APPLICATION GUIDE
TUNDRA Extreme Cold Spray Foam System

Dynamo TUNDRA two pound density (2.0 pcf) closed cell polyurethane spray foam (SPF) is commonly used in residential and commercial thermal insulation applications. This product adheres well to most building materials, providing a continuous barrier against air infiltration. Dynamo TUNDRA is used as a component of a "systems" approach to proper building envelope construction. All surfaces to be sprayed should be clean and dry. All metal to which the foam is to be applied must be free of oil, grease, etc. Pass thickness should not exceed two and half (2.5) inches. Allow enough cooling time between each pass. Multiple layers may be applied to reach the desired thickness and R-value. As with all spray polyurethane foam systems, care should be taken to avoid improper application techniques. Common examples of improper techniques include, but not limited to: ***off ratio material, excessive thickness of SPF, spraying into or under rising foam, spraying to damp surfaces and surfaces that are too cold or dirty.*** Improperly installed SPF can reach dangerously high reaction temperatures that may result in fire and offensive odors (odors may not dissipate with time). **REMOVAL** of improperly installed foam is mandatory. Replace with properly installed SPF. The applicator is responsible to thoroughly understand all: equipment, technical information, proper application techniques, safety operating procedures, proper PPE and job site safety pertaining to SPF applications.

Recommended Product Applications: Walls Floors Attics Ceilings (Vaulted or Cathedral) Crawl Spaces

Application Parameters

CHEMICAL STORAGE TEMPERATURE		50°F - 85°F (10-29°C)
SUBSTRATE AMBIENT TEMPERATURE	WINTER	>15F (-9°C)
MOISTURE CONTENT		< 18%
MAXIMUM LIFT PER PASS DYNAMO ECO 2000		2.5" Maximum

Processing Requirements

RESIN MATERIAL MUST BE > 70°F (21°C) BEFORE PROCESSING

Warning

DO NOT MIX
DO NOT RECIRCULATE

Equipment Settings

PRE-HEATERS (A) COMPONENT - DYNAMO ISO	105°F - 130°F (40-54°C)
PRE-HEATERS (B) COMPONENT - DYNAMO RESIN	105°F - 130°F 40-54°C)
HOSE HEAT TEMPERATURE	105°F - 130°F (40-54°C)
FLUID PRESSURE	1,150 - 1,500 psi - Dynamic
MIXING RATIO	1 : 1 By Volume
RECOMMENDED MIX CHAMBER	10 - 15 Lbs / Minute (GRACO - 01 - AR4242 or equivalent)

These are recommended "INITIAL" settings. These settings will vary depending on equipment type, ambient temperatures and substrate temperatures.

Application Guidelines

Dynamo Polyurethane foam systems should only be processed through commercially available spray equipment. The proportioning equipment must be capable of maintaining all designated ratios, temperature settings, spray pressures, etc. as shown in the equipment settings above. 2:1 transfer pumps are recommended for supplying the liquid components (Dynamo ISO "A" and Dynamo RESIN "B") to the proportioner. Proper spray guns should provide thorough blending of the two liquid components. The equipment shall be of the heated airless type capable of maintaining proper primary heat and hose heat temperatures. It is the responsibility of the professional qualified applicator to completely understand all: spray equipment, technical information and safety operating procedures pertaining to spray polyurethane foam applications and work areas.

Raw Material Storage Guidelines

Material shelf life is six (6) months from date of manufacture when properly stored in the original unopened containers at temperatures 50°F-80°F (10 - 27°C). Store in a dry and well-ventilated area. Cold chemicals will cause improper mixing, pump cavitation or other processing problems due to higher viscosity at lower temperatures. The material temperature should be conditioned between 70 °F to 85 °F (21-29 °C) for 48 hours before use. Avoid storing drums on concrete or metal floors especially in winter conditions.

Do not store in direct sunlight. Protect from freezing. Always keep drums tightly closed when not in use.

Flushing Procedures

Material Change Over:

This procedure must be followed when changing from one SPF system to another. Before Dynamo TUNDRA, is introduced into any equipment, previous material must be purged. Failure to do so can result in product issues. Care must be taken to not allow any other material into the Dynamo TUNDRA RESIN. Shut off all heats and spray machine. Disconnect air to both transfer pumps and remove the resin drum pump. Wipe all areas of pump clean and invert pump over bucket to ensure drum pump housing is emptied. Place pump into new resin drum. Remove spray gun from coupling block. With shut off valves closed connect air to resin transfer pump. On coupling block open resin side shut off valve only and allow material to pump into a clean bucket. Purging will take between 2-5 gallons. Re-connect cleaned spray gun and all air to transfer pumps. Turn on spray machine and begin heating procedures.

Characteristics of Spray Application

Material that is properly blended will have uniform cell structures and color throughout. Dynamo TUNDRA can be sprayed up to 2.5 inches per pass. When spraying less than 1/2 inch you will not achieve optimal results. This product should never be applied to surfaces with moisture content above 18%. If the sprayed foam appears to run, sag or drip, the hose and preheat temperatures should be increased. Increase in 3º-5º F increments until issues are corrected. At no time should the temperatures exceed 140º F for the A, B or hose. In some cases the machine pressure may need to be reduced to minimize the amount of material being applied and decrease the possibility of blowing reactive material off the substrate. When applying more than one lift of material, fifteen (15) minutes between passes is recommended particularly in cold weather to allow surface moisture to evaporate prior to the next application occurring. If the second application shows separation between passes or delamination, the time between passes should be increased

Product Issues: shrinkage or delamination of the sprayed material is observed, there are several issues that should be considered:

- **Improper Mixing of the Material:**

  Check the gauges for balance. If the gauges are balanced there may still be the possibility of a clogged screen or partial obstruction in the mixing chamber.
- **Material Is Too Hot:** Resolved by decreasing the temperature in 3º F increments until the issue stops.
- **High Moisture Content of the Substrate:** The moisture content (surface moisture) should be less than 18% max and preferably less than 16%.

Recommend heating an area in cold weather prior to an application to ensure optimum material performance. Use proper ventilation for this process. Air will heat more quickly than substrates. When the substrate has cold exposure to the outside, condensation will occur on the substrate. Small levels of moisture can contribute to Dynamo TUNDRA shrinkage. Continue to heat the area and wait for the condensation to evaporate.

START- UP PROCESS

Dynamo TUNDRA should be no less than 70º F and optimally 80º F before processing begins. Drum blankets should be used to increase temperature of material. Uniform drum temperature is desired before processing.

Remember to never mix other supplier's A or B materials with Dynamo TUNDRA resin.

SHUTDOWN PROCESS

Preparing for overnight shutdown: Park proportioner system according to manufacturer's guidelines. Grease and properly store spray gun according to manufacturer's procedures. Always properly secure drum bungs to avoid contaminating material. Fasten drums so they will not spill or fall over. Use proper care to not allow moisture to enter A - Side ISO drums.

For further information or guidance please contact the Dynamo Technical Staff.

THERMAL BARRIER

Building codes (IRC and IBC) require spray polyurethane foam be separated from the interior of a building by an approved fifteen (15) minute thermal barrier.

Examples of thermal barriers are: 1/2" gypsum wall board or equivalent. Exceptions to thermal barrier requirements: Code authorities can approve coverings based on specific fire test per application also SPF protected by one inch (1") thick masonry does not need a thermal barrier.

Ignition barriers are not thermal barriers unless they comply with NFPA 286 or other full scale burn tests. Always confirm code body approvals.

Material Handling

Due to the reactive nature of these components **RESPIRATORY PROTECTION IS MANDATORY.** The vapors and liquid aerosols present during application and for a short period thereafter must be considered and appropriate protective measures taken to minimize potential risks from over exposure. Routes of exposure are: inhalation, skin or eye contact.

Protective measures include: adequate ventilation, safety training for installers and other workers, use of prescribed personal protection equipment (PPE) as well as medical surveillance program. It is of the utmost importance for the applicator and crew to read and become familiar with all available information on proper use and handling of SPF materials. Additional information is available at: www.spraypolyurethane.org, www.polyurethane.org or by contacting the Dynamo Technical Department.

Personal Protective Equipment

Spraying polyurethane foam will result in the atomizing of components into a fine mist; everyone associated in the work area must avoid inhalation and exposure of these particle droplets. Applicators and crews working in the spray area must use the proper personal protective equipment recommended by the Center for Polyurethanes Industry for use in high pressure SPF applications.

Precautions include but are not limited to the following:

- Supplied air with full - face mask or hood (Refer to the CPI Model Respiratory Protection Program)
- Proper fabric coveralls
- Non-permeable gloves
- Solvent resistant gloves when handling raw materials and cleaning solvents
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WARNING : EXPOSURE MAY OCCUR EVEN WHEN NO NOTICEABLE ODOR IS ENCOUNTERED

Persons with known respiratory allergies should avoid exposure to the "A" (ISO) component. "A" components contain reactive isocyanate groups. Always use adequate ventilation. Vapors must not exceed the TLV (0.02 parts per million) for isocyanates.

Safe Handling of Liquid Components

When removing bungs from containers always wear proper PPE to avoid: inhalation, skin or eye contact. Loosen small bung slowly to allow any built up gas to escape before removing completely. Avoid breathing vapors. Proper care should be utilized to not let any debris enter drums. Always seal any containers not being used. Extra caution should always be taken for the A-side (ISO) MDI for more information refer to "MDI -Based Polyurethane Foam Systems: Guidelines for Safe Handling and Disposal" published by the American Chemistry Council.

Spills or Leaks

In case of a spill or a leak always wear appropriate PPE (personal protective equipment). Contain and cover spilled material with loose, absorbent material. Examples: Speedy dri, oil-dry, vermiculite, sawdust or Fuller's earth. Shovel absorbent waste material into proper containers. Wash contaminated area with hot soapy water. Always ventilate area to remove lingering vapors. Report sizeable spills to proper authorities.

In Case of Fire Extinguishing Media

In Case of Fire: ***It is recommended that a fire extinguisher be located in an easily accessible portion of the work area.***

Extinguishing Media: Dry chemical extinguishers such as monoammonium phosphate, potassium sulfate and potassium chloride. Additionally, carbon dioxide, high expansion (protein) chemical foam or water spray for large fires. Positive pressure ventilation of the work area is recommended to minimize the accumulation of vapors in the work area during the application. Improper application techniques for this foam system must be avoided, including: excessive thickness, off ratio material and spraying into rising foam. The potential results of improperly applied materials may include, but not limited to: excessive heat build-up that may result in a fire or offensive odors (which may not dissipate with time) and/or poor product performance due to improper density of the applied material. Large masses of sprayed materials should be avoided. When large masses are generated they should be removed from the area, cut into small pieces and allowed to cool before disposal. Failure to follow these recommendations may result in a fire.

Container and Waste Disposal

Steel drums must be emptied (as defined by RCRA, section 261.7 or state regulations that may be more stringent) and can be sent to a licensed drum re-conditioner. Do not discharge any waste into waterways or sewer systems. Proper disposal of all waste must follow local and state guidelines.

Finished Foam Protection

Keep a minimum distance of three (3) inches between finished foam and heat sources such as: combustion appliance flues, incandescent recessed light fixtures, fireplace flues, etc. The finished surface of the sprayed polyurethane foam should be protected from the adverse effects of direct exposure of ultra-violet light from the sun; exposure will cause discoloration and degradation. Use approved coatings to protect finished foam.

Mechanical Ventilation Requirements

When applying Dynamo Closed Cell Spray Foam Insulation it is required that a mechanical ventilation system be utilized in the workspace. The requirement for this ventilation system is at a minimum ventilation rate during spray application. The mechanical ventilation system to be used in the workspace must effectively exhaust air directly to the exterior of the building at a minimum rate of 0.3 Air Changes per Hour (ACH). The volume of the workspace must be determined for system design. If, for example, the volume of the workspace is 4,000 ft^3 then the minimum capacity of the ventilation system equals 4,000 ft^3 x 0.3 ACH = 1,200 ft^3/h = 20 ft^3/min (cfm).

Note that 0.3 ACH is a minimum ventilation rate at which most commercial ventilation fans can easily achieve. It is recommended that this level be exceeded. More ventilation utilized in the workspace the better.

Further information can be found in the "Guidance on Ventilation During Installation of Interior Applications of High-Pressure Spray Polyurethane Foam" available from the American Chemistry Council Spray Foam Coalition.

Health and Safety

First Aid responders should pay attention to self-protection and use the recommended PPE.
INHALATION: Supply fresh air or oxygen; ***call for doctor***.
EYE CONTACT: Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
AFTER SWALLOWING: Immediately call a doctor. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.
SKIN EXPOSURE: Immediately remove any clothing soiled by the product. Immediately wash skin with water and soap and rinse thoroughly. Remove breathing apparatus only after contaminated clothing have been completely removed. In case of irregular breathing or respiratory arrest provide artificial respiration.

It is the responsibility of the applicator to thoroughly understand all equipment technical information and safe operating procedures that pertain to a spray polyurethane foam application.

Technical Assistance

For additional assistance please contact the Technical Services Department of Dynamo Polyurethane Systems LLC at 469-799-9991 or tech@Dynamosps.com

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