

Polyisocyanurate (PIR) Foam: Spray Compatibility with PU Equipment

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Purpose: This paper outlines whether PIR foam can be sprayed using the same equipment as standard PU foam (e.g., Graco HFR or Reactor H50), and explains why PIR is recommended in certain high-temperature or long-term load situations relevant to HydroFoamer trench stabilization applications.

1. Why Use PIR Instead of PU?

- **Creep Resistance:** PIR maintains its structural shape better over decades under constant pressure. At 80°C, PU foam may deform significantly (>50% strain), while PIR remains within safe limits.
- **Temperature Tolerance:** PIR foam can withstand up to 120°C continuously, compared to PU's 60–70°C threshold. This makes PIR ideal for segments exposed to high thermal loads.
- **Fire Safety & Dimensional Stability:** PIR has better flame resistance and less shrinkage over time.
- **Cost Consideration:** PIR is approximately 20% to 80% more expensive than PU foam, depending on density and formulation. Despite the higher cost, it is likely worth the investment in areas subject to bends, high pressure, or high temperature, where deformation or mechanical failure is more likely.

2. Equipment Compatibility

- Plural-component systems (e.g., Graco HFR, Reactor H50) can be used for PIR foam, provided proper adjustments are made.
- PIR and PU both use isocyanate-based chemistry, so the machinery is inherently compatible.

3. Required Adjustments

Parameter	PU Foam (Standard)	PIR Foam (Adjusted)
Mixing Ratio	1:1	Often 1:1 or slightly varied
Preheat Temp	40–60°C	55–70°C
Viscosity	Lower	Higher (needs more heat)
Catalyst Sensitivity	Moderate	High (tight process window)
Reactivity Time	Moderate to fast	Variable (formulation-dependent)

4. Key Considerations

- Hose heat and pressure may require tuning.

- Some mixing chambers or nozzles (e.g., GAP sizes) may need to be swapped.
- Consult the PIR supplier for a sprayable formulation designed for in-situ application.

5. Temperature Suitability

Temperature Range	Best Foam Type	Reason
-30°C to +10°C	PU Foam	High stiffness, low creep, cost-effective
+10°C to +60°C	PU Foam (if not heat-loaded)	Good general performance
+60°C to +120°C	PIR Foam	PU deforms; PIR resists creep
>120°C	Phenolic/Other	PIR breaks down; needs exotic foams

6. PU-PIR Bonding Compatibility PU and PIR foam bind well together, due to their shared isocyanate-based chemistry. This enables flexible design where PU can be used in colder zones and PIR in high-temperature areas within the same trench system.

Bonding Scenario	Strength	Notes
PIR sprayed onto fresh PU	+++ Very strong	Ideal — forms chemical bond
PIR sprayed onto cured PU	++ Good	Clean and dry surface required
PU sprayed onto cured PIR	++ Good	Light abrasion improves grip
Delay >24h before overcoating	+ Moderate	Mechanical bond only; prep recommended

7. Summary: PIR foam can be used with PU spray machines, but only with proper settings and compatible formulations. It offers significantly better high-temperature performance and creep resistance, making it a suitable upgrade for sections of the HydroFoamer application exposed to >60°C. PU remains ideal for cold zones. Both foams bond effectively, enabling flexible deployment.

Recommendation: Use PIR in hot, high-pressure, or high-stress areas such as bends, where long-term creep or deformation could compromise mechanical integrity. Test PIR formulations with your existing equipment in controlled conditions before field deployment.