



TECHNICAL BULLETIN: Substrate Assessment, Preparation, and Advanced Acrylic Priming Techniques for Self-Leveling Underlayments

1. Substrate Assessment & Structural Requirements

Prior to primer application, concrete substrates must undergo rigorous evaluation and mechanical preparation to ensure structural integrity and a successful self-leveling underlayment (SLU) bond.

- **Structural Integrity:** The concrete substrate must be fully cured (typically minimum 28 days), sound, and structurally stable, exhibiting a minimum compressive strength of 3,000 psi (20.7 MPa) and a tensile bond strength exceeding 200 psi (1.4 MPa).
- **Surface Cleanliness:** All surface contaminants—including oil, grease, wax, dirt, dust, paint, efflorescence, curing compounds, sealers, asphalt, and weak surface laitance—must be completely removed. Chemical cleaning or acid etching is not acceptable.
- **Mechanical Surface Profiling:** Profiling is not always necessary. Good quality chalk free porous concretes may not require profiling. Poor quality substrates must be mechanically prepared using methods such as shot-blasting, scarifying, or diamond grinding to achieve an International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) of 1 to 3, depending on the underlayment thickness and specific application requirements.
- **Environmental & Temperature Conditions:** Ambient and substrate temperatures must be maintained between 50°F and 90°F (10°C and 32°C) during application and for at least 48 hours afterward. Avoid drafts and direct sunlight during application.
- **Expansion & Control Joints:** Never bridge movement joints. All existing control joints, expansion joints, and isolation joints must be honored and carried through the primer and self-leveling layer to the finished surface.
- **Cracks & Penetrations:** Dynamic or dormant cracks, floor drains, and perimeter wall/floor junctions must be sealed or isolated prior to priming to prevent slurry loss and unbonded movement.

2. Concrete Porosity Assessment

Applicators must evaluate concrete absorption rates before mixing or applying acrylic primers. Slab porosity varies across a single pour due to localized over-watering, variable finishing, or mechanical burnishing.

- **The Water Droplet Test:** Place several dime-sized drops of clean water across various zones of the prepared slab.
- **Highly Porous Substrates:** Water absorbs in **under 60 seconds**. The primer will penetrate rapidly, requiring multi-stage priming or higher dilution ratios to satisfy slab absorption and prevent premature drying.
- **Dense / Non-Porous Substrates:** Water beads or takes **longer than 10 minutes** to absorb. The concrete requires mechanical profiling (e.g., shot-blasting) to open the pore structure or an undiluted primer application.

3. Advanced Nano-Acrylics vs. Legacy Formulations

Modern primer formulas utilize nano-polymer technology with ultra-small particle sizes to maximize substrate penetration and mechanical bond strength. While legacy primers rested superficially on top of concrete, modern concentrated acrylic matrixes penetrate deep into the pore structure. This evolution provides protection against delamination but demands strict application precision. Most manufacturers offer one or more primers made for application over substrates that are not consistently porous. These primers are known to be highly effective for applicators that are unwilling to follow professional guidelines and for the DIY community. However, their cost is frequently 5 times greater per sq ft.

Feature	Legacy Large-Molecule Primers	Advanced Nano-Acrylic Primers
Substrate Penetration	Low (creates a superficial surface skin)	High (anchors deep inside concrete pores)
Delamination Resistance	Moderate (prone to shearing under stress)	Superior (creates a monolithic structural bond)
Application Skill Needed	Low (roll-on, single-layer, un-diluted)	High (requires tailored water dilution)

Feature	Legacy Large-Molecule Primers	Advanced Nano-Acrylic Primers
Slab Porosity Sensitivity	Low (bridges across variable porosity)	High (highlights and sinks into porous zones)
Material Coverage Cost	Low-High per sq. ft. (heavy solids, no dilution)	Low per sq. ft. (highly concentrated formulas)

4. The 15-Minute Wet Window Rule & Dilution Strategies

To ensure nano-molecules penetrate the slab and cross-link properly, the mixed primer must remain visibly wet on the concrete surface for a minimum of **15 minutes** after being broomed into place.

If the primer dries rapidly upon contact, it flashes on the surface without deep pore penetration, forming a thin, unanchored film prone to peeling under the shrinkage tension of curing self-leveling cement.

Crucial Rule: The primer film must maintain a continuous wet matrix during application to allow polymer alignment and pore anchoring.

Adjusting Dilution for Highly Porous Concrete

To counteract rapid absorption, adjust clean, potable water mixing ratios while maintaining total coverage solids:

1. **Standard Porosity:** Apply the standard base recommendation—typically a **3:1 water-to-primer** ratio.
2. **Extreme Porosity (Initialization Coat):** Increase base coat dilution up to **5:1 or 10:1 water-to-primer**. This ultra-diluted mixture satiates deep pores and preserves the 15-minute wet window.
3. **Secondary Coat:** Once the highly diluted base coat is completely dry, apply a secondary structural coat at a standard **3:1 ratio** (or 1:1 depending on system specifics) to seal the remaining surface profile.

5. Troubleshooting Surface Failures: Air Bubbles vs. Volcanoes

Improper substrate preparation and priming produce distinct visual defects in cured self-leveling underlayment.

Standard Air Bubbles

- **Occurrence:** Extremely rare in properly mixed and formulated underlayments, as entrained mixing air releases quickly.
- **Appearance:** Perfectly round, uniform surface bubbles restricted to the top layer.
- **Cause:** Normal mixing air trapped by rapid surface skinning. These are shallow and easily corrected by light mechanical sanding or flash patching.

Volcanoes (Substrate Outgassing Craters)

- **Appearance:** Elongated, irregular crater tubes extending from the finished surface straight down to the concrete core.
- **Cause:** Insufficient priming, unsealed pores, or pinholes in the primer layer. Water from the wet self-leveling mix breaks through the unsealed film and draws into the dry concrete, displacing trapped air that streams up through the setting cement.
- **Remediation:** While not always structurally compromising, cratered surfaces will telegraph through sensitive floor coverings (e.g., glue-down luxury vinyl tile or sheet goods) and must be flash-patched and smoothed.

6. Standard Field Execution Protocol

1. **Substrate Prep & Cleaning:** Mechanically profile concrete to CSP 1–3. Thoroughly vacuum all dust and debris. Ensure the slab is free from bond-inhibiting materials and that ambient/substrate temperatures are 50°F to 90°F (10°C to 32°C).
2. **Porosity Mapping:** Perform the water droplet test across multiple zones to map out areas requiring higher primer dilution.
3. **Broom Application:** Do not apply primer with a paint roller. Pour the diluted acrylic mixture directly onto the concrete and work it aggressively into the pore profile using a clean, stiff-bristled push broom.
4. **Monitor Wet Window:** Observe the application area for 15 minutes. If dry patches appear before 15 minutes, immediately apply a more diluted primer mixture over those zones to keep the matrix wet and open.
5. **Cure & Verify:** Allow the primer to dry completely to a clear, tack-free film (typically 1 to 3 hours). Conduct a follow-up water drop test on the cured primer layer. Water must bead on top of the film, confirming a complete seal prior to the self-leveling pour.