CYLINK®

NMA-LF Monomer

CYTEC

CYLINK® ***NMA-LF Monomer***

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Cytec Industries —

The world's leading producer of specialty self-crosslinking monomers for the emulsion polymer and related industries.

CYLINK NMA monomer from Cytec has earned a reputation in the textile, non-woven and adhesives industries as a cost-effective, high performance self-crosslinking monomer available for the production of binders which provide high solvent resistance, wet strength, and adhesive properties. CYLINK NMA monomer, however, does release some formaldehyde as part of the crosslinking mechanism. Since environmental concerns over formaldehyde continue to be one of the most pressing issues facing the textile, non-woven and adhesives industries, Cytec has developed CYLINK NMA-LF monomer, a proprietary formulation of our standard CYLINK NMA monomer.

CYLINK NMA-LF Monomer — Cost Effective, High Performance, Low Formaldehyde

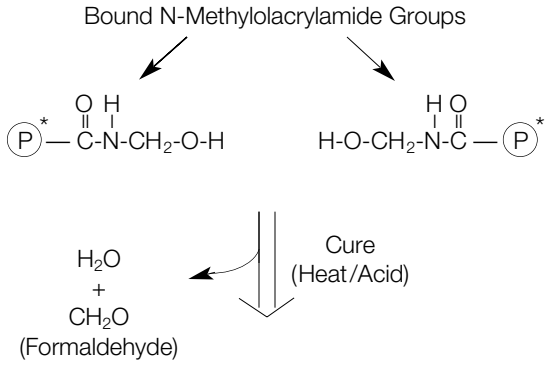
CYLINK NMA-LF monomer is specifically designed to provide effective self-crosslinking performance together with a significant reduction in both the formaldehyde present in the resulting emulsion polymer and the formaldehyde released to the environment upon curing. CYLINK NMA-LF monomer combines the cost-effectiveness of CYLINK NMA monomer with a dramatic reduction in total formaldehyde.

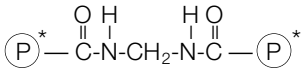
Chemistry

The active self-crosslinking species of CYLINK NMA-LF and CYLINK NMA monomers is N-methylolacrylamide (NMA). NMA contains both a vinyl group and an N-methylol group. The vinyl group is reactive and enables the NMA to be readily incorporated into a variety of the polymer backbones. Once incorporated into the polymer, the methylol group can be triggered to undergo crosslinking with itself, other functional groups in the polymer (such as hydroxyls or amines), or with cellulosic substrates. The bifunctional feature of NMA ultimately results in latex binders which provide important performance properties to the final product, such as wet strength, tear strength, and solvent resistance.

The manner in which CYLINK NMA monomer is believed to self-crosslink is shown in Scheme 1. The key feature of this process is the elimination of formaldehyde as the NMA undergoes crosslinking to form the methylene-bis-acrylamide (MBA) bridge. In contrast, CYLINK NMA-LF monomer's proprietary formulation provides an alternative route to the identical MBA crosslink but with a significant reduction in the formaldehyde released *(see "Performance" on the following page).*

Scheme 1. Crosslinking of bound CYLINK NMA monomer.





MBA Crosslink

* (P) Polymer Backbone

Physical Properties of CYLINK NMA-LF

The physical properties of CYLINK NMA-LF monomer are shown in Table 1.

Table 1. Typical Properties of CYLINK NMA-LF

Appearance	Clear to slightly hazy, liquid yellow to pink in color.
Color, APHA	80 max.
Total Solids, % by Weight	46-50
Free Formaldehyde, % by Weight	0.35 max.
Copper in Solution, ppm (as is)	4.0 max
MEHQ Inhibitor, ppm (as is)	30 ± 5
pH (as is)	5.5 - 7.0
Specific Gravity at 25°C (77°F)	1.05

Comparative Performance of CYLINK NMA-LF

Cytec evaluated the performance of latex films containing equal parts CYLINK NMA monomer and CYLINK NMA-LF monomer. Table 2 shows the latex recipes used.

Table 2. Recipe for the Preparation of Latex Containing CYLINK NMA-LF

	Parts by Weight	
	NMA	**NMA-LF**
Kettle Charge:		
Deionized Water	185.0	185.0
AEROSOL® A-102 Surfactant[1]	9.0	9.0
Sodium Bicarbonate	1.5	1.5
Ammonium Persulfate	1.5	1.5
Monomer Charge:		
Deionized Water	65.0	65.0
AEROSOL A-102 Surfactant	7.7	7.7
Sodium Metabisulfite	0.7	0.7
Vinyl Acetate	210.0	210.0
Butyl Acrylate	32.5	32.5
Delayed Addition:		
Deionized Water	10.0	10.0
NMA, 48%	15.6 (3% wt)	—
NMA-LF	—	15.1 (3% wt)

Procedure:

Preparation of Kettle Charge:
Dissolve 9.0 parts AEROSOL A-102 surfactant, 1.5 parts sodium bicarbonate, and 1.5 parts ammonium persulfate in 185 parts of deionized water. Purge the solution with nitrogen while stirring and heat to 60°C.

Preparation of Monomer Charge:
Dissolve 0.7 parts sodium metabisulfite and 7.7 parts AEROSOL A-102 surfactant in 65 parts deionized water. Add under sufficient stirring a mix of 210 parts vinyl acetate, and 32.5 parts butyl acrylate. Place this monomer pre-emulsion in addition vessel equipped with a stirrer. 15.6 parts N-methylolacrylamide, 48%, or 15.1 parts N-methylolacrylamide-LF in 10 parts deionized water is placed aside.

Addition of Pre-emulsified Monomer to Polymerization Flask
When the contents of the polymerization kettle reach 60°C, the nitrogen flow is reduced to a minimum and 10% of the monomer is added to the reactor. After initiation and maximum exotherm, the NMA-LF (NMA) solution is added to the monomer and the addition of monomer is started at the rate of 1.4 parts per minute. Total addition time should take approximately 3.5 hours.

Following monomer addition, the latex is held at 60°C for one hour, then cooled to room temperature and filtered into a suitable container.

Comparative Physical Properties

The physical properties of the resulting latex films were evaluated (Table 3) and are comparable in most aspects, including particle size, coagulum, and viscosity. One significant difference is that the films made using CYLINK NMA-LF monomer show a 75% reduction in the residual level of formaldehyde in the latex.

Table 3. Physical Properties of latex formed with CYLINK NMA-LF monomer

	Latex with NMA	**Latex with NMA-LF**
Solids, %	47.0	47.1
pH	5.5	5.7
Particle Size, nm	115.0	136.0
Viscosity, cps	374.0	246.0
Grit, 60 mesh, g	<0.1	<0.1
Grit, 200 mesh, %	0.02	0.02
Residual Formaldehyde	400ppm	<100ppm

[1] *Product of Cytec Industries Inc.*

Comparative Polymer Solvent Resistance

Table 4 demonstrates the acetone solvent resistance of latex film prepared from CYLINK NMA-LF monomer compared to films made from standard CYLINK NMA monomer. Since both films are essentially 92% resistant to acetone after four hours, comparable levels of crosslinking were achieved using either CYLINK NMA or CYLINK NMA-LF.

Table 4. Acetone solvent resistance of latex films prepared from CYLINK NMA-LF monomer and CYLINK NMA 48% monomer

	Latex with NMA	Latex with NMA-LF
Solvent Resistance (Acetone insolubles) Catalyzed (5 Min. cure)	92%	91%

Comparative Formaldehyde Content/Release

Table 5 shows the formaldehyde released from both latex films upon curing, and formaldehyde after extraction. As expected, due to the differences in crosslinking mechanism, the total formaldehyde released from the latex made from CYLINK NMA-LF is reduced by over 70% compared to the amount released from the control latex.

These results show that CYLINK NMA-LF can provide high performance with a significant reduction in formaldehyde release.

Table 5. Formaldehyde Release from latex films made from CYLINK NMA 48% and CYLINK NMA-LF monomers

Latex Containing	NMA	NMA-LF
Formaldehyde	PPM	
Released Air	1330	290
Extracted	170	130
Total	1500	420

Procedure:

Two grams of latex, either as is or pH adjusted to 2.8-3.0, are weighed in a glass tube. Product is dried for 60 minutes in an oil bath at 180°C (giving a drying temperature equivalent to 130°C for 30 minutes) while air is passed over at rate 50 l/h. The air is bubbled through 400 g of water (at 0°C) to collect the evolved formaldehyde. The remaining polymer is boiled for 2 hours in 150 g water to collect trapped formaldehyde. The formaldehyde content of the water layers is measured colorimetrically after derivitisation and back calculated to the latex.

Health & Safety Information

CYLINK® NMA-LF monomer is a proprietary formulation which contains acrylamide and formaldehyde. The acute oral (rat) and dermal (rabbit) LD_{50} values for NMA-LF are greater tham 500 mg/kg and 1000 mg/kg, respecively. Direct contact with this material may cause moderate skin and eye irritation. Rats, mice and guinea pigs exposed for six hours to air saturated with the vapor of N-methylolacrylamide exhibited no evidence of toxic effect. Administration of N-methyloacrylamide monomer to rats and mice for 2 years produced no evidence of cancer in rats but caused an increased incidence of tumors in mice. Acrylamide monomer has caused allergic skin reactions in animal studies.

Acrylamide and formaldehyde cause cancer in laboratory animals. Acrylamide and N-methyloacrylamide monomers have been proven to cause neurotoxicity. Signs and symptoms of exposure include increased sweating of the hands and feet, numbness, tingling and weakness of the extremities, unsteady gait and decreased reflexes. Acrylamide and formaldehyde are regulated substances, and workplace practices should be used which assure compliance with the appropriate regulations. Acrylamide is known to produce neurotoxicity. Refer to the Cytec Material Safety Data Sheet (MSDS) before handling.

Engineering Controls and Personal Protective Equipment (PPE)
Utilize a closed system process where feasible. Where a closed system is not used, good enclosure and local exhaust ventilation should be provided to minimize exposure. Food, beverages and tobacco products should not be carried, stored or consumed where this chemical is in use. Before eating, drinking or smoking,

wash face and hands with soap and water. Shower after completion of work shift. Launder work clothing at end of work shift prior to reuse. Store street clothing separately from work clothing and protective equipment. Work clothing and shoes must not be taken home.

Where adequate engineering controls are in effect, and measurements confirm airborne concentrations are below the Permissible Exposure Level, no respiratory protection is required. NIOSH does not approve cartridge respirators for use with NMA-LF solution. However, tests show that organic vapor cartridges do provide protection from airborne levels up to 2.5 mg/M^3. **If respirators are used, the cartridges must be changed at the beginning of each shift.** Full face piece, positive pressure, supplied air respirators or self-contained breathing apparatus must be used for higher or unknown concentrations. Note that NMA-LF solution exhibits no warning, characteristic, identifying properties at concentrations at or below the Permissible Exposure Level. Wear the following to prevent skin contact: impervious rubber or plastic gloves, rubber shoes and long- sleeved coveralls, which are provided clean daily. For operations where eye and face contact with NMA-LF solution can occur, wear chemical splash-proof goggles, a face shield and head covering. **Wash gloves thoroughly before removing and discard gloves that are contaminated on the inside.** When solutions are used, provide eyewash fountain and safety shower in close proximity to points of potential exposure.

Steps To Be Taken in Case Material is Released or Spilled

Where exposure level is not known, wear an approved, positive-pressure, self-contained respirator. Where exposure level is known, wear an approved respirator suitable for level of exposure. In addition to the protective clothing/equipment described in the above Section (Engineering Controls and Personal Protective Equipment), wear impervious boots. Cover spills with some inert absorbent material; sweep up and place in a waste disposal container. Flush area with water.

Handling and Storage

Do not get in eyes, on skin, on clothing. Buildup of heat and pressure in closed containers may result if polymerization occurs. Avoid contamination with iron, copper, aluminum, brass, bronze, acids, bases, oxidizing, reducing and chelating agents, precipitant for copper and known initiators for vinyl polymerizations. Wash thoroughly after handling. Keep container closed. Wear clean work clothing daily.

This product is stabilized by dissolved oxygen, cupric ion (Cu+2) and MEHQ (monomethyl ether of hydroquinone). Maintain air sparge at 0.2-0.4 cfm per 1000 gal. Maintain temperature between 32°F-85°F (0°C-29°C). Maintain pH between 5.5 and 7.0. To prevent loss of dissolved oxygen: do not heat, do not use an inert blanket, and do not sparge with an inert gas. Avoid temperatures above 85°F, initiators such as bisulfites, peroxides, reducing agents, oxidizing and redox systems.

Drums that have contained the material should be stored separately and not used for any other purpose. These drums should be incinerated. It is important that surfaces subject to acrylamide contamination be thoroughly cleaned on a routine basis. This is to prevent inadvertent skin contact and reduce airborne limits since acrylamide sublimes (goes directly from solid to vapor). NOTE: Due to sublimation of the dried material, a concentration of vapor up to 120 mg/M^3 can be reached in an enclosed area at 104°F (40°C).

Inhibition

Oxygen is the best inhibitor for NMA-LF solution. As shipped, NMA-LF solution is saturated with oxygen. The air in the head space of the container should be sufficient to maintain an adequate oxygen level for 90-days storage under normal conditions. NMA-LF solution also contains 30± 5 ppm MEHQ.

All conditions leading to the displacement of oxygen from the solution should be avoided.

Storage Temperatures

NMA-LF solution should be stored in a cool place where the temperature range is between 32°F (0°C) and 85°F (29°C). Storage at temperatures above 85°F (29°C) is not recommended. Drums placed near heat sources or in warm warehouses or vehicles have burst on occasion as a result of polymerization and the contents have spilled over the immediate area. The material is easily swept up, but, of course, is no longer usable.

At temperatures below 14°F (–10°C), N-methylolacrylamide may crystallize. If this happens, slowly warm the contents to about 32°F (0°C) while occasionally mixing or rolling the drum to facilitate redissolving the crystals. This will in no way affect the quality of the material. If cold solutions are to be warmed, the use of tempered water up to 120°F (49°C) is recommended. **Steam or other direct heat must not be used to warm NMA-LF solutions.**

Length of Storage
Drums containing NMA-LF solution should not be stored for more than three months, even under ideal conditions. Thus, it is important to observe a FIFO system of stock rotation so that the oldest material is used first.

Partially Emptied Containers
Once a drum of NMA-LF solution has been opened, the entire contents should be used if possible. If this cannot be done, replace the lid immediately after withdrawing the required amount while making certain that the polyethylene disc liner on the lid is in place so that the NMA-LF solution will not come into contact with the metal lid. The container should not be opened when there is a possibility of contamination from foreign matter.

Effect of pH
NMA-LF solution is shipped in the pH range of 5.5-7.0. The pH of NMA-LF solution tends to drift downward with time. This tendency is minimized if the temperature is maintained between 32°F-85°F (0°C-29°C). At a pH below 5.0 both vinyl and crosslinking reactions can take place simultaneously if accidentally initiated. Thus, it is important to monitor the pH of NMA-LF solution. Make adjustment with 3% sodium hydroxide solution if pH drifts below 5.0 and back adjust if required with 5% formic or sulfuric acid.

Processing Equipment; Materials of Construction

Storage Tanks — Pipes, fittings, valves, flanges and pumps.

Acceptable Materials

- Stainless steel type 304 or 316
- Fiber glass-reinforced, corrosion resistant polyester[1]

  Example: Atlac® polyester resin 382[2]
  Hetron® polyester resin 197[3]
- Phenol-formaldehyde resin coating[1]

  Example: Lithcote® LC-24[4]
- Poly (vinyl chloride) coating[1]

  Example: Lithcote® LC-100
- Polypropylene or Teflon® tetrafluorethylene fluorocarbon polymer[5] lining in stainless steel sheath

Unacceptable Materials

Carbon steel, iron, copper, brass, bronze and aluminum **must not be used.**

Foreign matter, such as dirt, fibers, pigments, heavy metal salts, crystals and polymers can be very harmful to NMA-LF solution because this monomer is subject to crosslinking. The presence of impurities such as these would act as sites to promote crosslinking during polymerization, particularly emulsion polymerization. In many instances, filters are installed in feed lines to prevent dirt particles and crystals from entering the kettle or the batch.

Equipment Design and Metering Devices
Good equipment design is an important factor in preventing pre-polymerization during pumping operations. NMA-LF solution may tend to homopolymerize at points of strong turbulence during both stirring and transporting through feed lines. Sharp bends in pipes, scratched or partially corroded equipment, and agitators constructed of aluminum, iron, copper or brass may promote formation of homopolymer. In addition to those mentioned above, Monel®[6] metal, glass and plastic are also satisfactory construction materials.

Piping must be designed so that all lines containing NMA-LF solution are self-draining and contain no stagnant areas.

All process equipment should be cold water flushed and air dried following use.

NMA-LF solution can be pumped and metered with the usual equipment used for low-viscosity liquids, provided that the materials of construction meet the conditions previously specified.

Effect of Light
Sunlight or strong light from other sources should be avoided. Light acts as a catalyst in the production of free radicals which will promote homopolymerization, especially in the presence of metallic impurities.

[1] *These materials were tested and found to be acceptable. Customers contemplating use of these materials should conduct their own tests.*
[2] *A product of Reichhold Chemicals*
[3] *A product of Ashland Chemical Company*
[4] *A product of Lithcote Company*
[5] *A product of E.I. duPont de Nemours & Company, Inc.*
[6] *A product of International Nickel Company*

Oxidizers
Any condition giving rise to peroxides promotes polymerization of NMA-LF solution. The risk of premature polymerization is reduced by the addition of a small amount of MEHQ to the 48% solution at the manufacturing plant. The small amount of inhibitor will not hinder subsequent copolymerizations.

Solvents as Stabilizers
Small amounts of solvents such as methanol, ethanol, isopropanol, ethyl acetate, butyl ethylene glycol monobutyl ether and methyl ethyl ketone may often be added to NMA-LF solution by the user to impart stability for storing, pumping and metering the feed solutions.

Determination of Prepolymer
The N-methylolacrylamide monomer present in NMA-LF solution is soluble in n-butanol; the polymer is not. To determine the possible presence of polymer, add 25 grams of the NMA-LF solution to 25 grams of n-butanol. Allow it to stand for 30 minutes. If polymer is present, a precipitate will form. Filter, dry and weigh the precipitate to determine the polymer content.

Bulk Storage and Handling

Caution:
NMA-LF solution is a potentially hazardous material. In the interest of safety and health this material must be handled and stored properly.

- Storage tanks must not be filled beyond 75% of capacity.
- If initiated, chemical reaction of NMA-LF solution can generate sufficient heat and pressure to burst closed vessels or vessels with restricted openings.

Handling precautions and procedures must be made clear to all personnel involved in storing and handling this product, and they should be carefully supervised to assure compliance.

Precautions should be taken to maximize the stability of NMA-LF solution in bulk storage.

1. Provide for air sparge 0.2-0.4 cfm /1000 gal.
2. Avoid contamination of NMA-LF solution with copper, aluminum, brass, bronze, iron, acids, bases, oxidizing agents, reducing agents, vinyl polymerization initiators, and certain organic compounds identified elsewhere in this brochure.
3. Recommended bulk storage temperature is 32°F-85°F (0°C-29°C).
4. Recommended pH is 5.5-7.0.
5. Do not store longer than six months at 32°F-85°F (0°C-29°C).
6. Storage tanks should be emptied, cleaned and inspected every three months.

Handle NMA-LF solution as a toxic monomer:

- Do not allow NMA-LF solution, spray, vapor, or dust to contact skin, eyes or clothing.
- Do not breathe vapors, spray or dust.
- Keep all empty containers in a protected location.
- Clean up spills and dispose of NMA-LF solution and rinse waters properly.
- Safety showers should be available.

Details of the above mentioned precautions are discussed in this brochure.

Contact your Cytec sales representative to discuss handling and storage methods for NMA-LF solution.

Unloading Station
All fittings, pumps, in-line instruments and piping should be constructed of stainless steel type 304 or 316 or other suitable materials. NMA-LF solution should be transferred through pipes or into tanks at a temperature between 32°F-85°F (0°C-29°C). During winter months care must be taken to avoid temperatures below 32°F (0°C) to prevent crystallization. Therefore, all exterior unloading facilities should be insulated. Draining and flushing of transfer lines are absolutely necessary — **stagnant material left in lines will gel, causing plugging of lines.** Tank trucks must be rinsed with water after contents are removed.

Handling and Metering
NMA-LF solution has a low viscosity. Thus, it can be transferred through meters by gravity flow and by pumps. Explosion-proof electrical equipment is not necessary for NMA-LF solution, but many of the monomers with which NMA-LF solution can be copolymerized do require explosion-proof electrical equipment. Any type pump that does not generate excessive heat in the liquid may be used, such as centrifugal pumps.

Aeration
Bulk storage tanks for NMA-LF solution must be provided with continuous air sparging. Clean air must be used (i.e., instrument air). The air rate should be 0.2-0.4 cfm per 1,000 gallons of storage capacity. For a 24,000 gallon (75% full) tank, the sparging rate may be set at about 5.4 cfm of air. The rate of sparging must be sufficient to maintain oxygen in the solution and to agitate the solution mildly, but not to cause evaporation of the water. Air flow must be monitored to assure constant aeration.

Pipe Lines
Piping must be designed so that all lines containing NMA-LF solution are self-draining and contain no stagnant areas. Where necessary, three-way plug valves with dead leg draining should be provided. Pipes should be insulated to maintain required temperatures. Pipes from storage tanks to polymerization kettles must be designed to prevent back-up of polymerization solution into storage tanks.

Insulation and Temperature Control
Storage tanks and all lines containing NMA-LF solution should be adequately insulated. Bulk storage of NMA-LF solution should be maintained between 32°F-85°F (0°C-29°C). One method of cooling is by recirculation of the tank contents through heat exchangers. A temperature sensor and alarm system are recommended.

Storage Tank Venting
Storage tank venting must be provided as a precaution in case polymerization of the NMA-LF solution is initiated accidentally. The vent sizes are derived by orifice flow calculations.[1] This calculation requires knowledge of the pressure rating of the storage tank, the amount of liquid in storage and the heat release rate expected during spontaneous polymerization. The last variable is difficult to determine because the amount of an initiator accidentally introduced cannot be predicted. As a practical matter, the vent should be made as large as possible. A 6" vent plus a 20"-24" Protectoseal[2] manhole vent or equal is believed adequate to protect a 10,000-gallon tank in the event of polymerization caused by contact with metal or other contaminants, loss of air sparge or external heat.

Water Quench
Storage tanks must not be filled beyond 75% of capacity to allow space for solution contact with air and to allow adequate room for dilution with water should polymerization begin. Means for rapid addition of cold quench water must be provided in case the tank contents begin to polymerize, as indicated by a rapid rise in temperature. Mixing can be accomplished by a recirculation loop.

Diking
The storage tank should be surrounded by a dike adequate to contain the total contents of the tank in case of tank failure.

Monitoring
The temperature, pH and air sparge should be monitored as an aid in preventing premature polymerization of the NMA-LF solution in the storage tank. A polymer check should be made daily.

Air Sparge
An air flow meter should be set up to monitor the air at the specified rate. It is recommended that an alarm be provided to signal discontinuation of air flow. **Air sparge is by far the most important factor in maintaining the stability of NMA-LF solution.**

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[1] *Perry, John H. Chemical Engineering Handbook, second edition. Equation 13 (page 403) and Equation 14 (page 404).*

[2] *Protectoseal, Engineering and Manufacturing Company, 1920 South Western Avenue, Chicago, Illinois 60608.*

Temperature
Temperature of stored solutions should be checked frequently (every eight hours is suggested). A temperature sensor connected to an alarm is recommended. Set the sensor to sound an alarm if the temperature of the NMA-LF solution rises 9°F (-12.8°C) above normal storage temperature. If the cause of a temperature rise is found to be a mechanical failure, take appropriate corrective measures. If corrective measures cannot be instituted immediately, and the temperature continues to rise, then activate the quenching procedure.

pH
The pH should be checked daily when stored at recommended temperatures. At higher storage temperatures more frequent pH checks are necessary. Adjustments in pH should be made with 3% sodium hydroxide solution and 5% formic or sulfuric acid.

Length of Storage
NMA-LF solution should not be stored in bulk for more than three months. If stored above the recommended temperature the length of storage in bulk will be considerably reduced.

Cleaning Storage Tanks Prior to NMA-LF Solution Service
All tanks, drums and containers to be used for storing NMA-LF solution, temporarily or for a prolonged period of time, must undergo a rigid inspection and a thorough cleaning and rinsing before they can be put into service. The following procedures are mandatory for assuring safe storage of NMA-LF solution:

1. Check previous history of tank or container. If it has a history of leaks, inadequate piping, poor temperature control, or was used for storing strong oxidizers or reducers, such as nitric acid, hydrogen peroxide, persulfates, metabisulfites, hyposulfites, sulfites, or metallic powders or salts, such as those of iron, aluminum, copper, brass, tin, zinc, or contains any materials of construction other than those recommended, then it cannot be used for storing NMA-LF solution without major overhaul.
2. Inspect tank or container thoroughly for cleanliness (i.e., film on walls, inside of covers or piping; and debris on interior surfaces). Manual scouring or abrasive cleaning is usually essential for tanks or containers previously used for storage of chemicals which leave residues that cannot be removed by use of detergents and water rinses. All surfaces and pipes should be visibly clean and should not leave dirt or stains on a wiping cloth.
3. Fill the tank or container with water. Add detergent as required. Circulate water or detergent solution through tank and all piping. Inspect for leaks, empty and rinse well with fresh water until the washings are clear, colorless and are about neutral in pH. Continue cleaning and rinsing until such is the case.
4. After the washings meet the specified requirements, a final rinse with deionized water is recommended.

   If all the other items of safety have been approved, the resultant tank or container may be used for storing NMA-LF solution.

Once the storage system is in use for storing NMA-LF solution, periodic inspection for leaks, cleanliness and absence of contamination is advised. If the storage system is to be emptied and is to be idled, it should be thoroughly rinsed with water to remove residual NMA-LF solution.

IMPORTANT NOTICE

The information and statements herein are believed to be reliable but are not to be construed as a warranty or representation for which we assume legal responsibility or as an assumption of a duty on our part. Users should undertake sufficient verification and testing to determine the suitability for their own particular purpose of any information, products or vendors referred to herein. NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE IS MADE. Nothing herein is to be taken as permission, inducement or recommendation to practice any patented invention without a license.

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