water, food or feed by storage and disposal. All containers of MAGNACIDE B Microbiocide are to be stored in a secured well-ventilated area, away from all other chemicals and outdoors. The containers shall not be stored in such a way as to allow the container bottom to contact soil or water. If surface conditions do not allow for this precaution, containers are to be placed on supporting structures such as pallets to eliminate direct soil or water contact. Acrolein containers are to be stored a minimum distance of 10 feet (3 m) from the facility property line. The

area must be kept free of debris, weeds, vegetation and other combustibles. The storage location should be chosen to minimize the potential for offsite consequences and vehicular traffic obstruction. Extremely sensitive locations (e.g., near large population, school, etc.) should not be used as permanent or unmanned application sites.

Acrolein neutralization materials are to be maintained at the storage facility (either soda ash and water or dilute bisulfite solution) in an accessible location, but not in direct proximity to the acrolein storage. See page 15 for spill control information. No acids, alkalis or oxidizing materials should be in the immediate storage area.

Any electrical equipment in the immediate area should be Class 1 – Division 2and properly grounded and meet local requirements for hazardous locations. Countries or states may place additional requirements upon chemical storage facilities. Prior to beginning storage in new location (i.e., first time acrolein storage and use scenarios), contact your Baker Petrolite LLC Acrolein Technical Specialist or Global Chemical Regulatory Affairs in Sugar Land, Texas.

Safety Information and Programs

For additional information on the Baker Petrolite LLC acrolein safety programs, refer to the following paper. These programs have been instituted for all of our storage and application locations, worldwide.

Horaska, D.D., San Juan, C.M., Bonnivier, B.M., Dickinson, A.L., Conaway, J.L. Safety Management Programs and Standardized Application Equipment Minimize Risks of Nonconventional Chemical Usage. SPE Paper 141882, SPE Americas E&P Health, Safety, Security and Environmental Conference, Houston, TX, USA, 21–23 March 2011.

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

DANGER POISON

KEEP OUT OF REACH OF CHILDREN

DANGER

Extremely flammable and irritating vapor and liquid. Fatal if swallowed, inhaled, or absorbed through skin. Do not breathe vapors or spray mist. Corrosive. Causes irreversible eye damage and skin burns. Do not get in eyes, on skin, or on clothing. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet.

When setting up and breaking down application equipment, a full-face air purifying respirator with organic vapor (OV) cartridges approved by the National Institute of Occupational Safety and Health (NIOSH) and butyl rubber gloves must be worn. For visual inspection during treatment, chemical splash goggles must be worn. If spilled on clothing, gloves, or shoes, remove them immediately and wash thoroughly with soap and water before reuse. Use with adequate ventilation.

USER SAFETY REQUIREMENTS

Users must wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.

Users must remove PPE immediately after handling this product. Wash the outside of the gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

If MAGNACIDE B Microbiocide is spilled or leaked on clothing, gloves, or shoes, immediately remove them and wash thoroughly with soap and water.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Discard clothing, gloves, shoes, and other absorbent materials that have come into contact with MAGNACIDE B Microbiocide. Do not reuse them.

PPE REQUIREMENTS

All certified applicators participating in the application during setting up and breaking down of application equipment and during visual inspection must wear:

- Coveralls or long-sleeved shirt and long pants,
- Chemical resistant footwear or shoes and socks,
- Chemical-resistant gloves made of butyl rubber, and

- A NIOSH-approved respirator with an organic vapor (OV) cartridge with a combination N, R, or P filter with NIOSH approval number prefix 84A; or NIOSH approved gas mask with an organic vapor canister with NIOSH approval number prefix TC – 14G; or a NIOSH approved powered air purifying respirator with organic vapor (OV) cartridge and combination HE filter with NIOSH approval number prefix TC 23C.

Respirator fit testing, training and medical qualification:

See OSHA's Respiratory Protection Standard for federal requirements on how to safely fit-test, train, and medically examine workers who will be using respirators.

ENGINEERING CONTROLS

Handlers must use a closed system that is designed by the manufacturer to prevent dermal and inhalation exposures. At any disconnect point, the system must be equipped with a dry disconnect or dry couple shut-off device that will limit drippage to no more than 2 ml per disconnect. The closed system must function properly and be used and maintained in accordance with the manufacturer's written operating instructions. Handlers must wear the personal protective equipment required on this labeling.

PHYSICAL AND CHEMICAL HAZARDS

DANGER: Acrolein, the active ingredient in MAGNACIDE B Microbiocide, is highly reactive chemically and readily forms polymers. If alkalies (such as ammonia and caustic) or strong acids are brought in contact with MAGNACIDE B Microbiocide in a closed system, the biocide can polymerize with sufficient violence to rupture the container. Do not apply with equipment used for acids and alkalies. Contamination of MAGNACIDE B Microbiocide with any foreign matter must be avoided. Clean application equipment with large amounts of water after using. Do not use or store near fire, sparks and heated surfaces.

A supply of sodium carbonate (soda ash) and water should be readily available for neutralizing spilled MAGNACIDE B Microbiocide. All spills should be confined and neutralized before disposal. Running water should be readily available to wash down the area after neutralization.

ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish and wildlife. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge this product to sewer systems without previously notifying the local sewage treatment authority. For guidance contact your State Water Board or Regional Office of the EPA. Do not contaminate water when disposing of equipment wash-waters.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

MAGNACIDE™ B Microbiocide is a water-soluble material for the control of bacteria and fungi in oilfield water injection systems. This material must only be applied in accordance with directions in the MAGNACIDE™ B Microbiocide Description and Use Manual under the supervision of trained personnel or licensed applicators.

MAGNACIDE™ B Microbiocide may only be used in the treatment of producing wells, produced water systems, disposal systems, produced water injection systems or in the treatment of water prior to oilfield use where the treated water is either disposed of in deep injection wells or re-used in oilfield operations. Holding ponds must be lined by an impermeable barrier. All production water treated with acrolein must be disposed of in deep injection wells or re-used in oilfield operations including water injection systems.
Maximum application rates:

Application	Maximum application rate
Open Fracking pond	50 ppm*
Covered Fracking pond**	500 ppm
Downhole treatment on well	12,000 ppm
Batch treatment of closed production vessel or tank	1,000 ppm
Continuous injection of production vessel or tank	100 ppm

ppm= parts per million (equivalent to milligrams per liter; mg/L)
*One application of 100ppm allowed per calendar year per oil/gas lease
** Must be covered by an impermeable material that restricts offsite movement of volatilized substances.

For fracking specific operations prior to acrolein treatment of fracking pond

- Only essential personnel are allowed within 100 meters of fracking pond during acrolein treatment of the frac pond. Non-essential personnel may return to the area one hour after application of acrolein is complete. Essential personnel are those that are directly involved in or assisting with the application of acrolein.
- During application and for one-hour post treatment, all personnel within 100 meters of the fracking pond must remain upwind, and a respirator (see PPE requirements) must be worn or kept within reach in case of leak or change of the wind direction.
- Water from fracking pond may not be used until 48 hours after acrolein treatment is complete.

POSTING OF APPLICATION

- The Certified Applicator in charge of the application must post signage at all entrances to the application area. Signs must be posted 24 hours prior to the beginning of acrolein treatment, must remain legible during the entire posting period and must be removed once access to the application area is no longer restricted and no later than 3 days after treatment.
- Signage must contain the following information:
  - Skull and crossbones symbol
  - DANGER/PELIGRO
  - DO NOT ENTER/NO ENTRE
  - Acrolein treatment in progress
  - The date and start time of application
  - The estimated end time of application

RECOMMENDATIONS FOR HANDLING ACROLEIN PRODUCTS

Acrolein is a very reactive liquid chemical that can form polymers, evolving tremendous heat. Contamination with alkalis or strong acids can initiate polymerization. Contamination with all foreign materials must be avoided. If the product is stored or handled improperly, the polymerization process can occur. The integrity of all acrolein product containers is protected with a rupture disc and pressure relief valve (PRV) assembly. Any release from the PRV would primarily contain nitrogen gas from the headspace of the container.

Acrolein polymerizes slowly in the presence of air. Therefore, all containers are packaged with a blanket of nitrogen to exclude air. To avoid the possibility of air contamination during use, MAGNACIDE B Microbiocide must be displaced from the container with nitrogen only. In addition, hydroquinone is added to inhibit oxygen catalyzed polymerization. However, hydroquinone does not inhibit polymerization catalyzed by alkalis and strong acids. *These precautionary statements refer to the neat solution of acrolein. Dilute aqueous solutions of acrolein are applied such that polymerization reactions are avoided.*

Personal Safety Equipment and Use

The applicator, to protect from an accidental splash or spray, must wear a full face air-purifying respirator with organic vapor cartridges and pre-filter, butyl rubber gloves and fire retardant long sleeve shirts/pants or coveralls during applications. Applications are designed as a closed system process; the respirator is worn for precautionary purposes, as well as to provide superior eye protection. Fresh water must be available in case of irritation to the eyes or skin from acrolein liquid or vapors.

Spill Control Procedure

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use of according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Acrolein spills can be neutralized using aqueous sodium carbonate (soda ash). Addition of sodium carbonate results in the formation of solid, inert polymer. All spills should be confined and neutralized before disposal. Running water should be readily available to wash down the area after neutralization. Never flush acrolein into sewers or natural waterways as this can result in biological upset of treatment systems and kill fish in waterways.

Recommended Procedure for Handling Spills

1. Evacuate all nonessential personnel to an upwind area.
2. All decontamination personnel must wear self-contained breathing apparatus and appropriate protective clothing.
3. Contain spill with dirt or soda ash.
4. Add powdered soda ash to the spill (20 pounds soda ash per one gallon of acrolein). Follow up by dilution with water (at least 5 gallons per one gallon of acrolein). *This neutralization will not occur without dilution with water.* Mix slurry for 20 minutes using a broom or shovel.

5. When neutralization is complete, collect the polymer and place in properly marked containers for disposal at an approved waste disposal facility. Contact Baker Petrolite LLC HSE and Global Chemical Regulatory Affairs in Sugar Land, Texas (1-800-231-3606) for assistance on disposal options that comply with local requirements.

Vapor and Fire Hazards

Acrolein is a highly volatile liquid. In certain combinations with air, vapors can have an explosive potential if ignition sources are present. Keep away from all sources of heat, spark and flame. In the event of a fire, acrolein is highly flammable and produces toxic vapors. All firefighting personnel must wear self-contained breathing apparatus and protective clothing. Carbon dioxide or dry chemical extinguishers can be used on small fires. Alcohol-resistant foam is recommended for large fires. If the fire can be tolerated without endangering additional personnel or property, it should be left to burn itself out.

Water spray is effective if used in large quantities and is recommended to help disperse vapors and cool containers. At least 20 volumes of water per volume of acrolein are required.

FIRST AID FOR ACROLEIN PRODUCTS

FIRST AID

Have the product container or label with you when calling a poison control center doctor, or going for treatment. You may also contact 800-231-3606 for emergency medical treatment information.

1. If Inhaled
- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible.
- Call a poison control center or doctor for further treatment advice.

2. If on Skin or Clothing
- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15 – 20 minutes. DO NOT USE SODA ASH NEUTRALIZING SOLUTION.
- Call a poison control center or doctor for treatment advice.

3. If in Eyes
- Hold eyes open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

4. If Swallowed
- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to do so by the poison control center or doctor.

Do not give anything by mouth to an unconscious person.

Note to Physician: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

WARNING SIGNS AND SYMPTOMS: Liquid MAGNACIDE B Microbiocide is absorbed by the skin and is particularly irritating to any lesion and to the eyes. The vapors act principally on the mucous membrane of the eyes and respiratory tract. Because of the extreme lachrymatory warning effect, the concentration tolerable by man is far below the minimum lethal concentration.

TREATMENT: Treat exposed area as a chemical burn. Thoroughly flush eyes with water and treat symptomatically. Persons exposed to MAGNACIDE B Microbiocide vapors may have a delayed reaction and experience irritation of the respiratory tract. In severe cases, this may progress to pulmonary edema. Therefore, it is advisable to keep persons exposed to MAGNACIDE B Microbiocide under observation for 24 hours following exposure.

Acrolein Exposure Symptoms:
Acrolein is irritating to the eyes, nose, and throat; the resulting irritation is ordinarily recognized by most people at non-hazardous levels in a short period of time. This practically precludes the possibility of prolonged, voluntary exposure to the vapor in harmful concentrations. It is virtually impossible for a person to ingest a harmful quantity of acrolein due to its extreme irritating effect.

Symptoms of exposure to acrolein includes irritation of the eyes, throat, and skin; reddening or blistering of the skin; headaches; acute distress in affected areas; possible cessation of breathing after long exposure. In all cases of suspected poisoning, call a physician at once. There is no emergency antidote for acrolein.

Note: Persons exposed to vapors may have a delayed reaction and experience severe irritation of the respiratory tract and pulmonary edema. Therefore, it is strongly advised to keep persons exposed to high concentrations of vapor under observation for at least 24 hours following exposure.

Rely on the Safety Data Sheet (SDS) for specific information on how to treat personnel exposed to MAGNACIDE B Microbiocide. For product information or an SDS, contact either your local Baker Hughes representative, the local Baker Petrolite LLC office, any acrolein technical specialist, access our web site **bakerhughesdirect.com** or contact our headquarters in Sugar Land, Texas at 281-276-5400 (8 am to 5 pm CST, M-F).

If Medical Attention is required
Have the Safety Data Sheet, product label, or this application manual with you when calling a poison control center, contacting a doctor, or going to an emergency medical facility. For 24-hour emergency information call:

Baker Hughes	800-231-3606 (North America, 24 hours)
CHEMTREC	800-424-9300 (U.S. 24 hours)
CANUTEC	613-996-6666 (Canada, 24 hours)
CHEMTREC Int'l	01-703-527-3887 (Europe, Latin America, 24 hours)
Australia	1-800-033-111 (24 hours)

FLOW CONTROL AND ADJUSTMENT

A number of arrangements can be used to apply Baker Petrolite LLC acrolein products. They range from simple manual systems to more complex automated setups. The accurate injection of these products is very important for an effective and economical program. Recommended methods for monitoring injection of chemical rates are:

Turbine meters: These units are in-line meters that provide instantaneous injection rates and totals, typically with digital displays. Turbine meters measure liquids very accurately but gas will cause erratic reading and damage the unit. Turbine meters should be obtained from the authorized Baker Petrolite LLC acrolein equipment supplier.

Timer/solenoid: Timers can be used to control pumps or solenoid valves. The method requires electricity and air pressure (usually instrument air is sufficient). By controlling the on/off time interval, a large range of injection rates can be achieved. This method also allows for application at selected hours of the day, thus lowering the possibility of accidental exposure. Verification that materials of construction of all wetted components are compatible with acrolein must be made prior to use.

Pumps: Baker Petrolite LLC acrolein products are often injected with a chemical pump for a continuous treatment or into production systems that exceed 80 psi. For low pressure treatment (< 80 psi), nitrogen displacement with solenoids/timers may be considered as an alternative to a pump. For high pressure injections, use a TEFLON diaphragm metering pump that is equipped with an internal pressure relief. Timers can be used to turn the pump on and off to make applications at selected hours of the day or for a specific length of time. Consult the pump manufacturer's operating manual for instructions on flow rate adjustment. Downstream of the pump a spring-loaded check valve which opens at 50 psi or greater must be installed. This prevents unintentional nitrogen displacement of the product through the pump and into the application site should the system pressure drop to a low level.

Sight glass: The injection rate can be measured in quarts, liters, or gallons per day with an acrolein-compatible sight glass system available from Baker Petrolite LLC's specified supplier. The sight glass should be part of the closed application system (see Diagrams F and G) and should be rinsed and left empty after use.

Rotameters: The use of rotameters (variable-area flowmeters) is an economical method to control and monitor the injection rate. The units are available in various flow rates and pressure ratings. Rotameters should be ordered through the Baker Petrolite LLC Acrolein Technology group to insure all materials are compatible (e.g., borosilicate glass with EPR, TEFLON or KALREZ seats or o-rings are preferred) and that they are calibrated for acrolein. Many rotameters are equipped with integrated needle valves that facilitate fast and accurate adjustments. Rotameters are not suitable for use with diaphragm pumps.

Weight loss: The measurement of weight loss over time can be conducted by several methods such as platform scales, crane scales, or load cells. Although weight loss is not instantaneous, the injection rate can be determined reliably.

Mass flowmeters: The use of a mass flowmeter will provide a very accurate injection rates. They will usually provide the application rate in pounds/day, kg/day, gallons/day, or by total usage.

TRANSPORTATION OF ACROLEIN CONTAINERS

Transportation of hazardous chemicals is regulated by the country that ships the material, international maritime codes, and the country that receives the shipment. There are requirements for special shipping papers that must accompany the transport of full or empty containers which previously contained a hazardous material. Any vehicle or shipment container transporting full, partial or empty acrolein containers must be correctly placarded.

The shipping description for full or partial MAGNACIDE B Microbiocide containers is:

UNITED STATES	CANADA
UN 1092 Acrolein, stabilized Class 6.1 (3), Packing Group I Toxic-Inhalation Hazard, Zone A RQ (contains acrolein) Marine Pollutant (contains acrolein)	Acrolein, stabilized Class 6.1 (3), UN1092, Packing Group I Toxic by Inhalation, Marine Pollutant (acrolein) Emergency Response Code #: 131P ERAP #: ERP2-0132; 24-hour number: 1-844-380-8099 Equivalency Certificate No. SU 10922 Dangerous goods may be marked in accordance with 49 CFR

The 6.1 denotes a material that is toxic by inhalation, the (3) indicates that the material is flammable. UN 1092 is specific for acrolein. Packing Group I and Zone A define the toxic properties of the inhalation hazard. RQ indicates that a spill above a specified level will require a report to regulatory agencies.

Prepare empty containers for shipment as follows:

1. Relieve container pressure down to minimum of 12psi & maximum of 60psi for skids and minimum of 12 psi & maximum of 20psi for cylinders. This can be accomplished by venting the empty acrolein container through the *blue* container valve into a bucket containing neutralizing solution. Refer to the included training guidelines for more information.
2. Replace plugs in the inlet and outlet valves and tighten securely.
3. Fasten down valve handles and secure.
4. Close lid and secure with latch.
5. Containers should be transported upright. Alert the carrier to secure containers to prevent overturning during travel.
6. Dual restraints are required when transporting acrolein containers.

An example of the correct shipping description for transport of empty acrolein containers is:

UNITED STATES	CANADA
Residue, Last Contained: UN 1092 Acrolein, stabilized Class 6.1 (3), Packing Group I Toxic-Inhalation Hazard, Zone A RQ (contains acrolein) Marine Pollutant (contains acrolein)	Residue, Last Contained: Acrolein, stabilized Class 6.1 (3), UN1092, Packing Group I Toxic by Inhalation, Marine Pollutant (acrolein) Emergency Response Code #: 131P ERAP #: ERP2-0132; 24-hour number: 1-844-380-8099 Equivalency Certificate No. SU 10922 Dangerous goods may be marked in accordance with 49 CFR

Properly worded bills-of-lading, safety data sheets (SDS), shipping documents, and local information on vehicle placards for transporting acrolein containers are available from Baker Hughes Incorporated. For proper international shipping information, contact the local Baker Petrolite LLC office, Global Chemical Regulatory Affairs, or the Logistics Department at Baker Petrolite LLC's main office in Sugar Land, Texas.

MAGNACIDE B MICROBIOCIDE

Oilfield water injection and disposal operations have required the development of water clarification and treatment processes which ensure the continuous subsurface injection of substantial quantities of water. Operation of these waterflood facilities is often impaired by chemical and microbiological factors. Decreased water injection due to plugging of the near well bore by water-borne (planktonic) microbes, proliferation of surface-adhering (sessile) bacteria, and/or solids generated as a result of bacterial metabolic activity often results in costly well maintenance and disruptions in water injection. Highly localized corrosion of metal goods by bacteria attached to the metal surfaces (sessile bacteria) has also been a problem that has adversely affected the integrity of pipelines and injection well tubing. Similarly, fresh water or seawater often contains additional nutrients that when mixed with produced water will accelerate growth of undesirable bacteria. To generate water that is suitable for consistent operation, bacteria levels must be controlled throughout the waterflood/disposal facility.

Extensive laboratory and field tests have shown that acrolein (2-propenal), the active ingredient in MAGNACIDE B Microbiocide, is very effective in controlling bacteria. MAGNACIDE B Microbiocide has been proven to be effective in controlling both planktonic and sessile sulfate-reducing bacteria, other anaerobes, and aerobes. The benefits from the control of such microorganisms are (a) improved water quality through the elimination of insoluble iron sulfide, other suspended solids, slimes, and molds; and (b) a reduction in corrosion by the control of localized electrolytic cells produced by the bacteria (microbiologically influenced corrosion, or MIC).

Acrolein is in the aldehyde family, but it controls bacteria by a different mechanism than other aldehydes such as formaldehyde or glutaraldehyde. The primary reactive site in acrolein is the carbon-carbon double bond, rather than the carbonyl (carbon oxygen) bond, as is the case with

other aldehydes. In addition, this difference in reactivity explains why acrolein acts on dissolved sulfides and iron sulfides which are often the byproducts of microbial metabolism in oilfield production systems. Other commonly used aldehydes cannot effectively provide this benefit.

The high order of reactivity of MAGNACIDE B Microbiocide suggests several modes of action. It is known to inhibit several enzyme systems and is especially reactive with sulfhydryl and amine groups in the cell membrane and proteins of bacteria. These reactions result in rapid formation of very stable irreversible adducts. A variety of laboratory studies have shown that MAGNACIDE B Microbiocide is generally toxic to microorganisms and has a broad spectrum of activity, including activity on Gram-negative, Gram-positive, acid-fast bacteria, and fungi.

The ability to penetrate oil-coated biofilms is another physical property that separates MAGNACIDE B Microbiocide from other oilfield biocides. All produced water systems, even with extensive water clarification, will develop at least a mono-molecular layer of oil on the surface of the piping and vessels. Sessile biofilms on those surfaces will have the same oil film. Biocides that are not surface-active are completely water soluble and cannot easily penetrate a biofilm with an oil-wet surface. Acrolein is water soluble up to 22% by volume but also has infinite solubility in all common hydrocarbons and crude oils. This dual solubility allows for easy access to the biofilm for rapid reaction with sulfhydryl and amine groups in the bacteria. In mixtures of oil and water approximately 20% of the acrolein will partition to the oil phase and 80% to the water phase. However, as the reactions of acrolein occur predominantly in the water phase, the acrolein initially solubilized in the oil phase will migrate to the water phase over time and become available for reactions with bacteria.

See page 25-28 for treatment guidelines and application methods for MAGNACIDE B Microbiocide.

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MAGNACIDE B MICROBIOCIDE TREATMENT GUIDELINES

The following section will assist in understanding the different application methods and suggested dosage rates for oilfield uses of MAGNACIDE B Microbiocide. Countries where MAGNACIDE B Microbiocide is sold may have other specific guidelines for treatment. Such guidelines are listed on the container labeling. In such countries, it would be a violation of local law to use MAGNACIDE B Microbiocide in a manner inconsistent with the label.

The successful control of bacteria in injection waters has been brought about economically by the introduction of MAGNACIDE B Microbiocide into oilfield water systems using a specialized application technique. MAGNACIDE B Microbiocide is used effectively under field conditions in the treatment of producing wells, produced water systems, disposal systems, produced water injection systems or in the treatment of water prior to oilfield use where the treated water is either disposed of in deep injection wells or re-used in oilfield operations.

To control sessile and planktonic bacterial contamination, MAGNACIDE B Microbiocide should be introduced into the system as far upstream as can be conveniently arranged to treat as much of the system as possible before the water reaches the injection or disposal wellhead. MAGNACIDE B Microbiocide can be added to the water system at almost any convenient location. The product can be added at a storage tank, heater treater, free water knock out (FWKO), producing or injection wellhead, or any number of other easily accessible locations in a facility.

MAGNACIDE B Microbiocide is typically metered directly from the container in which it is supplied into the injection point. In specialized treatments, such as squeeze applications, MAGNACIDE B Microbiocide is diluted in a water stream immediately before being injected downhole. In all cases, MAGNACIDE B Microbiocide is applied using a closed system.

The following simple formulae are used to calculate treatment quantities for MAGNACIDE B Microbiocide applications:

MAGNACIDE B Microbiocide (lb/treatment) =

$$\frac{[\,V\ (bbl/D) \times 42\ (G/bbl) \times SG_{PW} \times T\ (hrs) \times C\ (ppm\ desired)]}{[SG_A \times 24\ (hrs/D) \times 10^6]} \times 7.06\ (lb/G)$$

where: V volume of water to be treated in barrels per day (1 barrel = 0.159 m^3)
lb pounds (1 pound = 2.204 Kg)
G gallons of liquid (1 gallon = 3.785 liters)
C ppm desired or concentration required (ppm = parts per million)
T time in hours

SG_A specific gravity of acrolein (0.846)
SG_{PW} specific gravity of produced water (assume 1.007)

Or

$$\text{MAGNACIDE B Microbiocide (lb/treatment)} = \frac{\text{V (bbl/D)} \times \text{T (hrs)} \times \text{C (ppm desired)}}{68{,}000}$$

$$\text{MAGNACIDE B Microbiocide (kg/treatment)} = \frac{\text{V (m}^3\text{/D)} \times \text{T (hrs)} \times \text{C (ppm desired)}}{23{,}758}$$

or

$$\text{MAGNACIDE B Microbiocide (lb/hr)} = \frac{\text{V (bbl/D)} \times \text{C (ppm desired)}}{68{,}000}$$

$$\text{MAGNACIDE B Microbiocide (kg/hr)} = \frac{\text{V (m}^3\text{/D)} \times \text{C (ppm desired)}}{23{,}758}$$

Limitations

In closed systems where sulfite/bisulfite is used to scavenge oxygen or hydrogen sulfide is naturally present at high levels, consideration must be given to the dosage of MAGNACIDE B Microbiocide versus the concentration of these components. Approximately 1 ppm acrolein will react with 3.7 ppm excess sodium sulfite or 4.5 ppm excess sodium bisulfite; 4 ppm acrolein will be consumed by 1 ppm hydrogen sulfide. In addition, consideration must also be given to acrolein compatibility with other treatment chemicals that may be used in the system.

Continuous Treatment

Depending on the type of water and organisms present, it is possible to effectively control microorganisms with a continuous treatment as low as 5 to 50 ppm.

Example:
A secondary oil recovery waterflood injecting 40,000 bbl (6360 m^3) of produced water per day is to be treated with MAGNACIDE B Microbiocide at a rate of 10 ppm. What is the dosage rate per hour for a continuous treatment?

$$\frac{(40{,}000)(10)}{68{,}000} = 5.9 \text{ lb/hr} \quad \text{or} \quad \frac{(40{,}000)(24)(10)}{68{,}000} = 141 \text{ lb/D}$$

$$\frac{(6{,}360)(10)}{23{,}758} = 2.7 \text{ kg/hr (3.2 liter/hr)} \quad \text{or} \quad \frac{(6{,}360)(24)(10)}{23{,}758} = 64 \text{ kg/D (75 liters/D)}$$

Therefore, ~ 6 lb/hr (~ 3.2 liters/hr) of MAGNACIDE B Microbiocide metered continuously into the water injection system would provide a concentration of 10 ppm MAGNACIDE B Microbiocide.

Tests should be completed to evaluate the effectiveness of the product; e.g., bacteria counts, solids levels, sulfide concentrations, differential pressure, length of filter cycle, injection pressure, or water output rates.

Batch Treatment

Extensive field testing has proven that MAGNACIDE B Microbiocide, applied at regular intervals, can maintain a clean and trouble-free system. Application concentrations may vary from 50 to 12,000 ppm (0.005 - 1.2%) depending on available contact time, system requirements, bacteria populations and degree of contamination. Prior experience from a similar system or a biocide kill study using a cultured population of sessile bacteria can be used to establish initial batch treatment rates.

In the absence of a recommended dosage, a reasonable starting point for treatment is 175 ppm of MAGNACIDE B Microbiocide with a minimum two-hour contact time. Large facilities or systems with multiple tanks may require several application points. Systems with high sessile populations will require higher treatment concentrations for effective control.

After the initial treatments, the MAGNACIDE B Microbiocide program should be optimized. This is accomplished by adjusting application ppm, contact time, treatment frequency, or the amount of MAGNACIDE B Microbiocide used in the treatment. An optimized program may be achieved with higher concentration and shorter contact time, or lower concentration and longer contact time. Changes in the program should be based on water quality data or other routine monitoring programs.

Example:
A waterflood is injecting 124,000 bbl/D (19,714 m^3/D). The recommended batch treatment dosage is 175 ppm for two hours. The MAGNACIDE B Microbiocide rate in pounds/hour (kg/hour) is calculated using the same formulae as above for the continuous treatment.

$$\text{MAGNACIDE B Microbiocide (lb/hr)} = \frac{\text{V (bbl/D) x T (hrs) x C (ppm desired)}}{68{,}000}$$

$$\frac{(124{,}000)\ (2)\ (175)}{68{,}000} = 638 \text{ lb applied over two hours}$$

$$\text{MAGNACIDE B Microbiocide (kg/hr)} = \frac{\text{V } (m^3/D) \text{ x T (hrs) x C (ppm desired)}}{23{,}758}$$

$$\frac{(19{,}714)\ (2)\ (175)}{23{,}758} = 290 \text{ kg (342 liters) applied over two hours}$$

Therefore, in this example 638 lb (342 liters) of MAGNACIDE B Microbiocide, applied over a two hour period, provides a 175 ppm dosage.

Slug and Squeeze Treatments

Vessels: MAGNACIDE B Microbiocide is also effective at treating produced water tanks that are fouled with bacteria. Application concentrations vary from 50 to 12,000 ppm (0.005 - 1.2%) depending on system requirements, available contact time, bacteria populations and degree of contamination. In this treatment scheme, the retention time of the water in the tank provides the

required biocidal contact time. A treatment rate of 150 ppm is the minimum for retention times greater than 4 hours; less retention time and/or significant bacteria contamination require higher treatment levels.

The formulae for treating a fixed volume of water are:

$$\text{MAGNACIDE B Microbiocide (lb)} = \frac{\text{V (bbl) x C (ppm desired)}}{2833}$$

$$\text{MAGNACIDE B Microbiocide (kg)} = \frac{\text{V (m}^3\text{) x C (ppm desired)}}{990}$$

Example:
A 5,000 barrel (795 m^3) water tank, with a 2 hour retention time, and a high SRB population is to be treated. A treatment of 300 ppm is recommended to compensate for system conditions.

$$\frac{\text{Vessel size (bbl) x C (ppm desired)}}{2833} = \text{lb of MAGNACIDE B Microbiocide}$$

$$\frac{(5{,}000)\ (300)}{2833} = 529 \text{ lb of MAGNACIDE B Microbiocide}$$

$$\frac{\text{Vessel size (m}^3\text{) x C (ppm desired)}}{990} = \text{kg of MAGNACIDE B Microbiocide}$$

$$\frac{(795)\ (300)}{990} = 240 \text{ kg (~284 liters) of MAGNACIDE B Microbiocide}$$

Therefore, 529 pounds (284 liters) batched into the tank should provide a biocidal treatment. Subsequent treatments would be adjusted based on the results of water quality tests or routine monitoring programs.

Well Squeezes (Production and Injection): Typical treatment dosages are 3000 to 12,000 ppm (0.3 - 1.2%). Treatment volumes should be adjusted based upon individual well design. Formation porosity, length of treatment interval, and desired depth of penetration into the formation are the important factors to be considered in treatment design. Compatible products to improve the performance of the MAGNACIDE B Microbiocide are routinely added to the treatment mixture. Wells should be shut in for a period of 24 to 72 hours to achieve optimum results. Contact a Baker Petrolite LLC acrolein technical specialist for additional information on squeeze programs.

ACROLEIN SAFETY MANAGEMENT PROGRAM (ASMP)

Enterprise Operational Control (EOC)

The Acrolein Safety Management Program (ASMP) Enterprise Operational Control (EOC) establishes Baker Hughes minimum requirements to be implemented for an effective ASMP at a Baker Petrolite LLC facility (excluding Taft Manufacturing) or client site where acrolein containers with 150 pounds (68 Kg) or more remain onsite (storage or application) for more than 24 hours.

Each Baker Petrolite LLC facility, Operations, Account, Manufacturing or Facility Manager must ensure that the tasks described in the ASMP EOC are implemented. The Acrolein Safety/Technology group will assist in completing the required documentation, provide training, assess acrolein applicators for competency and conduct internal ASMP audits as required.

Acrolein installations requiring piping and instrumentation for chemical pumps, programmable logic controllers, sensors, valve actuators, or methanol flush must be installed by certified personnel appointed by the customer following local regulatory requirements. For additional information see ASMP EOC Resources for documents, forms and work instructions available.

ACROLEIN BATCH APPLICATION PROCEDURES

Pre-Job Checklist and Precautions

1. Have safety gear – full-face air purifying respirator with organic vapor cartridges and pre-filter, butyl rubber gloves, appropriate FRC work clothing, soda ash/water or bisulfite neutralizing solution, at least 5 gallons of fresh water, 20 pounds of dry soda ash, and 5 lb. fire extinguisher. Wear full-face respirator, butyl rubber gloves and appropriate clothing as soon as the bonnet lid is open, when hooking up, changing or breaking down acrolein application equipment.
2. Have the acrolein applicator documents that contain current SDS, batch application ORA, STP, acrolein products manual, EPA Pesticide Recordkeeping forms (USA regulation MAGNACIDE B), and Special Permits for transportation (country specific), etc.
3. Be familiar with first aid procedures.
4. Conduct on-site safety meeting and complete relevant STP or customer JSA as required.
    - Review 1st aid information
    - Review relevant physical properties of acrolein (vapor density, flammability, etc.)
    - Review roles and responsibilities (only essential personnel on site)
    - Review application procedures
    - Review leak procedure contingency plan
    - Note wind direction (park upwind if possible)
    - Discuss escape plan and muster point
5. Use critical component application equipment from single source supplier.
6. Know your procedures thoroughly, rehearsing if necessary before doing the job.
7. Before assembling or breaking down application equipment ensure that blue and orange valve handles on the acrolein container are in the closed and locked position with clips installed.
8. Tape all NPT connections using nickel anti-seize Teflon tape to prevent leaks and thread

galling.

9. Use “DANGER” tags at appropriate locations (e.g., injection point, sampling locations) to alert personnel of the presence of acrolein treated water.

Procedures for Verifying Integrity of Acrolein Manifold Check Valves

1. Before connecting nitrogen regulator to nitrogen bottle, check the following:
    a) Nitrogen regulator handle is fully out (counterclockwise).
    b) A 100psi cracking check valve is installed on the inlet side of the regulator.
    c) An excess flow valve is installed on the discharge of the regulator to prevent over pressuring the acrolein container if regulator fails.
2. Connect nitrogen regulator.
3. Open nitrogen bottle valve and quickly turn regulator valve clockwise until excess flow valve actuates (20-40 psi). If excess flow valve does not activate and restrict flow replace immediately and check function of replaced excess flow valve.
4. Turn regulator valve counter-clockwise then clockwise to reseat excess flow valve.
5. Ensure all valves on manifold are closed.
6. Nitrogen side of manifold:
   Remote Mount: Attach nitrogen hose to JIC fitting at the bottom of cross below pressure gauge. With nitrogen valve (blue) and by-pass valve (yellow) closed, adjust nitrogen pressure to 10psi then open nitrogen valve (blue) on manifold. Listen/feel or observe for nitrogen escaping through inlet JIC fitting (by placing some soap solution on a finger then trying to form a slight seal on the open end of the fitting any leak will form bubbles if nitrogen is escaping). If nitrogen is escaping rebuild or replace the check valve and repeat check of check valve.
   Container Mount: Attach nitrogen hose to JIC fitting at side of cross below pressure gauge. Use ½” cap to cap end of ½” riser nipple. With nitrogen valve (blue) closed adjust nitrogen pressure to 10psi then open nitrogen valve (blue) on manifold. Listen/feel or observe for nitrogen escaping through inlet JIC fitting. If nitrogen is escaping rebuild or replace the check valve and repeat check of check valve.
7. Back off pressure on regulator valve. Close blue nitrogen valve and disconnect nitrogen hose.
8. Acrolein side of manifold:
   Remote Mount: Attach nitrogen supply hose to JIC fitting downstream of by-pass valve (yellow). Adjust nitrogen pressure to 10psi then open yellow valve. Listen/feel or observe for nitrogen escaping through JIC fitting at bottom of cross below pressure gauge. If nitrogen is escaping rebuild or replace the check valve and repeat check of check valve.
   Container Mount: Attach ½” collar with ¼” male JIC to riser nipple. Attach nitrogen supply hose to JIC fitting at bottom of riser. With by-pass valve (yellow) and acrolein valve (orange) closed adjust nitrogen pressure to 10psi then open yellow valve. Listen/feel for or observe nitrogen escaping through JIC fitting at bottom of cross below pressure gauge. If nitrogen is escaping rebuild or replace the check valve and repeat check of check valve.
9. Back off pressure on regulator valve. Close yellow by-pass valve and disconnect nitrogen hose.
10. Attach nitrogen supply hose to JIC fitting downstream of acrolein valve (orange). Adjust nitrogen pressure to 10psi and open acrolein valve. Listen/feel or observe for nitrogen escaping from upstream JIC fitting (remote mount) or bottom of riser. If nitrogen is escaping rebuild or replace the check valve and repeat check of check valve.
11. Back off pressure on regulator. Close orange manifold valve and disconnect nitrogen hose.

12. Injection point check valve: Cover open end of sample point with rag or direct open end to a pail and open system valve and check for back flow of fluid. If fluid back flows through check valve, close system valve and repair/replace check valve. Repeat check of check valve.

This procedure is to be used prior to any assembly or installation of an acrolein manifold. This includes the first assembly each day of temporary installations (truck treating or drive on/drive off). There are separate procedures for container mount and remote mount type manifolds. If any manifold component is found to be malfunctioning or defective, replace immediately.

Procedures for Leak Test

1. Ensure correct PPE is worn or available i.e. appropriate work clothing, respirator with organic vapor cartridges with P-100 pre-filters, butyl rubber gloves, soda ash solution or bisulfite, and at least 5 gallons of fresh water.
2. Open bonnet and remove plugs from blue nitrogen and orange acrolein valves on container.
3. Remove any Teflon tape from inside valves and blow out debris with nitrogen utilizing the stainless-steel braided hose from nitrogen regulator assembly.
4. Attach the stainless-steel braided hose from nitrogen regulator assembly to the nitrogen inlet JIC fitting on the manifold.
5. Attach manifold to acrolein container. Keep acrolein container valves closed. All manifold valves should be closed.
6. Attach nitrogen and acrolein hoses to respective fittings on manifold and acrolein container.
7. Attach discharge hose to injection point.
8. With all manifold and injection point valves closed, open the nitrogen supply valve and adjust nitrogen regulator to 88psi (10% above max application pressure).
9. Check for leaks at all fittings from the nitrogen bottle up to the blue nitrogen valve on the manifold using a soap solution. Back off pressure and retighten connections if necessary.
10. Open blue nitrogen valve (on the manifold) and check for leaks at all fittings up to the yellow by-pass valve and to the nitrogen valve on the container using a soap solution. Back off pressure and retighten connections if necessary.
11. Open yellow by-pass valve and check all connections up to the orange acrolein valve on the manifold and to the acrolein valve on the container. Back off pressure and retighten connections if necessary.
12. Open orange acrolein valve (on the manifold) and check all connections to the injection point for leaks. Back off pressure and retighten connections if necessary.
13. Close nitrogen bottle valve.
14. Conduct a 3 minute nitrogen pressure hold test to verify integrity of discharge hose. If hose does not hold pressure replace before applying acrolein.
15. Bleed nitrogen pressure off of the entire system into the customers system. NOTE: Observe pressure gauge on manifold to ensure it decreased to system pressure as this ensures the injection point is clear of debris verifying the system is open and ready for treatment.
16. If plugging has occurred bleed off nitrogen pressure, remove fittings from vessel and remove debris. If plugging cannot be cleared select another suitable injection point.
17. Reassemble and repeat steps 7-14 in section above regarding leak/pressure testing.
18. Close orange acrolein and yellow by-pass valves on manifold.

Procedure for Treating

1. Have on appropriate work clothing, respirator with organic vapor cartridges, butyl rubber gloves, soda ash solution or bisulfite, and at least 5 gallons of fresh water.
2. Open blue nitrogen valve on manifold and acrolein container then adjust nitrogen regulator to desired application pressure (maximum allowed pressure 80psi).
3. Zero flow meter then slowly open orange acrolein valve on container and orange acrolein valve on manifold then proceed with application.
4. Regulate acrolein flow with acrolein ball valve or needle valve and by adjusting nitrogen pressure. Always use as low a nitrogen pressure as possible to achieve desired application rate.
5. When application is complete, close orange acrolein valve and blue nitrogen valve on the acrolein container.
6. Increase nitrogen pressure to 20psi above container pressure and/or system pressure but do not increase above maximum allowable pressure of 80psi.
7. Open yellow by-pass valve to purge acrolein from equipment and discharge hose into the customers system by walking out the line twice. Close valve at injection point.
8. Close orange acrolein valve on the manifold.
9. With yellow by-pass valve still open, fully open and close orange acrolein valve on container 4 times to force remaining acrolein in manifold hose or riser back into the container. Close orange valve on the acrolein container and secure with clip.
10. Close nitrogen supply valve on bottle.
11. Optimally (if system pressure allows) open injection point valve, yellow by-pass valve and orange acrolein valve on manifold then open blue nitrogen valve on the container. Allow as much depressurization as possible into the treated system. To complete depressurization open blue nitrogen valve on acrolein container and nitrogen bleed valve on manifold and bleed off (into neutralizing solution) container pressure to a minimum of 12psi and a maximum of 20psi for cylinders and 60psi for skids. Close and secure blue valve and close vent valve. Alternatively open yellow by-pass and orange acrolein valves on manifold and bleed excess pressure from container through the bleed valve at the injection point. Purge acrolein vapor from equipment with nitrogen when depressurization is complete.
12. Close all valves on manifold.
13. Disconnect the hose between nitrogen regulator assembly and manifold.
14. Remove nitrogen regulator assembly. Replace nitrogen bottle valve stem cover.
15. Remove manifold and discharge hoses then tape and re-install plugs in container valves.
16. Close acrolein container bonnet and secure with latch. Re-secure with dual restraints.
17. Remove full-face respirator.

Multiple Container Batch Application Procedures

1. Ensure correct PPE is worn i.e. appropriate work clothing, respirator with organic vapor cartridges with P-100 pre-filters, butyl rubber gloves, soda ash solution or bisulfite, and at least 5 gallons of fresh water.
2. Open bonnets and remove plugs from blue nitrogen and orange acrolein valves on each container.
3. Remove any Teflon tape from inside valves and blow out debris with nitrogen utilizing the stainless-steel braided hose from nitrogen regulator assembly.
4. Attach manifold to one acrolein container. Keep all acrolein container valves closed. All

manifold valves should also be closed.
5. Attach the stainless-steel braided hose from nitrogen regulator assembly to the nitrogen inlet JIC fitting on the manifold.
6. Attach male JIC fittings to their respective blue nitrogen and orange acrolein valves on the other container(s) to be used.
7. Attach nitrogen and acrolein hoses to respective fittings on manifold and to each acrolein container.
8. Attach discharge hose to injection point.
9. NOTE: It is critical to verify that all nitrogen container valves do not have polymer blockage below the valve. With all manifold and injection point valves closed, open the nitrogen supply valve and adjust nitrogen regulator to 40psi.
10. Open blue nitrogen valve on manifold to pressurize manifold to 40psi then close blue nitrogen valve on the manifold.
11. Quickly open and close the blue nitrogen valve on the container that the manifold is connected to. Verify 40psi on manifold gauge decreases to container pressure.
12. Re-pressurize manifold to 40psi and close blue nitrogen valve on manifold.
13. Quickly open and close the blue nitrogen valve on the second container. Verify 40psi on manifold gauge decreases to container pressure.
14. Repeat this procedure for each acrolein container.
15. NOTE: It is critical to verify that all acrolein container valves do not have polymer blockage below the valve. With all manifold and injection point valves closed, open the nitrogen supply valve and adjust nitrogen regulator to 40psi.
16. Open blue nitrogen valve and yellow bypass valve on manifold to pressurize manifold to 40psi then close blue nitrogen valve on the manifold.
17. Quickly open and close the orange acrolein valve on the container that the manifold is connected to. Verify 40psi on manifold gauge decreases to container pressure.
18. Re-pressurize manifold to 40psi and close blue nitrogen valve on manifold.
19. Quickly open and close the orange acrolein valve on the second container. Verify 40psi on manifold gauge decreases to container pressure.
20. Repeat this procedure for each acrolein container.
21. With all manifold and injection point valves closed, open the nitrogen supply valve and adjust nitrogen regulator to 88psi (10% above max application pressure).
22. Check for leaks at all fittings from the nitrogen bottle up to the blue nitrogen valve on the manifold using a soap solution. Back off pressure and retighten connections if necessary.
23. Open blue nitrogen valve on the manifold and check for leaks at all fittings up to the yellow by-pass valve and to the nitrogen valves on each container using a soap solution. Back off pressure and retighten connections if necessary.
24. Open yellow by-pass valve and check all connections up to the orange acrolein valve on the manifold and to the acrolein valves on each container. Back off pressure and retighten connections if necessary.
25. Open orange acrolein valve on the manifold and check all connections to the injection point for leaks. Back off pressure and retighten connections if necessary.
26. Close nitrogen bottle valve.
27. Conduct a 3-minute nitrogen pressure hold test to verify integrity of all SS braided hoses. If hoses do not hold pressure replace before applying acrolein.
28. Bleed nitrogen pressure off from the entire system into the customers system. NOTE:

Observe pressure gauge on manifold to ensure it decreased to system pressure as this ensures the injection point is clear of debris verifying the system is open and ready for treatment.
29. If plugging has occurred bleed off nitrogen pressure, remove fittings from vessel and remove debris. If plugging cannot be cleared select another suitable injection point.
30. Reassemble and repeat steps 7-14 in section above regarding leak/pressure testing.
31. Close orange acrolein and yellow by-pass valves on manifold.
32. Follow **Procedure For Treating** stated above with the exceptions stated below.
33. **NOTE**: If the application rate and total is required for the treatment the application should be done using only one container at a time as containers will not empty at the same time.
34. After the application is complete purge the acrolein hoses back into each container one at a time.
35. If applicable, the containers can be depressurized one at a time or all at the same time.

Emergency Shut Down Procedures

1. Prior to application, should the burst of nitrogen (40-80psi) indicate the injection point became plugged:
    a. Shut off nitrogen supply
    b. Slowly release trapped nitrogen through bleed of valve at the injection point
    c. Remove injection hose and attempt to clear injection point
    d. Reattach hose and apply 40-80psi nitrogen pressure to discharge hose by opening yellow bypass valve ensuring the injection point is clear
    e. Close injection point valve, increase nitrogen to pressure to 88psi and spray soap solution on manipulated fittings
    f. Repair leaks as required
    g. Begin application
2. Should a small leak occur in the application equipment during application
    a. Put on PPE
    b. Close both the acrolein and nitrogen valves on the cylinder
    c. Open yellow bypass valve to purge acrolein from manifold and discharge hose
    d. Close acrolein valve on manifold
    e. Increase nitrogen pressure by 20psi then fully open and close acrolein valve on cylinder 4 times to sweep acrolein from hose or riser back into the container
    f. Latch both nitrogen and acrolein valves on cylinder
    g. Repair leak as required
    h. Follow steps for leak test with soap solution
    i. Complete application
    j. Purge, clean, and properly store equipment

Continuous Injection with Pump and Sight Glass

Pre-Job Checklist and Precautions

1. Have full-face air purifying respirator with organic vapor cartridges and pre-filter, butyl rubber gloves, appropriate FRC work clothing, soda ash/water or bisulfite neutralizing solution, at least 5 gallons of fresh water, 20 pounds of dry soda ash, and 5 lb. fire extinguisher. Wear

full-face respirator with organic vapor cartridges, butyl rubber gloves, and appropriate clothing as soon as the bonnet is open, when hooking up, changing, or breaking down acrolein application equipment.

2. Have the Acrolein Safety Management Plan (ASMP) that contains all required documents such as SOP's, current SDS, continuous application ORA, acrolein product manual, equipment hookup/change out forms, EPA Pesticide Recordkeeping forms USA regulation), and Special Permits for transportation (if applicable and are country specific), etc.
3. Be familiar with first aid procedures.
4. Ensure critical component application equipment is from single source supplier. See pressure gauge and gauge isolation valve.
5. Know your procedures thoroughly, rehearsing if necessary, before doing the job.
6. Check injection point to ensure it is clear and valve is operating properly.
7. Before assembling or breaking down application equipment ensure that blue and orange valve handles on the acrolein container are in the closed and locked position with clips installed.
8. Tape all NPT connections using nickel anti-seize tape to prevent leaks and thread galling.

USE OF PRESSURE GAUGE AND GAUGE ISOLATION VALVE

NOTE: Ensure that the pressure gauges are all stainless steel (including internals) and are liquid filled. The pressure rating of the gauge on the discharge side of pump should be a minimum of 2 times the maximum pump rating. This gauge rating is to ensure gauge integrity in case of stinger/quill plugging, internal relief valve failure, and gauge isolation valve failure. A stainless-steel Teflon seat "self-closing" Apollo brand ball valve is to be installed below the gauge. The spring loaded self-closing isolation valve will ensure the pressure gauge is isolated except while monitoring injection pressure. No other pressure gauge value or ball valve type and manufacturer can be used. **NOTE**: See **Step 30** in "Procedure for Assembling, Pressure Testing, and Setting Injection Rates" for operating procedure.

ALTERNATIVELY, a diaphragm isolated gauge could be utilized, contact an Acrolein Technical Specialist for details of suitable gauges.

Procedures for Verifying Integrity of Manifold Check Valves

This procedure is to be used at each acrolein container change out. If any manifold component is found to be malfunctioning or defective, repair/replace immediately.

1. Injection system must be purged so no liquid (acrolein or methanol/water) remains in the line and system is depressurized. Ensure bypass around pump and the bypass, if installed, around the 50psi check at the injection point have also been purged. Use approximately 80psi nitrogen for purging system for a few minutes. Ensure sight glass has been isolated prior to purge.
   NOTE: For higher pressure systems purging of fluid can be accomplished by using the bleed valve at the injection point. Purge into neutralizing solution.
2. Ensure that nitrogen regulator valve is closed (handle turned counter-clockwise) and all valves on the manifold and at the injection point are closed.
3. Disconnect the nitrogen hose from the regulator then open nitrogen bottle valve and begin quickly turning regulator valve clockwise until excess flow valve actuates (usually 20-30psi). If the excess flow valve does not shut off flow replace immediately to prevent possible over-pressuring acrolein container if regulator fails.
4. Turn off nitrogen valve and turn regulator valve counter-clockwise then clockwise to reseat

excess flow valve.

5. Connect nitrogen supply hose to regulator and JIC fitting below the gauge on remote mount manifold. Adjust nitrogen pressure to 10psi then open nitrogen valve (blue) on manifold. Listen/feel for nitrogen escaping through inlet JIC fitting. If nitrogen is escaping rebuild or replace the check valve.
6. Back off pressure on regulator valve. Close blue nitrogen valve.
7. Attach nitrogen supply hose to JIC fitting downstream of bypass valve (yellow). Adjust nitrogen pressure to 10psi then open yellow valve. Listen/feel for nitrogen escaping through JIC fitting below gauge. If nitrogen is escaping rebuild or replace the check valve.
8. Back off pressure on regulator valve. Close yellow bypass valve.
9. Attach nitrogen supply hose to JIC fitting downstream of acrolein valve (orange). Adjust nitrogen pressure to 10psi. Listen/feel for nitrogen escaping from upstream JIC fitting. If nitrogen is escaping rebuild or replace the check valve.
10. Back off pressure on regulator valve. Close orange manifold valve and disconnect nitrogen supply hose.
11. Injection point check valves: To check the 50psi check open bleed off valve at injection point and injection point valve to ensure produced fluid does not come out. If produced fluid comes out of bleed off valve repair or replace 50psi check valve.
    1psi injection point bypass check valve, if applicable: If the 50psi check is functioning properly open the bypass valve around the 50psi check to ensure produced fluid does not come out. If fluid comes out repair/replace the 1psi check.

Procedure for Assembling, Pressure Testing, and Setting Injection Rates

1. Don full-face respirator and butyl rubber gloves. Open bonnet and remove valve plugs from (blue) nitrogen and (orange) acrolein valves on the acrolein container. (Use brush to remove Teflon tape from inside valves and blow out debris with nitrogen)
2. Attach manifold nitrogen and acrolein SS hoses to acrolein container at respective valves. Double check to ensure proper orientation. Keep acrolein container valves closed. All manifold valves should be closed.
3. Attach the SS hose from regulator assembly to the manifold inlet nitrogen JIC fitting.
4. With all manifold valves closed, open the nitrogen bottle valve and adjust nitrogen regulator valve to 88psi (10% above maximum application pressure).
5. Check all fittings up to the (blue) nitrogen inlet manifold valve for leaks by using a soap solution. Retighten/retape connections if necessary.
6. Open (blue) nitrogen valve and check all fittings for leaks by using a soap solution up to the (yellow) bypass valve. Include nitrogen fittings on hose connected to acrolein container and nitrogen line to top of sight glass. Retighten connections if necessary.
7. Open (yellow) bypass valve and check all fittings for leaks by using a soap solution up to the (orange) acrolein valve. Include acrolein fittings on hose connected to acrolein container. Retighten connections if necessary.
8. Open (orange) acrolein valve on manifold and check all fittings up to injection point valve for leaks by using a soap solution. Include fittings on bypass of pump and pump. Retighten connections if necessary. **NOTE: Open self-closing valve below gauge and check for leaks.**
9. Close nitrogen bottle and conduct 3-minute hold test on entire system to check for leaks.

10. Back off regulator, open nitrogen bottle, and set nitrogen pressure to 40psi. Open either top or bottom sight glass valves and pressurize sight glass. IMPORTANT; Remove shield from sight glass and spray soap solution around the top and bottom of glass tube. If there is a leak around the glass tube isolate sight glass, then depressurize into neutralizing solution through nitrogen bleed off valve. Remove sight glass, loosen set screw on the bottom and carefully tighten the large nut that holds the glass into place. Caution: Do Not Over-tighten this nut or the compression on the tube will break the glass. Reinstall sight glass, re-pressurize and soap test again.
11. Back off nitrogen regulator valve (counter-clockwise) then bleed nitrogen pressure off of entire system through bleed off valve at injection point. Depressurize into neutralizing solution.
12. Close bleed off valve and open system valve at injection point.
13. Close (yellow) bypass valve and (orange) acrolein valves on manifold.
14. Open methanol container valve and methanol valve at bottom of sight glass. With sight glass vent valve open to neutralizer add only a few inches of methanol to sight glass.
15. Isolate methanol valves then slowly crack open bottom sight glass valve to allowing any trapped nitrogen to bubble through the methanol.
16. Isolate sight glass and close valve between sight glass and pump.
17. Set nitrogen regulator to 20psi and slowly open nitrogen (blue) valve on acrolein container. Allow container to pressurize to 20psi.
18. Slowly open acrolein (orange) valve on container.
19. With sight glass valves closed, open acrolein (orange) valve on manifold.
20. Open sight glass vent valve to neutralizer solution.
21. Open acrolein (orange) valve upstream of the sight glass then **very slowly** crack open bottom sight glass isolation valve.
22. Allow trapped nitrogen from dip tube, hose, and manifold to slowly bubble through methanol until most of the bubbling stops and acrolein starts entering the sight glass. This can take several minutes.
23. Close acrolein valve upstream of sight glass and bottom sight glass valve.
24. Fill sight glass with methanol.
25. Close sight glass vent valve. Apply injection system (20psi) nitrogen to sight glass.
26. Open bottom sight glass isolation valve and valve between sight glass and pump.
27. Turn on pump and by repeating above steps pump enough methanol to fill the discharge lines and check all pump and discharge fittings for leaks. **Open the pressure gauge isolation valve to note proper gauge function, injection line pressure, and also check for leaks.**
28. If the pump remains air locked quickly open and close the 50psi bypass on the injection point. Continue to add methanol to the sight glass and repeat this procedure until the pump is operating smoothly. Alternatively, leave the bypass valve open and continue pumping methanol until stroke length indicates the pump is fluid filled.
29. Turn off pump.
30. Close valves downstream of sight glass and at the bottom of sight glass.
31. Depressurize sight glass into neutralizing solution.
32. If bypass around 50psi check valve at injection point is open close it and attach clip to handle.
33. Slowly open valve upstream of sight glass and **very slowly** crack open bottom sight glass isolation valve allowing additional trapped nitrogen to bubble through remaining methanol and allow acrolein in sight glass (enough to check injection rate).
34. Close vent valve and valve upstream of sight glass. Open nitrogen valve to pressurize sight

glass (still 20psi).
35. Open valve downstream of sight glass then turn pump on and set desired rate. Turn pump off and follow previous procedure to add methanol for flushing the sight glass.
36. Restart pump and when methanol is out of sight glass quickly close bottom sight glass valve while opening acrolein valve upstream of sight glass. DO NOT leave methanol or acrolein in the sight glass.

Procedure for Changing Out Acrolein Containers

1. Shut off chemical pump.
2. Close acrolein (orange) valve and nitrogen (blue) valve on container.
3. Close acrolein (orange) valve on manifold.
4. Increase nitrogen pressure to 40psi.
5. Open bypass (yellow) valve on manifold.
6. Fully open and close the container acrolein (orange) valve several times to force any remaining acrolein in line back into the container. Close and secure orange valve.
7. Open bypass valve around 50psi check at injection point.
8. Open sight glass vent into neutralizer then fill sight glass with methanol then close vent.
9. Increase nitrogen pressure to 40-60psi then slowly open sight glass valve to push methanol through the pump. Do not empty the sight glass. Refill sight glass 3 times to push methanol into the injection system.
10. Increase nitrogen to 80psi and ensure sight glass is isolated.
11. Open acrolein valve on manifold and purge (for several minutes) methanol and acrolein from pump and discharge line into the customers system. If system pressure is too high purge fluid into neutralizing solution bucket.
12. Back off the regulator then close nitrogen bottle valve.
13. Bleed nitrogen pressure from entire system through bleed off valve at the injection point into neutralizing solution.
14. Close all valves including nitrogen bottle.
15. Remove hoses from acrolein container. Replace valve plugs and secure lid.
16. Follow previous procedures for Verifying Check Valve Integrity and Assembly, Pressure Testing, and Setting Rate.

Startup After Emergency Shut Down

1. Follow above “Procedure for Changing Out Acrolein Containers” for purging system.
2. Ensure system being treated is in normal condition, if that was the reason for shutdown.
3. If emergency shut down was due to a problem with the acrolein injection system repair or replace faulty equipment.
4. Follow above stated “Procedure for Assembling, Pressure testing, and Setting Injection Rate”.

Acrolein Squeeze Applications

Pre-Job Checklist and Requirements

1. Have safety gear – full-face air purifying respirator with organic vapor cartridges and pre-filter, butyl rubber gloves, appropriate FRC work clothing, soda ash/water or bisulfite neutralizing

solution, at least 5 gallons of fresh water, 20 pounds of dry soda ash, and 5 lb. fire extinguisher. Wear full-face respirator, butyl rubber gloves and appropriate clothing as soon as the bonnet lid is open, when hooking up, changing or breaking down acrolein application equipment.

2. Have the acrolein applicator documents that contain current SDS, squeeze application ORA, acrolein products manual, equipment hookup/change out forms, EPA Pesticide Recordkeeping forms (USA regulation MAGNACIDE B), and Special Permits for transportation (country specific), etc.
3. Be familiar with first aid procedures.
4. Conduct an on-site safety meeting and complete relevant STP or customer JHA as required.
    - Review 1st aid information
    - Review relevant physical properties of acrolein (vapor density, flammability, etc.)
    - Review roles and responsibilities (essential personnel only on site)
    - Review application procedures
    - Review leak procedure contingency plan
    - Note wind direction (park upwind if possible)
    - Discuss escape plan and muster point
5. Ensure pump truck is suitable for job with no leaks and has required water volume.
6. Use critical component application equipment from single source supplier.
7. Know your procedures thoroughly, rehearsing if necessary, before doing the job.
8. Before assembling or breaking down application equipment ensure that blue and orange valve handles on the acrolein container are in the closed and locked position with clips installed.
9. Tape all NPT connections using nickel anti-seize tape to prevent leaks and thread galling.
10. Use LOTO as required.

Procedures for Verifying Integrity of Manifold Check Valves

1. Before connecting nitrogen regulator to nitrogen bottle, check the following:
    - Nitrogen regulator handle is fully out (counter-clockwise).
    - A 100psi cracking check valve is installed on the inlet of the regulator.
    - An excess flow valve is installed on the discharge of the regulator to prevent over pressuring the acrolein container if regulator fails.
2. Connect nitrogen regulator.
3. Open nitrogen bottle valve and quickly turn regulator valve clockwise until excess flow valve actuates (20-30psi). If excess flow valve does not activate and restrict flow replace immediately.
4. Turn off nitrogen bottle valve and turn regulator valve counter-clockwise then clockwise to reseat excess flow valve.
5. Ensure all valves on manifold are closed.
6. Nitrogen side of manifold:
   Remote Mount: Attach nitrogen hose to JIC fitting at bottom of cross below pressure gauge. With nitrogen valve (blue) and by-pass valve (yellow) closed adjust nitrogen pressure to 10psi then open nitrogen valve (blue) on manifold. Listen/feel for nitrogen escaping through inlet JIC fitting. If nitrogen is escaping rebuild or replace the check valve.
   Container Mount: Attach nitrogen hose to JIC fitting at side of cross below pressure gauge. Use ½" cap to cap end of ½" riser nipple. With nitrogen valve (blue) closed adjust nitrogen

pressure to 10psi then open nitrogen valve (blue) on manifold. Listen/feel for nitrogen escaping through inlet JIC fitting. If nitrogen is escaping rebuild or replace the check valve.
7. Back off pressure on regulator valve. Close blue nitrogen valve.
8. Acrolein side of manifold:
   Remote Mount: Attach nitrogen supply hose to JIC fitting downstream of by-pass valve (yellow). Adjust nitrogen pressure to 10psi then open yellow valve. Listen/feel for nitrogen escaping through JIC fitting at bottom of cross below pressure gauge. If nitrogen is escaping rebuild or replace the check valve.
   Container Mount: Attach ½" collar with ¼" male JIC to riser nipple. Attach nitrogen supply hose to JIC fitting at bottom of riser. With by-pass valve (yellow) and acrolein valve (orange) closed adjust nitrogen pressure to 10psi then open yellow valve. Listen/feel for nitrogen escaping through JIC fitting at bottom of cross below pressure gauge. If nitrogen is escaping rebuild or replace the check valve.
9. Back off pressure on regulator valve. Close yellow by-pass valve.
10. Attach nitrogen supply hose to JIC fitting downstream of acrolein valve (orange). Adjust nitrogen pressure to 10psi and open acrolein valve. Listen/feel for nitrogen escaping from JIC fitting at bottom of riser. If nitrogen is escaping rebuild or replace the check valve.
11. Back off pressure on regulator. Close orange manifold valve and disconnect nitrogen hose.
12. Injection point check valve: Open system valve and check for back flow of fluid. If fluid back flows through check valve repair/replace.

Procedures for Leak Test

1. Attach the stainless-steel braided hose from nitrogen regulator assembly to the nitrogen inlet JIC fitting on the manifold.
2. Have on appropriate work clothing, respirator with organic vapor cartridges, butyl rubber gloves, soda ash solution or bisulfite, and at least 5 gallons of fresh water.
3. Open bonnet and remove plugs from blue nitrogen and orange acrolein discharge valves on container.
4. Remove any Teflon tape from inside valves and blow out debris with nitrogen. Attach manifold to acrolein container. Keep acrolein container valves closed. All manifold valves should be closed.
5. Attach nitrogen and acrolein hoses to respective fittings on manifold and acrolein container.
6. Attach discharge hose to injection point.
7. With all manifold and injection point valves closed open the nitrogen supply valve and adjust nitrogen regulator to 88psi (10% above max application pressure).
8. Open blue nitrogen valve (on the manifold) and check for leaks at all fittings up to the yellow by-pass valve and up to the nitrogen valve on the container using a soap solution. Back off pressure and retighten connections if necessary.
9. Open yellow by-pass valve and check all connections up to the orange acrolein valve on the manifold and up to the acrolein valve on the container. Back off pressure and retighten connections if necessary.
10. Open orange acrolein valve (on the manifold) and check all connections to the injection point for leaks. Back off pressure and retighten connections if necessary.
11. Close nitrogen bottle valve.
12. Conduct a 3-minute nitrogen pressure hold test to verify integrity of discharge hose. If hose does not hold pressure replace before applying acrolein.

13. Bleed nitrogen pressure off from the entire system into neutralizing solution utilizing the bleed off valve at the end of the discharge hose.
14. Close orange acrolein and yellow by-pass valves on manifold.

Procedure for Treating

1. Open blue nitrogen valve on manifold and acrolein container then adjust nitrogen regulator to desired application pressure (maximum allowed pressure 80psi; typical squeeze <20psi).
2. Zero flow meter then slowly open orange acrolein valve on container and orange acrolein valve on manifold then proceed with application.
3. Regulate acrolein flow with acrolein ball valve or needle valve and by adjusting nitrogen pressure. Acrolein rate is based on desired concentration and pump rate of water.
4. When application is complete, close orange acrolein valve and blue nitrogen valve on the acrolein container.
5. Open yellow by-pass valve to purge acrolein from equipment and discharge hose by walking out line twice. Close valve at injection point. NOTE: The pump truck may need to decrease rate to prevent nitrogen from interfering with pumping (knocking of pump fluid end). NB if nitrogen causes pump to stall (lose prime) then line product can be purges into a container of neutralizing solution.
6. Close orange acrolein valve on the manifold.
7. Increase nitrogen pressure to 20psi above container pressure.
8. With yellow by-pass valve still open, fully open and close orange acrolein valve on container 4 times to force remaining acrolein in manifold hose or riser back into the container. Close orange valve on the acrolein container and secure with clip.
9. Close nitrogen supply valve on bottle.
10. Put on full-face respirator.
11. Open orange acrolein valve on manifold and bleed off entire system nitrogen pressure slowly through discharge hose into neutralizing solution through injection point bleed off valve.
12. Close all valves on manifold.
13. If required due to container pressure >20psi open blue nitrogen valve on acrolein cylinder and nitrogen bleed valve on manifold and bleed off (into neutralizing solution) container pressure to a minimum of 12psi and maximum of 20psi for cylinders and 60psi for skids. Close and secure blue valve and close vent valve. Alternatively open yellow by-pass and orange acrolein valves on manifold and bleed excess pressure from container through the bleed valve at the injection point. Purge acrolein vapor from equipment with nitrogen when depressurization is complete.
14. Disconnect the line between nitrogen regulator assembly and manifold.
15. Remove nitrogen regulator assembly. Replace nitrogen bottle valve stem cover.
16. Remove manifold and discharge hoses then tape and re-install plugs into container valves.
17. Close acrolein container bonnet and secure with latch. Re-secure with dual restraints.
18. Remove full-face respirator.
19. Rinse application equipment (optional) with water or methanol and store in a clean, dry and secure location.
20. Tag wellhead with Acrolein Danger tags with date, time, time to return well to production, and contact information.

Multiple Container Squeeze Application Procedures

1. Ensure correct PPE is worn i.e. appropriate work clothing, respirator with organic vapor cartridges with P-100 pre-filters, butyl rubber gloves, soda ash solution or bisulfite, and at least 5 gallons of fresh water.

2. Open bonnets and remove plugs from blue nitrogen and orange acrolein valves on each container.

3. Remove any Teflon tape from inside valves and blow out debris with nitrogen utilizing the stainless-steel braided hose from nitrogen regulator assembly.

4. Attach manifold to one acrolein container. Keep all acrolein container valves closed. All manifold valves should also be closed.

5. Attach the stainless-steel braided hose from nitrogen regulator assembly to the nitrogen inlet JIC fitting on the manifold.

6. Attach male JIC fittings to their respective blue nitrogen and orange acrolein valves on the other container(s) to be used.

7. Attach nitrogen and acrolein hoses to respective fittings on manifold and to each acrolein container.

8. Attach discharge hose to injection point.

9. NOTE: It is critical to verify that all nitrogen container valves do not have polymer blockage below the valve. With all manifold and injection point valves closed, open the nitrogen supply valve and adjust nitrogen regulator to 40psi.

10. Open blue nitrogen valve on manifold to pressurize manifold to 40psi then close blue nitrogen valve on the manifold.

11. Quickly open and close the blue nitrogen valve on the container that the manifold is connected to. Verify 40psi on manifold gauge decreases to container pressure.

12. Re-pressurize manifold to 40psi and close blue nitrogen valve on manifold.

13. Quickly open and close the blue nitrogen valve on the second container. Verify 40psi on manifold gauge decreases to container pressure.

14. Repeat this procedure for each acrolein container.

15. NOTE: It is critical to verify that all acrolein container valves do not have polymer blockage below the valve. With all manifold and injection point valves closed, open the nitrogen supply valve and adjust nitrogen regulator to 40psi.

16. Open blue nitrogen valve and yellow bypass valve on manifold to pressurize manifold to 40psi then close blue nitrogen valve on the manifold.

17. Quickly open and close the orange acrolein valve on the container that the manifold is connected to. Verify 40psi on manifold gauge decreases to container pressure.

18. Re-pressurize manifold to 40psi and close blue nitrogen valve on manifold.

19. Quickly open and close the orange acrolein valve on the second container. Verify 40psi on

manifold gauge decreases to container pressure.

20. Repeat this procedure for each acrolein container.

21. With all manifold and injection point valves closed, open the nitrogen supply valve and adjust nitrogen regulator to 88psi (10% above max application pressure).

22. Check for leaks at all fittings from the nitrogen bottle up to the blue nitrogen valve on the manifold using a soap solution. Back off pressure and retighten connections if necessary.

23. Open blue nitrogen valve on the manifold and check for leaks at all fittings up to the yellow by-pass valve and to the nitrogen valves on each container using a soap solution. Back off pressure and retighten connections if necessary.

24. Open yellow by-pass valve and check all connections up to the orange acrolein valve on the manifold and to the acrolein valves on each container. Back off pressure and retighten connections if necessary.

25. Open orange acrolein valve on the manifold and check all connections to the injection point for leaks. Back off pressure and retighten connections if necessary.

26. Close nitrogen bottle valve.

27. Conduct a 3-minute nitrogen pressure hold test to verify integrity of all SS braided hoses. If hoses do not hold pressure replace before applying acrolein.

28. Bleed nitrogen pressure off from the entire system into the customers system. NOTE: Observe pressure gauge on manifold to ensure it decreased to system pressure as this ensures the injection point is clear of debris verifying the system is open and ready for treatment.

29. If plugging has occurred bleed off nitrogen pressure, remove fittings from vessel and remove debris. If plugging cannot be cleared select another suitable injection point.

30. Reassemble and repeat steps 7-14 in section above regarding leak/pressure testing.

31. Close orange acrolein and yellow by-pass valves on manifold.

32. Follow Procedure For Treating stated above with the exceptions stated below.

33. NOTE: If the application rate and total is required for the treatment the application should be done using only one container at a time as containers will not empty at the same time.

34. After the application is complete purge the acrolein hoses back into each container one at a time.

35. If applicable, the containers can be depressurized one at a time or all at the same time.

Emergency Shut Down Procedures

Prior to application, should the burst of nitrogen (40-80psi) indicate the injection point became plugged:

a. Shut off nitrogen supply
b. Slowly release trapped nitrogen through bleed of valve at the injection point
c. Remove injection hose and attempt to clear injection point
d. Reattach hose and apply 40-80psi nitrogen pressure to discharge hose by opening

yellow bypass valve ensuring the injection point is clear
e. Close injection point valve, increase nitrogen to pressure to 88psi and spray soap solution on manipulated fittings
f. Repair leaks as required
g. Begin application

Should a small leak occur in the application equipment during application

a. Put on PPE
b. Close both the acrolein and nitrogen valves on the cylinder
c. Open yellow bypass valve to purge acrolein from manifold and discharge hose
d. Close acrolein valve on manifold
e. Increase nitrogen pressure by 20psi then fully open and close acrolein valve on cylinder 4 times to sweep acrolein from hose or riser back into the container
f. Latch both nitrogen and acrolein valves on cylinder
g. Repair leak as required
h. Follow steps for leak test with soap solution
i. Complete application
j. Purge, clean, and properly store equipment

Purge Vessel and/or Neutralizing Containers.

The choice of container for either a purge chemical or neutralizing container could be as simple as a plastic carboy or pail or a stainless-steel soda keg. Consideration must be made on the pressure requirements and safety devices or procedures with the chosen type of container. A soda keg is very suitable as it is stainless steel, rated to 100psi and fitted with a pressure relief valve. Contact your local Acrolein Technical Specialist for more information of system best suited for your application.

Diagram A Container Mount Acrolein Manifold

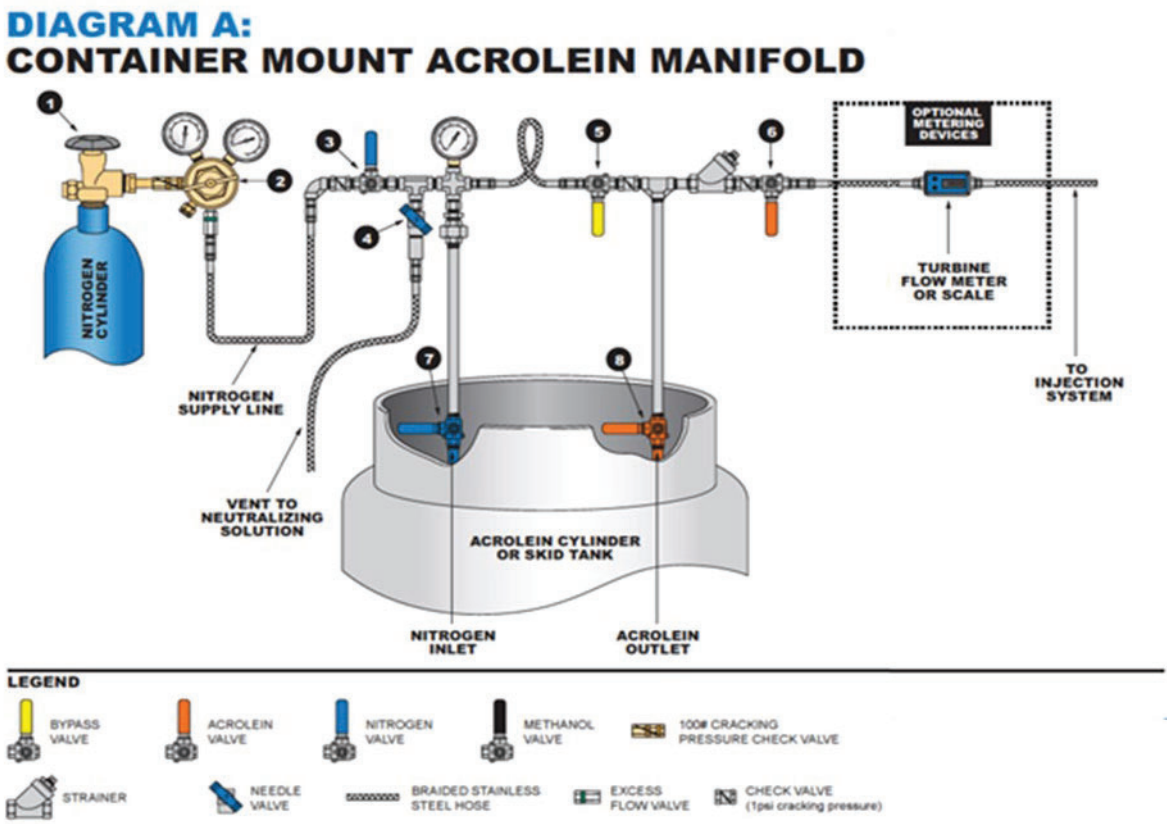

Diagram B Remote Mount Acrolein Manifold

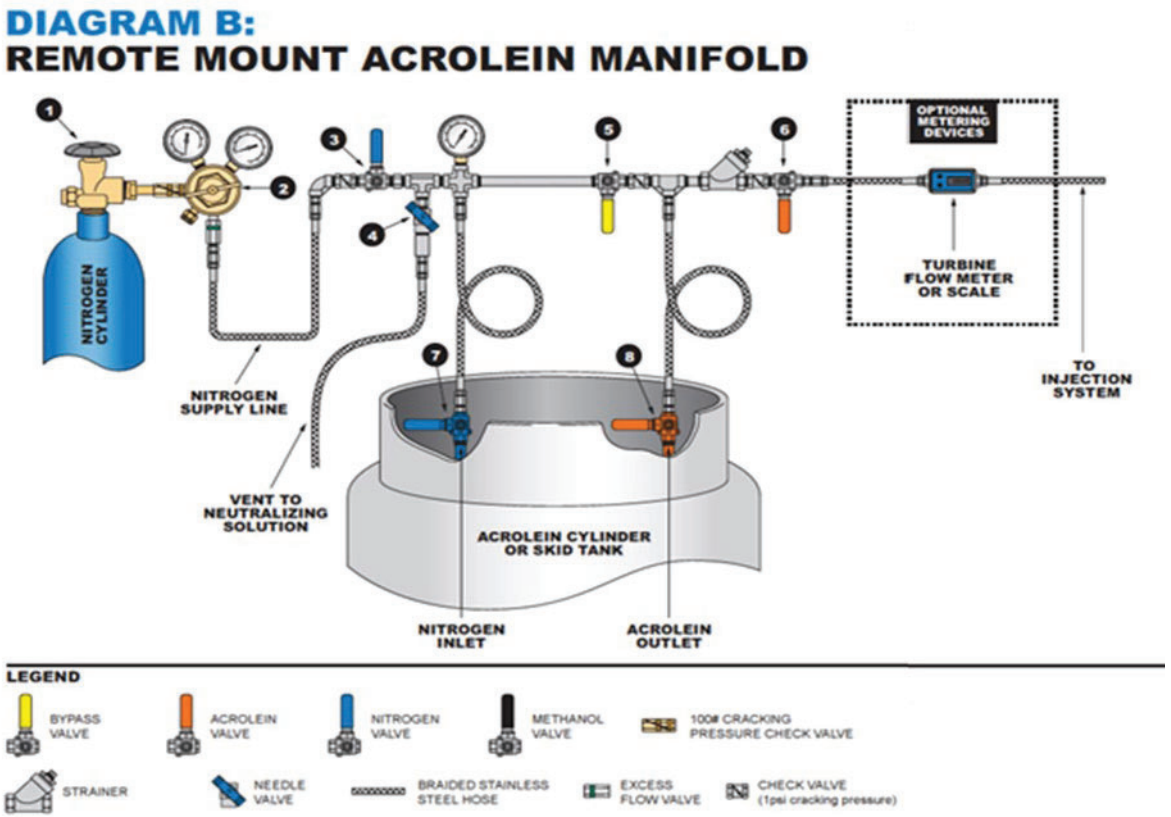

Diagram C Acrolein Injection Point

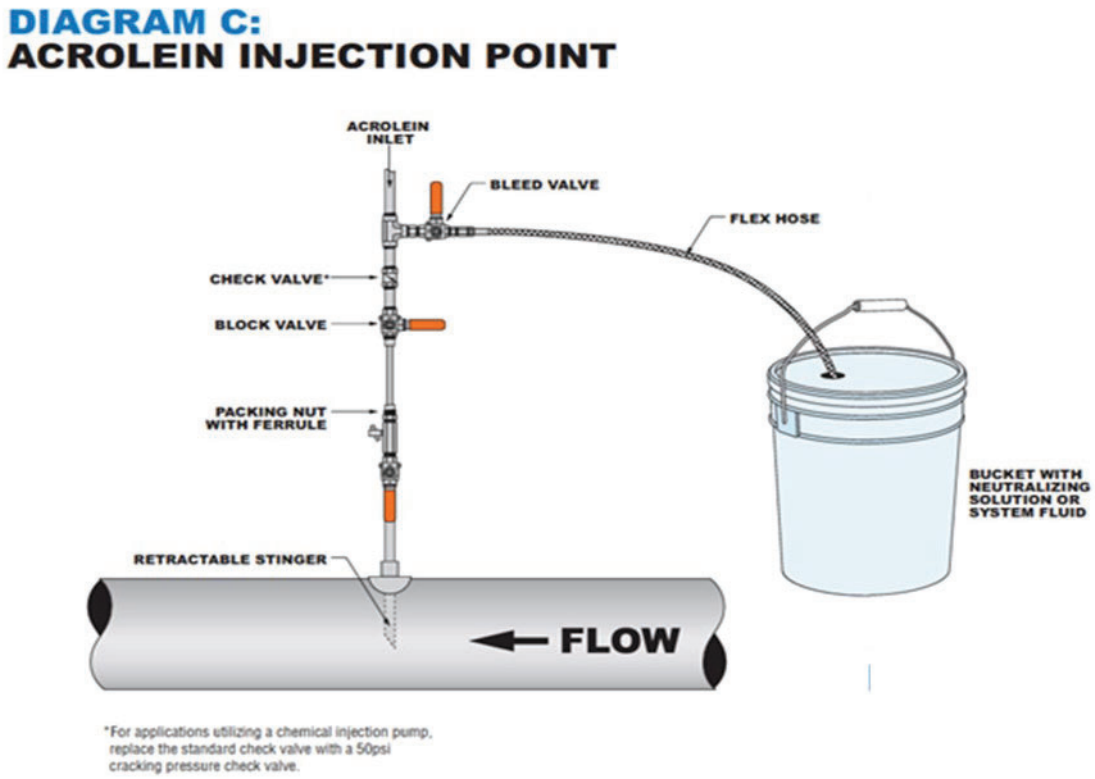

Diagram D Container Mount Multiple Acrolein Containers

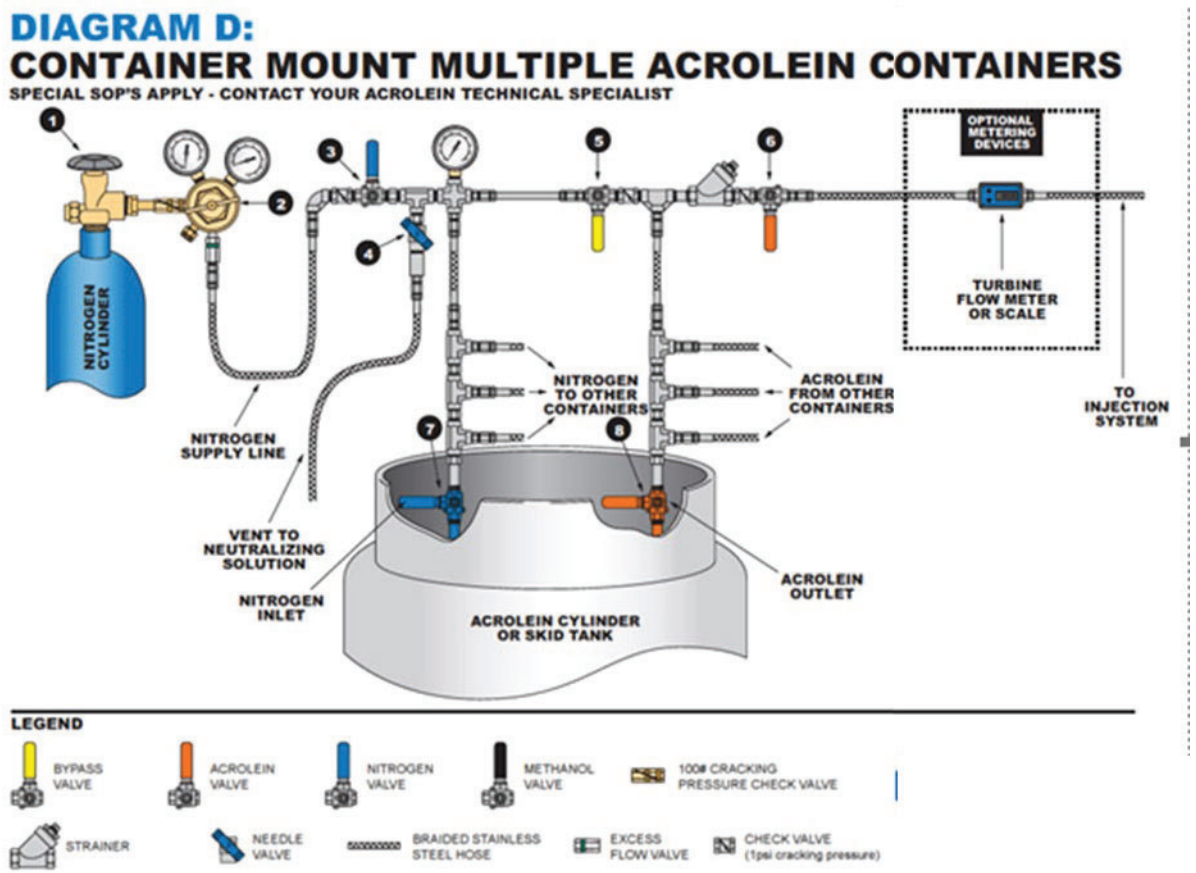

Diagram E Remote Mount Multiple Acrolein Containers

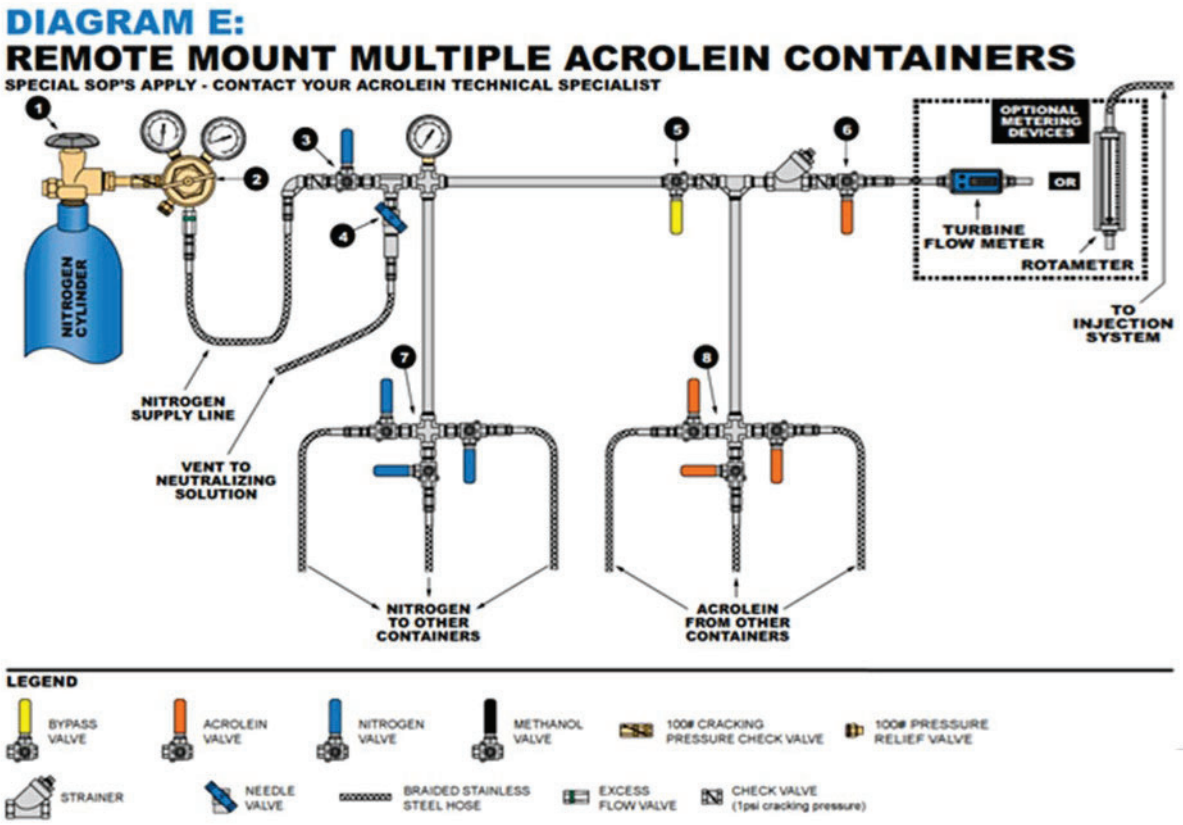

Diagram F Acrolein Installation with Pump and Sight Glass

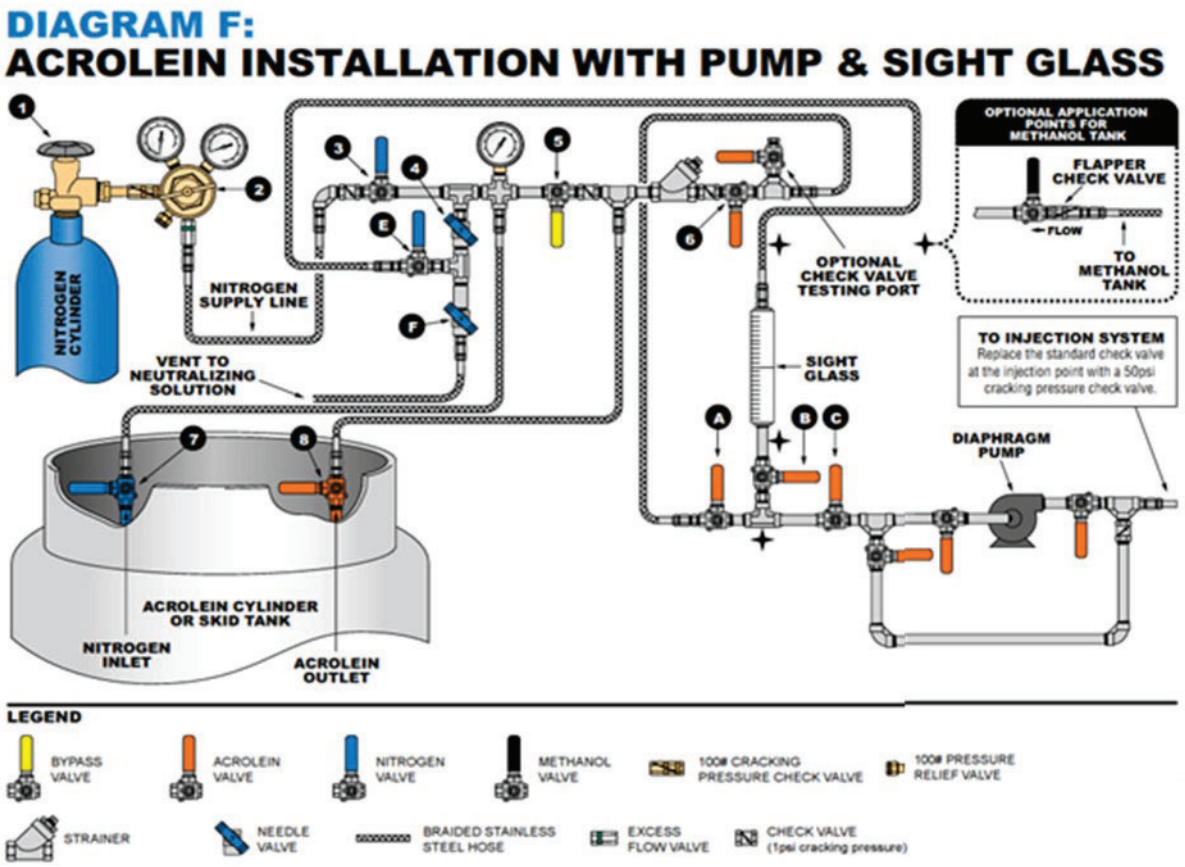

Diagram G Acrolein Application with Timer/Solenoid Actuator

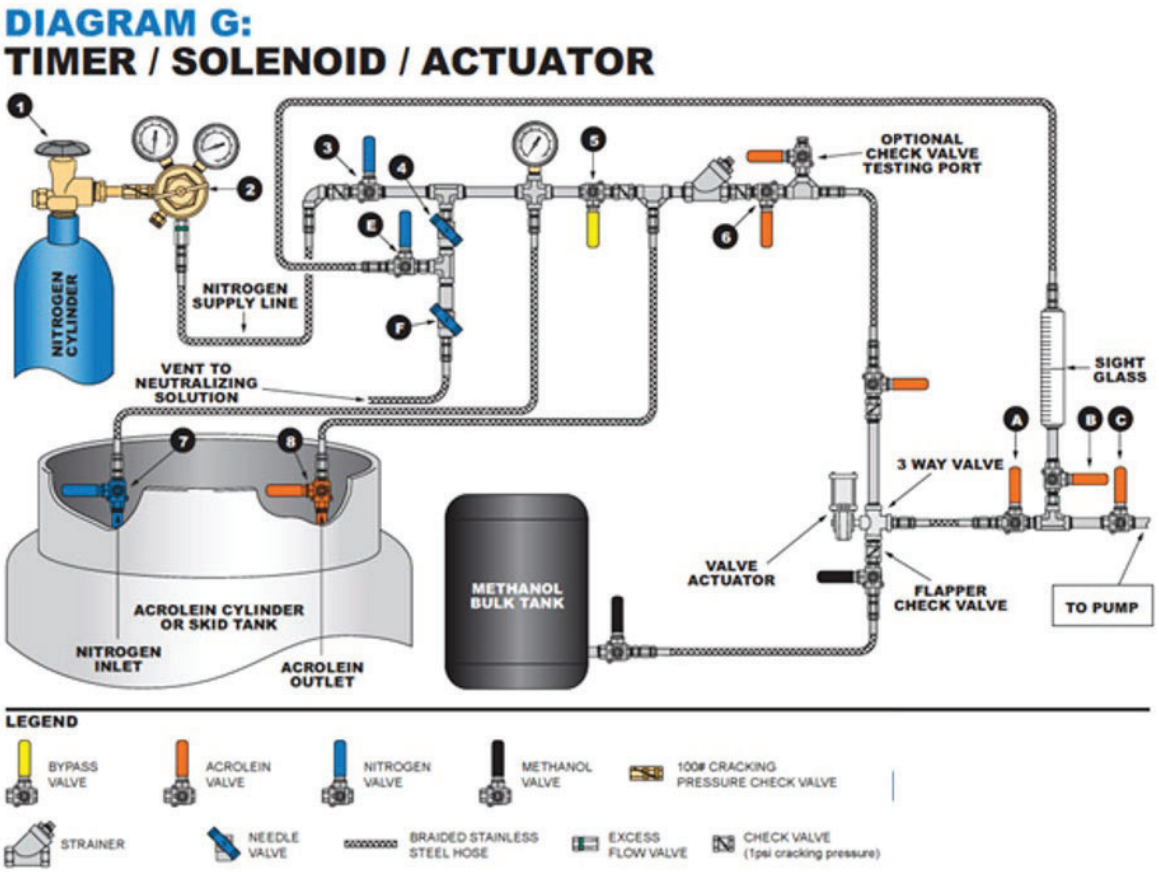

Diagram H Acrolein Application with Actuator and Pump

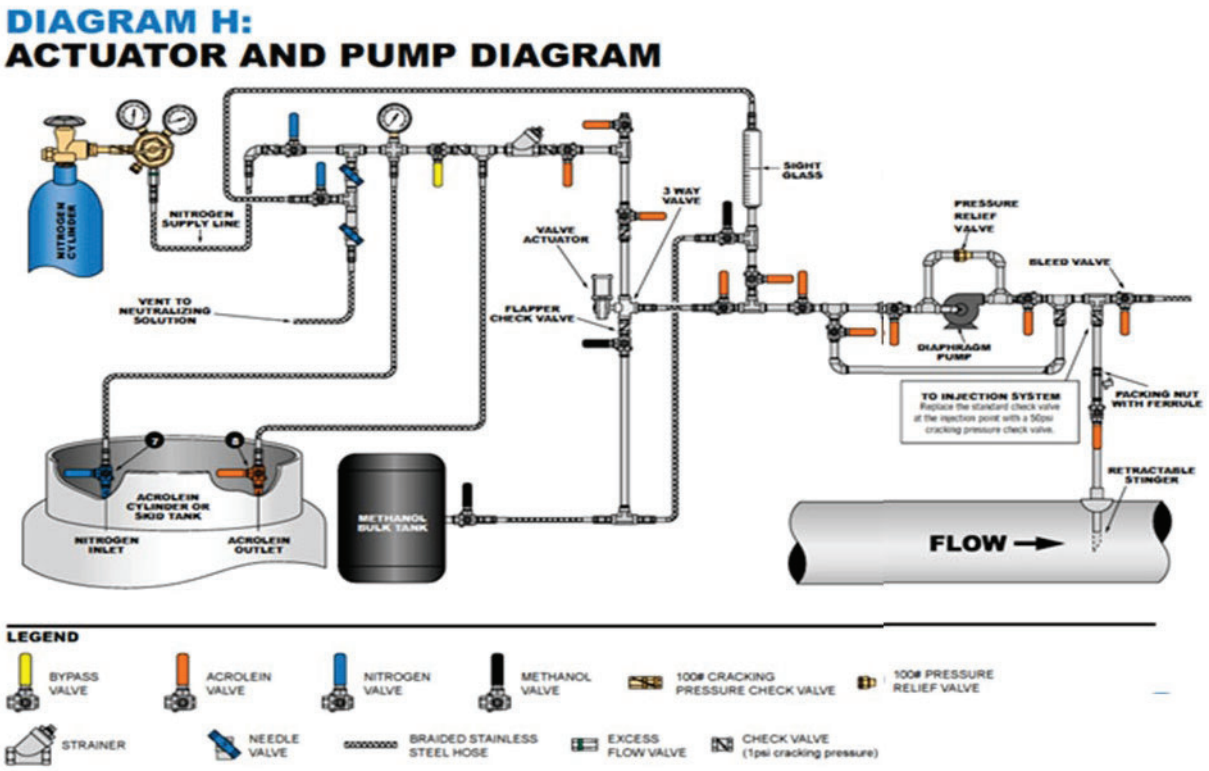

Diagram I Acrolein Sample Apparatus