VORAMER™ Adhesives for Manufactured Housing

Product Manual

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Section I. Product overview

VORAMER™ Adhesives for Manufactured Housing

Chemistry	Product name	Description
Two-component	VORAMER™ MB 3099 VORAMER™ ME 3044	A two-component polyurethane adhesive for adhering roof trusses with drywall ceiling board or assembling walls typical in Manufactured Housing.
Two-component	VORAMER™ MB 3022 VORAMER™ ME 3044	
One-component	VORAMER™ ME 3515	A one-component, moisture curing polyurethane adhesive for adhering dry wall to wooden studs or any porous substrate – typically used in assembling walls and subfloors in Manufactured Housing.

Chemistry	Product name	Shelf Life	Viscosity (Cps)[1]	Working Time[2] (min)	Rise (sec)	Tack-Free (sec)	Final Cure (min)
Two-component	VORAMER™ MB 3099 VORAMER™ ME 3044	6 months	3099: 700 3044: 200	—	15-25	40-50	5
Two-component	VORAMER™ MB 3022 VORAMER™ ME 3044	6 months	3022: 350 3044: 200	—	10-20	30-40	5
One-component	VORAMER™ ME 3515	6 months	3,500	17-23	—	—	42-48

[1]77°F using ASTM D4889
[2]65°F and 45% humidity

Product testing

VORAMER™ Adhesives for Manufactured Housing are extensively tested at Dow's research facilities and additionally by independent engineering facilities. **Independent product and assembly evaluation reports can be accessed at: http://www.p-e-i.com/prod_eval_reports.php**

Copies of all tests can be provided by your Technical Sales Representative.

All commercial materials are tested by Dow's Quality Assurance Laboratory to ensure that each batch is correctly manufactured and will meet exact specifications.

For recommended PPE, handling and storage, and first aid please refer to the Safety Data Sheets (SDS). For additional safe handling precautions, refer to Dow's MDI and VORANOL™ safe handling guides. Copies of these can be provided by your Technical Sales Representatives.

Safety Data Sheets (SDS) are available from Dow. SDS are provided to help customers satisfy their own handling, safety and disposal needs and those that may be required by locally applicable health and safety regulations. SDS are updated regularly, therefore, please request and review the most current SDS before handling or using any product.

Section II. Safe handling of chemicals

Equipment maintenance

Two-component VORAMER™ products were designed to be processed through plural component impingement-metering unit. This equipment should accurately meter the component materials at a 1:1 volume.

Alternatively, the one-component VORAMER™ product requires a single nematic pump.

Reference the table in Section III for specific application temperatures and pressure.

I. Preconditioned stock/day drum chemicals
All chemicals need to be preconditioned and varies between two-component and one-component systems. Reference the table in Section III. Conditioning the material maintains chemical viscosity, allows proper chemical flow to day drums and machine, and maintains more consistent dispensing heat. Consistent dispensing heat at the dispenser/gun improves chemical performance.

II. Desiccant/filter assembly/setup
All chemicals need to be filtered from contaminants and isolated from moisture. Moisture reacts with the one-component product and the A-side of the two-component products, increasing viscosity and forming contaminant crystals. It can also diminish performance of the B-side in two-component products. Desiccant filters prevent moisture penetration into the chemicals, thus minimizing the contamination of the dispensing system over time. Not properly filtering the chemicals can create gun clogs due to mentioned crystals allowing them to flow through the system during system operation.

III. Chemical feed system/setup
Chemicals need to be continuously fed to the day drums and machines with no restrictions (free flowing), air pockets or cavitation (starving). Maintaining constant flow of chemicals to day drums and equipment will help prevent any chemical pressure differential and allow for optimal process operation.

IV. Pump lubrication containment
Proportioning pumps and lube cup/packing nuts need to be clean and lubed at all times as well as tightened properly to build/hold desired chemical pressures. Cleanliness and proper tightness are extremely important. This will help maintain a consistent operating pressure and increases the life of pumps seals.

V. Two-component only
Optimal preheater temperature may vary with season, due to ambient temperature changes, i.e. set higher in winter and lower in summer. Typical preheater range is 90° and 120°F. If heat needs to be adjusted, it is suggested that you adjust hose heat first, before making any changes to preheater. Preheater temperature helps maintain consistent hose heat, especially during high production, to maximize chemical performance (adhesion, yield and application). Higher temperatures generally lead to more foam expansion.

VI. Hose train and transformer
Hose trains/train controls and transformer must be working properly at all times. Hose train temperature for two-component products should typically be between 90°F and 120°F (determined by ambient temperature) to optimize final product performance. Heat to the hose is not required for the one-component product. All hoses must be insulated and protected (scuff guarded) to provide consistent heat and prevent hose train replacement. Important- Any exposed heat trace elements need to be protected, insulated, and scuff guarded immediately. PREVENT COILING OF HOSETRAIN TO LESS THAN A 3 FT RADIUS WHEN POSSIBLE. DO NOT CLEAN OUT AND REUSE A CROSSED OVER HOSETRAIN LENGTH. REPLACE IT. If a multiple tap transformer (amp adjustment per hose train length w/heat sink) is present, wire leads may need to be adjusted to existing hose length depending on type of proportioning being used.

VII. Online equipment
All equipment should be kept in good working condition and clean at all times. With two-component products, each component of equipment has an important function that helps keep other components working properly. Everything works together to keep the overall process at optimal performance.

VIII. Dispenser (gun)
With two-component applicator guns, you should close the manual valves of coupling blocks immediately after each use. Clean dispenser using recommended cleaning procedures, after each use and before any repairs. Dispensers are one of the most critical components of the process. Please follow all supplier recommendations for setup, cleaning, maintaining, and repairs. It is extremely important that each part of the dispenser function properly. Please no shortcuts or worn out parts replacement.

IX. Startup and shutdown procedures
Follow equipment supplier startup and shutdown procedures. Following recommended/written procedures as well as good working equipment prevents unnecessary wear and tear of critical and expensive components.

X. Backup/spare parts and equipment on hand
To prevent unnecessary production downtime, backup equipment is highly recommended to be on hand and/or operational at all times. Investing in a backup machine, proportioning pumps, spare hose train, dispenser and any recommended high use spare parts is extremely important to help prevent lost production time.

Please note: Equipment/dispenser manuals should be on hand for any reference about needed repairs, spare parts, procedures, and basic troubleshooting. Only knowledgeable personnel should operate, maintain, or repair any part of overall process. Improper handling, operation, maintenance or repair can result in loss of production time, major/costly equipment repair or serious injury. For additional information on equipment operations, please refer to the individual manufacturer operation manuals for the specific equipment type used in your facility.

Loading/unloading drums and totes

VORAMER™ Adhesives for Manufactured Housing are packaged in 55-gallon drums and 250-gallon collectable totes. Two-component products consistent of two parts, the “A” (MDI) component and the “B” (polyol) component. The “A” (MDI) component will be in blue packaging and the “B” (Polyol) component will be in black packaging. Alternatively, the one-component product only consistents of one component and is typically supplied in totes.

DRUM UNLOADING OPTION 1:

The drums have 2” threaded bung and a ½” threaded bung. Lay the drums on their side on a rack or drum stand. The 2” bung should be fitted with a spigot leading to the machine and the ½” bung would be at the top and you would attach an elbow and a desiccant trap.

1. Remove the 2” bung and fit a spigot. Place a small amount of Vaseline or white lithium grease onto the spigot threads of the MDI.
2. Thread a 2”x1” Cam-lock adapter to the spigot. Make sure the spigot is closed. Place a small amount of Vaseline or white lithium grease onto the Cam-Lock adapter of the MDI.
3. Lay the drum on the rack or drum stand with the spigot at the bottom and the ½” bung at the top.
4. Attach the chemical delivery hose to the drum using the cam-lock coupling.
5. Open the spigot valve by turning the handle so that it is pointing straight away from the drum. This is the OPEN position.
6. Check for leaks around the spigot.
7. Open valve on chemical delivery hose.
8. The material supply system is now ready for normal operation.

DRUM UNLOADING OPTION 2:

1. Attach a desiccant trap to the ½” bung.
2. Remove the 2” bung and insert a transfer pump with a hose attached to the machine [2:1 T2 Type Pump Is recommended]. Place a small amount of Vaseline or white lithium grease onto the pump threads of the MDI.

TOTE UNLOADING:

The totes are equipped with a 2” male threaded spigot at the base, and a 6” threaded port at the top with a 2” bung. The totes are translucent, allowing the liquid level to be determined by visual inspection. The totes are labeled according to DOT regulations, and also have labels with the following information listed:

- Product name
- Product GMID (Dow identification number)
- Labeled to isocyanate or polyol
- Batch number
- Expiration date
- Tote disposal 800 number

Totes may be stacked 2-high, but should not be stacked 3-high or more.

Full totes should not be stacked upon empty totes.

Care should be taken when handling totes with forklifts, as it is possible to puncture these containers causing a chemical spill.

Section III. Product application

Attaching totes to a chemical delivery system

1. Using a bung wrench, open the 2” bung at top of the tote.
2. Place a desiccant (air drying) cartridge at the top of the tote, in order to allow dry make-up air to enter the tote when delivering chemical.
3. Place the tote in the area where it will sit during chemical delivery.
4. Remove the protective cap from the spigot at the base of the tote.
5. Place a small amount of Vaseline or white lithium grease onto the spigot threads of the MDI.
6. Thread a 2”x1” Cam-lock adapter to the spigot.
7. Attach the chemical delivery hose to the tote using the cam-lock coupling.
8. Using a screwdriver, remove the valve handle retention screw at the base of the spigot valve handle.
9. Open the Spigot valve by turning the handle so that it is pointing straight away from the tote. This is the OPEN position.
10. Check for leaks around the spigot.
11. Open valve on chemical delivery hose
12. The material supply system is now ready for normal operation.

Detaching totes from a chemical delivery system

1. Make sure the tote is completely empty.
2. Close all valves.
3. Place rags and a small bucket under the Cam-lock coupling.
4. Disconnect the Cam-lock coupling; allow both sides to drain completely.
5. Remove the male extensively Cam-lock fitting from the tote spigot.
6. Replace the spigot handle retention screw.
7. Replace the Spigot cap.
8. Remove the desiccant cartridge and replace the 2” bung.
9. Call the 800 number on the tote to arrange for pick-up.

Material waste and drum/pail containers must be disposed of in compliance with Federal, State and local regulations. Do not heat or cut empty containers with electric or gas torch.

Contact information is provided on each tote of material for container return.

VORAMER™ Adhesives for Manufactured Housing rise quickly upon application, allowing the operator to see where, and how much, material has been applied to the junction between substrates. Properly applied, VORAMER™ Adhesives for Manufactured Housing will contribute to the construction of a quality ceiling diaphragm, subfloors and walls. Improper application can lead to defects. The rate of application will impact the total amount of material used per linear foot. Reference the table below for product application temperatures and pressure.

Chemistry	Product name	Material conditioning temp (°F)	Application temp (°F)	Equipment application pressure (psi)	Substrate temp (°F)	Equipment temp (°F)	Hose temp (°F)
Two-component	VORAMER™ MB 3099	70-95	≥50	500-1000	≥50	90-120	90-120
Two-component	VORAMER™ MB 3022						
One-component	VORAMER™ ME 3515	59-95	≥50	—	≥50	—	—

Storage and pre-conditioning

The key to dispensing VORAMER™ Adhesives for Manufactured Housing is providing **consistent storage temperature of the liquid materials and conditioning the material before application**. This keeps the viscosity low enough to provide free flow of the material into the proportioner, and also allows the material to run at the correct temperature upon application. Although the proportioner is equipped to provide heat to the chemicals, it does this most efficiently when the chemicals are preheated. During cold months, problems with the application of material are very often attributable to chemical temperature.

Application conditions

The gypsum board should be clean and dry with loose dust blown off and free from liquids, oil, grease, etc. All substrates are recommended to be at a temperature greater than 50°F. No masking tape is required to be used over gypsum seams with VORAMER™ Adhesive systems. The product should always be applied through properly maintained equipment.

Two-component application considerations

For two-component products, keeping a consistent, narrow gap between the truss and the gypsum enables:

- More efficient material usage
- Strong, uniform adhesion between the truss and drywall

All products should be applied at correct operating temperatures found in the table above.

If shipping or storage temperature should fall below 50°F (10°C) for the VORAMER™ ME 3044 Isocyanate, some crystallization could occur. Crystallization results in product with a higher viscosity, reduced NCO-content, and overall reduced reactivity. In this application, isocyanate crystals can clog the dispensing equipment, resulting in inconsistent product mixing, “cross-over” of dispensing gun, and ultimately poor final adhesive quality, lost production time, and/or equipment damage.

At the beginning of the day, a test shot should be attempted into a bucket, or garbage bag, to ensure that the foam looks consistent in color and cell structure. If chemical striations are evident (streaks of brown chemical mixed through the foam), or if the foam is not rising properly, refer to the POOR MIX TROUBLESHOOTING PROCEDURE at the end of this document.

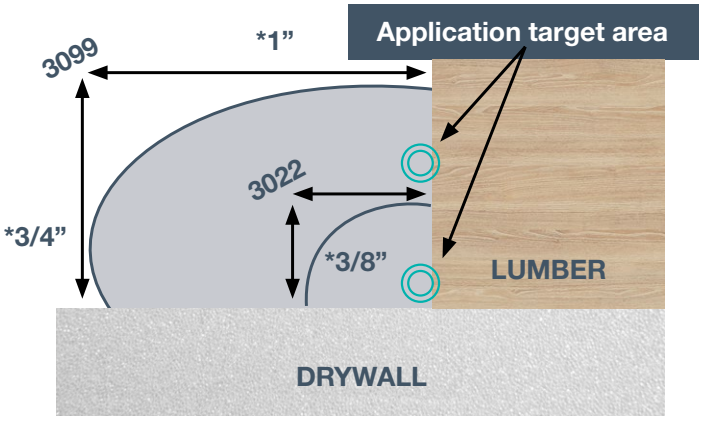
Ensure that no other persons are in the immediate area where the product is being applied.

With the work surface at waist level or below, pull the trigger and fire a stream of material approximately 6-8 feet from the tip of the dispensing gun, at the center of the truss. Attempt to apply the material directly in the junction of the truss and the drywall, applying the material above the junction will waste material, because it reacts so quickly. In a smooth pulling motion, the applicator should apply the stream from 8 feet away until the point of application is approximately 2 feet away. The operator should then step back 2 feet to allow the stream to be applied for the final 2 feet of the truss chord.

Using VORAMER™ MB-3099, the final bead should make contact with 1” of Gypsum and ¾” of Wood along the entire length of the truss. The bead may run under the truss, or along the side of the truss, as long as it is contacting at least ¾” of wood and 1” of Gypsum at any point, the application will meet the requirements as outlined in the testing that we have conducted to meet HUD-Code guidelines. Using VORAMER™ MB-3022, the final bead should be 3/8” by 3/8.” The contact area of wood and gypsum should be the same.

After the materials are applied, VORAMER™ MB 3099/ VORAMER™ ME 3044 and VORAMER™ MB 3022/ VORAMER™ ME 3044 will form an intimate adhesive bond with wood or gypsum board within the five minutes of application at the recommended processing temperatures. Longer cure time may be required in lower temperatures.

Cold conditions may lead to longer cure time. The ceiling can be lifted within minutes after the application of the material.



POOR MIX TROUBLESHOOTING PROCEDURE

If the mix is poor, it will typically be for one of the following reasons:

1. **Temperature and viscosity of the materials is out of balance.**
2. **Delivery pressure is out of balance.**
3. **Impingement of materials is blocked in the dispense gun.**

Check all of these parameters in the following order before calling your authorized Dow technical contact.

1. **Temperature and viscosity of the materials is out of balance.**

Check the storage temperature, pre-heater temperature, and hose temperature of the material. If they are all in recommended ranges, then check pressures. If the temperatures are out of the recommended ranges, then check to see if the equipment is properly able to deliver temperature to the hose train and pre-heater.

Most common problems with temperature:

- Hose train is damaged, and areas of hose have no heat.
- Chemical is stored below recommended temperatures
- Fuse is blown on hose-train or pre-heater

2. **Delivery pressure is out of balance.**

Look at the pressure gauges on the proportioning equipment. Dispense material from the gun for 2-3 seconds, and watch the gauges move. They should remain within 300 psi of one another at all times. If they are greater than 300 psi from one another, perform the pressure balancing procedure recommended in the equipment manual.

Most common problems with pressure:

- Gun is clogged, causing pressure imbalance.
- Check valves at pump base are blocked, causing material to force back into the delivery lines, rather than deliver to the gun.
- Viscosity too high on the component (chemical).
- Pump seals are worn, causing pressure to increase.

3. **Impingement of materials is blocked in the dispense gun.**

If pressures continue to remain out of balance, it is advisable to perform a gun maintenance procedure to clean out the ISO and resin ports on the dispenser. Be sure to depressurize the hose and release pressure in the gun before disassembly. Check the ISO filter on the gun, to ensure that no blockage exists.

If none of the above procedures improves the mix of the product, call your Dow TSR or Technical Service contact for additional instructions.

One-component application considerations

For VORAMER™ ME 3513 two 1/16” beads should be applied to the timber prior to assembling with drywall. Application should take place at temperatures of 50ºF and rising. Cooler temperatures and lower humidity will delay the reactivity of the adhesive. Typical working time at 65ºF and 45% humidity is about 17-23 minutes. The product will be set up in about 42-48 minutes. After fastening, product will set up faster.

Additional resources

- Request two-component bead measurement cards from your technical or sales representative to help ensure proper application.
- Request a Quality Analysis Report from your technical or sales representative. This exercise can help determine product use efficiency and opportunities for improvements.
- View helpful application videos for two-component products at www.dow.com/manufacturedhousing, including: Start-up, General Maintenance, Proper Spray Technique, Spray Gun Care, and Shut-down.
- View ICC-ES Evaluation Reports for each VORAMER™ product:
  All reports: Reports Directory - ICC Evaluation Service, LLC (ICC-ES)
  3022: ESR-5082 - ICC Evaluation Service, LLC (ICC-ES)
  3099: ESR-5083 - ICC Evaluation Service, LLC (ICC-ES)
  3515: ESR-5084 - ICC Evaluation Service, LLC (ICC-ES)

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