III

Subfloors and Underlayments

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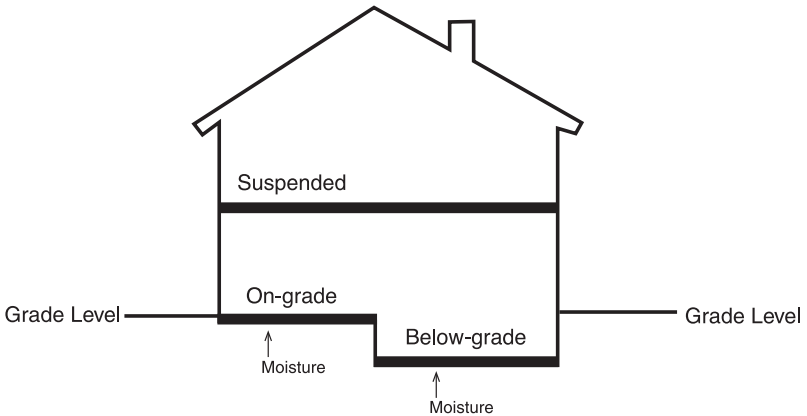
A. GRADE LEVELS

1. **Suspended -** A suspended floor is one with a minimum of 18" of well-ventilated air space below.
2. **On-grade -** An on-grade floor is in direct contact with ground or over a fill in direct contact with ground.
3. **Below-grade -** A below-grade floor is partially or completely below the surrounding grade level in direct contact with the ground or over a fill in direct contact with the ground.



B. DEFINITIONS

1. **Subfloor -** A subfloor is selected for structural purposes and is the substrate (supporting layer) for the underlayment.
2. **Sleeper-constructed subfloor -** Consists of wood subfloor installed over or on an existing concrete subfloor on- or below-grade without 18" of well-ventilated air space.
3. **APA trademarked -** Wood underlayments approved as suitable for the installation of resilient flooring by APA–The Engineered Wood Association.
4. **STURD-I-FLOOR -** An APA-rated panel specially designed as combination subfloor/underlayment.
5. **Underlayment -** The smooth surface used as the substrate for the floor covering.
6. **Subfloor/Underlayment Combination -** A surface that must meet structural requirements and have a smooth surface suitable for the floor covering.
7. **Substrate -** The smooth surface prepared to accept the resilient floor covering, such as concrete, underlayment, or existing resilient floor covering.

Regardless of the type of underlayment used under Armstrong resilient flooring, the responsibility for warranties and/or performance guarantees for the underlayment rests solely with the underlayment manufacturer and/or supplier and not with Armstrong.

The types of subfloors and underlayment panels described in this manual (F-5061) are intended only as a guide and should not be construed as an Armstrong warranty for these products.

Armstrong cannot be responsible for:

- joint or texture show-through
- tunneling and ridging over underlayment joints
- discoloration from stain sources in the panel, regardless of the type of underlayment panel used
- underlayment panel problems caused by local climate conditions, basement wall and subfloor construction, or improper installation

We strongly suggest that you secure a written guarantee and installation instructions from the supplier or manufacturer of the underlayment board being used.

C. WOOD SUBFLOORS

Armstrong resilient floors are recommended on suspended wood subfloors with a 1/4" underlayment (see product installation systems for exceptions) and a minimum of 18" of well-ventilated air space below. Armstrong does **not** recommend installing resilient flooring on wood subfloors applied directly over concrete or on sleeper-construction subfloors.

Loading requirements for subfloors are normally set by various building codes on both local and national levels. Trade associations (such as APA–The Engineered Wood Association) provide structural guidelines for meeting various code requirements. Subfloor panels are commonly marked with span ratings showing the maximum center-to-center spacing in inches of supports over which the panels should be placed.

1. APA-Rated STURD-I-FLOOR

Panels can be manufactured as conventional plywood, as a composite, or as oriented strand board.

a. For all flooring, except the ToughGuard II installation system, Armstrong recommends an additional 1/4" or thicker layer of APA plywood underlayment.

b. When installing directly over wood subfloors, the moisture content of the subfloor should be 13% or less. Single-layer wood subfloors increase the potential for staining from the panel components, coated nails, construction adhesives, spills, overspray, and show-through from texture and mechanical or water damage when resilient floors are installed directly to single-layer STURD-I-FLOOR.

2. Wood Strip, Board, or Plank Subflooring

These subfloors must meet structural requirements. Regardless of whether the subfloor is single- or double-layer, Armstrong recommends the following:

- If the top layer is tongue-and-groove and the strip wood is 3" or less in face width, cover with 1/4" or thicker underlayment panels.
- All other layers should be covered with 1/2" or thicker underlayment panels.

D. WOOD OR BOARD-TYPE UNDERLAYMENTS

1. Underlayments

Subject to the board manufacturer's recommendations and warranties, the following underlayments may be used with Armstrong resilient flooring products with certain limitations indicated for each underlayment type.

Armstrong Floor	Plywood, APA Underlayment, Poplar or Birch Plywood or Lauan*	Hardboard	Oriented Strand Board	Particle Board (CPA)	Fiber Reinforced Gypsum, Fiber cement Board and Cementitious Backerboards
All Armstrong Floors	X				X
ToughGuard II	X		Modified Loose Lay Only		X
Residential Felt back	X	Perimeter Bond Only		Perimeter Bond Only	X

* Some Lauan may present severe problems such as discoloration, indentation, loss of bond and delamination when used as an underlayment.

a. Plywood

1. **APA Trademarked Plywood or Equivalent Agency Certified Plywood** rated as suitable underlayment for resilient floor coverings such as tile or sheet vinyl. It should have an Exterior or Exposure 1 exposure durability classification and a fully sanded face. APA plywood underlayment grades recommended for areas to be covered with resilient non-textile flooring are A-C, B-C, C-C Plugged, or C-C Plugged EXT when marked "sanded face." Also, Marine EXT or sanded plywood grades (A-C, B-C, A-D, or B-D) marked "Plugged Crossbands Under Face," "Plugged Crossbands (or Core)," "Plugged Inner Plies," or "Meets Underlayment Requirements."
2. **Poplar or Birch Plywood** with a fully sanded face and exterior glue.
3. **Lauan Plywood**, when used as an underlayment, should be Type 1 (Exterior). The best grade is BB and the next best is CC, while overlay grade (OVL) is the minimum acceptable face grade. There is a wide variety of quality and species classed as lauan. Some may present severe problems such as discoloration, indentation, loss of bond, or delamination when used as an underlayment.

4. **Treated Plywood –** Armstrong resilient flooring is not recommended directly over fire-retardant treated plywood or preservative treated plywood. The materials used to treat the plywood may cause problems with adhesive bonding. An additional layer of at least 1/4" thick underlayment should be installed so that the construction still meets the applicable building or fire codes.

b. Hardboard
Untempered hardboard that meets requirements for wood underlayments is acceptable only for use under Armstrong resilient flooring products installed by the Residential Felt-Back perimeter bond method.

c. Oriented Strand Board (OSB)
OSB is made of thin narrow strands of hardwoods and softwoods that are longer than they are wide. The strands are dried, screened, blended with adhesive, and formed into a multilayered mat. In the surface layer, the long axes of the strands are oriented so that they are, in general, parallel with the long direction of the panel. The strands in the inner layers may not be oriented in any particular direction or may be generally oriented perpendicular to the long direction of the panel.

d. Particleboard
Particleboard, often called "chipboard," is comprised of small particles usually arranged in layers by size, but not oriented. Composite Panel Association-approved grades of particleboard underlayment are acceptable only for use under Armstrong resilient flooring installed by the Residential Felt-Back perimeter bond method.

e. Fiber Reinforced Gypsum Underlayment, Fiber Cement Board, and Cementitious Backerboard
These products must be designed specifically for vinyl floor coverings. Written installation instructions and a guarantee for the product's use in conjunction with vinyl floor coverings should be provided by the manufacturer.

f. Wood Subfloors with Concrete or Gypsum Toppings
These subfloors consist of lightweight concrete or gypsum-based topping over plywood on wood joists or trusses. See Concrete, Floor Fills, Underlayments and Toppings (E-8).

2. Underlayment Requirements

Underlayments for resilient floors must:

- be structurally sound
- be designed for resilient flooring underlayment purposes
- be a minimum of 1/4" thick
- have panels smooth enough so that texture or graining will not show through the finished flooring
- resist dents and punctures from concentrated loads
- be free of any substance that may stain vinyl such as edge patching compounds, marking inks, paints, solvents, adhesives, asphalt, dye, etc.

- be installed in strict accordance with the board manufacturer's recommendations

3. Underlayment Installation

a. Armstrong suggests the panels be lightly butted and not filled or flashed, unless the manufacturer specifically recommends filling the joints.

b. It has been Armstrong's experience that filling or flashing joints between panels with patches may increase the tunneling and/or ridging over these joints.

c. Differences in the thickness of wood panels should be corrected by sanding.

d. All wood product panels will change in size with changes in water content. Since panels received from the mill generally have very low moisture content compared to the interior of the building and the structural subfloor, allow the panels to condition to the job site per the panel manufacturer's recommendations. This will minimize the chance of tunnels or ridges over the underlayment joints.

e. Some fasteners for underlayment panels or single-layer subfloor panels are coated with resin, rosin or cement that can discolor vinyl flooring. **Coated fasteners should not be used to install underlayments unless you know they will not stain the finished flooring product and you assume responsibility for their use**.

How to Evaluate Fasteners for Staining Potential

a) "Weave" or "thread" the coated nail through two small cuts 1" apart in a 2" x 4" sample of white vinyl flooring.

b) Smaller coated staples can be laid on both the face and the back of the sample and held in place by foil wrapping.

c) The coated fastener must be in direct contact with both the face and the back of the flooring sample.

d) Tightly wrap each sample (with coated fasteners) in aluminum foil.

e) Place in conventional oven set at 200°F (93.3°C) for 1 hour. **Do not exceed temperature or time recommendation. Do not place in microwave oven**.

f) Remove sample from oven and allow to cool.

g) Inspect for staining characteristics of fastener.

f. Some construction adhesives used to glue subfloors and underlayments can stain resilient flooring. Solvent vapors can distort some flooring. **Do not use adhesives to install underlayments unless you know they will not stain the resilient flooring. You assume responsibility for their use**.

4. Underlayment Preparation

a. A wood floor to be covered with a new resilient floor must first be properly prepared.

b. Check panels for sources of discoloration such as contamination from paint, varnish, stain overspray or spills, plumbing sealers, asphalt, heater fuel, markers, or potential staining agents such as wood or bark not visible on the surface, edge sealers, logo markings, printed nail patterns, and synthetic patches.

c. Remove old adhesive*.

d. Cover adhesive, oil, or wax residue with an appropriate underlayment. If the residue is tacky, place a layer of felt or polyethylene sheeting over it to prevent a cracking sound when walking on the floor.

e. Remove all paint, varnish, oil, and wax from all subfloors. Many buildings constructed before 1978 contain lead-based paint, which can pose a health hazard if not handled properly. State and federal regulations govern activities that disturb lead-based painted surfaces and may also require notice to building occupants. **Do not remove or sand lead-based paint without consulting a qualified lead professional for guidance on lead-based paint testing and safety precautions**. Armstrong does not recommend the use of solvents to remove paint, varnish, oil, wax, or old adhesive residues because the solvents can remain in the subfloor and negatively affect the new installation. Whenever sanding, be certain the work site is well ventilated and avoid breathing dust. If high dust levels are anticipated, use an appropriate National Institute for Occupational Safety and Health (NIOSH) designated dust respirator. All power sanding tools must be equipped with dust collectors. Avoid contact with skin or eyes. Wear gloves, eye protection, and long-sleeve, loose fitting clothes.

NOTE: For additional information on the installation and preparation of wood and board-type underlayments, see ASTM F1482, "Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring."

** Some previously manufactured asphaltic "cutback" adhesives contain asbestos (see warning statement on page x). For removal instructions, refer to the Resilient Floor Covering Institute's publication Recommended Work Practices for Removal of Resilient Floor Coverings.*

E. CONCRETE

New and existing concrete subfloors must meet the requirements of the latest edition of ASTM F710, "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring" available from the ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428; 610 832 9500; http://www.astm.org.

NOTE: Regardless of the type of concrete or other cement-like material used as a base for resilient flooring, in the event of underlayment failure, the responsibility for warranties and/or performance guarantees rests with the concrete or cement-like material manufacturer and not with the manufacturer of resilient flooring.

1. Concrete Floors and Moisture

Any concrete subfloor can be a source of moisture-related flooring failures, including above-grade concrete floors. By its very nature, concrete starts as a water-saturated mass which must cure and then dry sufficiently to allow the installation of flooring. Above-grade floors normally have only the mix water with which to contend, although rain, spills, and water leaks can add more water. Roughly one-half of the mix water is consumed by hydration of the cement during the curing period, with the rest slowly reduced by evaporation. Once dry enough for installation, there is little chance of future moisture-related problems on above-grade concrete slabs. Concrete for on-ground or below-ground floors not only has the mix water to consume and dissipate, also has a potentially inexhaustible source of moisture from the ground. When covered with resilient flooring, a slab that is constructed directly on sub-grade soil will become approximately as moist as the soil on which it is placed.

To reduce this ingress of moisture, a well-designed floor system will have a capillary break and an effective and intact moisture vapor retarder in place. Slabs on and below grade can be affected by both water vapor and capillary rise. Below-grade slabs are closer to the water table, have poorer ventilation for drying and have the added risk of hydrostatic pressure. On-ground concrete slabs and below-grade slabs must have an effective and functional vapor retarder directly beneath the concrete to prevent ingress of moisture from the sub-base and sub-grade soil.

Resilient flooring products, whether sheet, plank, or tile, function as moisture vapor retarders on top of the floor slab. If more moisture is rising from beneath the concrete than can be accommodated by the flooring and adhesive, failure of the installation is inevitable.

Too much ground moisture can create problems for on-grade and below-grade areas of commercial and residential buildings over and beyond those relating to the installation and use of resilient flooring. These problems vary from merely slight but unpleasant dampness to actual structural damage. Moisture near the surface of a concrete slab varies as the weather changes and moisture within the slab usually approximates the dampness of the subsoil.

NOTE: The water-cement ratio is the most important factor regarding moisture migration, permeability, and the drying rate of a concrete slab. Water-cement ratios in the range 0.45 to 0.5 are practical and recommended by the concrete construction industry for slabs to receive resilient flooring. A water-cement ratio of 0.5 is an achievable and reasonable requirement for slabs on or below grade. Significantly higher water-cement ratios may lead to slower drying and problems with moisture movement through the slab, causing flooring failures.

2. Below-Grade Concrete Floors

a. The floor classification must be per the current edition of the American Concrete Institute (ACI) "Guide for Floor and Slab Construction," ACI 302.1R:

   1) For residential and light commercial: Class 2 (except minimum compressive strength must be 3500 psi)

   2) For commercial and institutional: Class 4

b. The concrete slab should have a minimum compressive strength of 3500 psi.

c. The concrete slab must be dry, clean, smooth, structurally sound, and free of foreign materials that might prevent an adhesive bond as described in ASTM F710, "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring."

d. The concrete slab must be protected from ground moisture with an effective and intact vapor retarder that conforms to the requirements of ASTM E1745, "Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs."

e. The concrete slab must be placed directly on the vapor retarder.

f. The concrete must be wet cured with a moisture-retaining curing cover. Do not use spray-on curing compounds because these reduce the drying rate of concrete and can interfere with the adhesive bond.

g. Before installing the finished flooring, moisture, alkali, and bond testing must be conducted.

   1) Moisture testing must be performed in accordance with ASTM F2170 "Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes" (preferred method) or in accordance with ASTM F1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride." See section E-10 on Moisture Testing for more details.

   2) The surface of the concrete must have a pH of 9 or less when tested according to the method described in ASTM F710.

   3) Bond testing must be performed to determine compatibility of the adhesives to the concrete slab.

3. On-Grade Concrete Floors

a. The slab must be of good quality, standard density concrete with low water/cement ratios consistent with placing and finishing requirements, having a maximum slump of 4", a minimum compressive strength of 3500 psi, and following the recommendations of ACI Standard 302.1R for Class 2 or Class 4 floors and the Portland Cement Association's recommendations for slabs on ground.

b. The concrete slab must be dry, clean, smooth, structurally sound, and free of foreign materials that might prevent an adhesive bond as described in ASTM F710 "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring."

c. The concrete slab must be protected from ground moisture with an effective and intact vapor retarder that conforms to the requirements of ASTM E1745 "Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs."

d. The concrete slab must be placed directly on the vapor retarder.

e. The concrete must be wet cured with a moisture-retaining curing cover. Do not use spray-on curing compounds because these reduce the drying rate of concrete and can interfere with the adhesive bond.

f. Before installation of the finished flooring, moisture, alkali, and bond testing must be conducted.

   1) Moisture testing must be performed in accordance with ASTM F2170 "Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes" (preferred method) or in accordance with ASTM F1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride." See section E-10 on Moisture Testing for more details.

   2) The surface of the concrete must have a pH of 9 or less.

   3) Bond testing must be completed to determine compatibility of the adhesives to the concrete slab.

4. Above-Grade Concrete Floors

a. Above-grade concrete is usually protected from most sources of moisture except the moisture initially in the mix and water vapor in the atmosphere. As with concrete placed on and below grade, above-grade concrete must be kept damp during the curing process to permit hydration to occur. Concrete poured on a metal deck is often produced with lightweight aggregate that can retain excess water longer than normal-weight aggregate. Because drying is only possible from the top surface, such construction usually takes additional drying time.

b. Floors on metal decks or above-grade structural concrete floors must be dried and must meet the same requirements as described in sections E-2 and E-3 for slabs on and below grade.

c. Before installation of the finished flooring, moisture, alkali, and bond testing must be conducted.

1) Moisture testing must be performed in accordance with ASTM F2170 “Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes” (preferred method) or in accordance with ASTM F1869 “Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.” See section E-10 on Moisture Testing for more details.

2) The surface of the concrete must have a pH of 9 or less.

3) Bond testing must be completed to determine compatibility of the adhesives to the concrete slab.

5. Concrete Compressive Strengths

Because of traffic loads anticipated for commercial and institutional environments, concrete slabs should meet the requirements for ACI* Class 2 or Class 4 floors. For these environments, all concrete slabs, including lightweight slabs, must have a compressive strength of 3,500 psi or greater.

6. Lightweight Concrete

a. Armstrong resilient flooring may be acceptable over lightweight aggregate concretes having dry densities greater than 90 lbs. per cubic foot and cellular concretes having plastic (wet) densities over 100 lbs. per cubic foot (94 lbs. dry weight), providing the surface is troweled to a smooth, even finish. This is a **minimum** requirement for the application of resilient floor covering. Concrete slabs with heavy static and/or dynamic loads should have higher design strengths and densities calculated to accommodate such loads.

b. Because lightweight concrete can retain significant amounts of moisture within the slab, it is imperative that lightweight floors be tested for moisture in accordance with ASTM F2170 “Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.” DO NOT TEST LIGHTWEIGHT CONCRETE FLOORS USING ASTM F1869 “Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.” This test method does not indicate the moisture condition deep within a slab and can be especially misleading when used on lightweight concrete slabs.

7. Preformed Concrete Plank or Sections

Because of the joints between the sections, this type of subfloor requires finishing with a concrete topping before resilient flooring is installed. The topping prevents the finished floor from cracking or loosening from the subfloor due to movement of the concrete. Trowelable underlayments are not satisfactory for smoothing preformed concrete subfloors. Concrete toppings on precast concrete must be tested for moisture as for ordinary concrete floor slabs.

** ACI 302.1R-96, Guide For Concrete Floor And Slab Construction, pp. 5 and 22.*

8. Floor Fills, Underlayments, and Toppings

There are numerous products available for use as floor fills, patches, self-leveling underlayments and trowelable underlayments. They include proprietary blends of compounds such as Portland Cement, calcium aluminates, and gypsum-based products. These are recommended by their manufacturers for smoothing rough or uneven subfloors, enhancing acoustical and fire characteristics of structures, or as substrates to receive resilient floor covering for otherwise unsuitable subfloor conditions. When using these products, be sure to follow the manufacturer's recommendations regarding application, drying time, and moisture testing.

Do not install Armstrong floors over gypsum-based products which have been applied to on- or below-grade concrete or damp, suspended concrete for commercial and institutional environments. The floor fill, topping or underlayment **must** also have a minimum compressive strength of 3500 psi. Armstrong S-184 or S-194 meet or exceed this requirement as underlayments.

All recommendations and guarantees regarding their suitability as substrates for resilient flooring are the responsibility of the manufacturer and installer of the substrate.

9. Curing, Sealing, Hardening, or Parting Compounds

"Curing compounds leave a film that can interfere with the adhesion of other materials to the treated surface. … Their use should be avoided on surfaces that will later be covered with resilient floor coverings. … Where applicable, a letter of compatibility should be obtained from the manufacturer before the use of a curing compound on a floor receiving a subsequent finish." (Quote from American Concrete Institute, ACI, publication 302.1R-04, Guide for Concrete Floor and Slab Construction, Chapter 9.2, Methods of Curing.) Any letter of compatibility must come from the manufacturer of the compound.

When curing, sealing, hardening, or parting compounds have been used, the following general statements can be made:

a. If they contain soap, wax, oil, or silicone, the compounds must be removed before a resilient floor can be installed.The compounds can be removed by using a terrazzo or concrete grinder, by sanding with a drum sander or by using a polishing machine equipped with a heavy-duty wire brush.

b. There are many materials that do not contain soap, wax, oil, or silicone and are advertised as being compatible with resilient flooring adhesives. No specific statement can be made regarding their use or need for removal. Conduct bond tests to determine the need for removal. If the bond fails after 72 hours, the compound must be removed.

Curing agents are applied to concrete slabs to retard the escape of water during the initial curing process. Such compounds can remain on the surface of a slab and continue to retard the escape of water during the drying process, and they may break down after the floor covering has been installed and the building is in use. This can occur on above-grade slabs as well as those in contact with the ground.

The elimination of excessive free water from the concrete is essential for the formation of a bond between the adhesives, the flooring materials, and the concrete. In the presence of excessive free water, water-based adhesives will not set up and solvent-based adhesives will not adhere. In the case of adhesives already bonded to the concrete, the adhesive will be displaced by water if the availability of water is sustained.

NOTE: In the event of adhesion failure, the responsibility for warranties and/or performance guarantees rests with the compound manufacturer and not with the manufacturer of the resilient flooring and/or adhesives.

10. Moisture Testing

Moisture testing is an essential part of determining the suitability of a concrete slab to receive a resilient floor covering. Moisture testing must be performed on all concrete slabs, regardless of their age or grade level, including areas where resilient flooring has already been installed. Moisture testing should be conducted with the area or building at service conditions, (i.e., fully enclosed, weather-tight, and with the permanent or temporary HVAC in operation). In general, moisture testing should be conducted on concrete surfaces that exhibit the final prepared stage before the installation of the flooring material and before installation of smoothing or leveling compounds.

Armstrong recommends the following test methods:

a. **Percent Relative Humidity (RH) in Concrete Slabs - Preferred Method**
Testing for internal relative humidity of concrete slabs must be conducted in strict accordance with the latest edition of ASTM F2170 "Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes."

b. **Moisture Vapor Emission Rate (MVER) Test**
MVER tests must be conducted in accordance with the latest edition of ASTM F1869 "Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride." When performing these tests, it is important to remove any curing agents or residues down to the bare concrete. The calcium chloride tests are to be performed only on ordinary concrete floors and are not applicable on lightweight concrete, smoothing or leveling compounds, gypsum underlayments, or other fills.

Following are Armstrong's maximum allowable moisture and pH limits.

Commercial Resilient Products	Adhesive	% Internal Relative Humidity	MVER Pounds Per 1000 ft² Per 24 Hours	pH
MEDINTECH, MEDINTONE, MEDLEY, ROYAL, SOLID	S-599 and S-240	80	5	5 to 9
	S-543 High Moisture	90	5	5 to 11
REJUVENATIONS (TIMBERLINE, StoneRun, Ambigu)	S-599 and S-240	80	5	5 to 9
	S-543 High Moisture	90	5	5 to 11
Abode	S-288 and S-289	80	5	5 to 9
POSSIBILITIES Petit Point, Connection CORLON	S-599 and S-240	80	5	5 to 9
	S-543 High Moisture	90	5	5 to 11
Linoleum	S-240	80	5	5 to 11
	S-780	85	5	5 to 11
Commercial Vinyl Composition Tile (VCT)	S-700 and S-750	80	5	5 to 9
	S-515 High Moisture	90	7	5 to 11
	S-525 High Moisture	85	7	5 to 11
SAFETY ZONE	S-700, S-750 and S-240	80	5	5 to 9
	S-515 High Moisture	90	7	5 to 11
	S-525 High Moisture	85	7	5 to 11
Bio-Based Tile	S-525 High Moisture	85	7	5 to 11
	S-700	80	5	5 to 9
NATURAL CREATIONS LVT PARALLEL LVT	S-288 and S-240	80	5	5 to 9
	S-543 High Moisture	90	7	5 to 11
	Flip Spray Adhesive	90	NA	5 to 11
NATURAL CREATIONS with I-Set	I-Set Technology S-288 and S-240	80	5	5 to 9
LUXE PLANK	Floating S-288	80	5	5 to 9
EXCELON SDT	S-202	75	3	5 to 9
RUBBER TILE, STAIR TREADS and TRANSITION STRIPS	S-240	80	3	5 to 9

Residential Resilient Products	Adhesive	% Internal Relative Humidity	Pounds Per 1000 ft² Per 24 Hours	pH
Residential Felt-Backed	S-235 and S-254	80	5	5 to 9
Residential Vinyl-Backed (StrataMax)	S-288 and S-289	80	5	5 to 9
Residential Fiberglass-Reinforced	S-288 and S-289	80	5	5 to 9
Residential Tile - Urethane No-Wax and Vinyl No-Wax	S-700 and S-750	80	5	5 to 9
	S-515 High Moisture	90	7	5 to 11
	S-525 High Moisture	85	7	5 to 11
Natural Living, Natural Personality LVT	S-288	80	5	5 to 9
Alterna	S-288	80	5	5 to 9
Linoleum	S-780	85	5	5 to 11

All tests must meet allowable moisture limits. Any area that exceeds the allowable moisture limit must be further dried to an acceptable level or treated with a moisture remediation system before flooring installation. Performance of any third-party moisture remediation system rests with the manufacturer of that system, not with Armstrong. As a reminder, these tests **cannot predict long-term moisture conditions of concrete slabs**. They are only indicators of moisture conditions at the time the tests are conducted.

NOTE: On installations for which both the Percent Internal Relative Humidity and Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed in the above tables.

11. Concrete pH

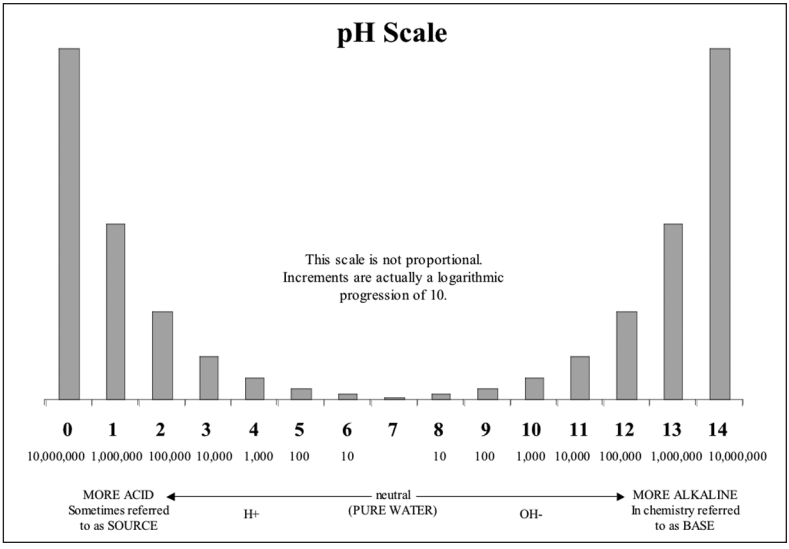
pH is a measure of the concentration of acid ions in a solution. The pH scale runs from 0 to 14; 7 is neutral. Below 7 is considered acidic and above 7 is basic. It is often incorrectly called “alkalinity” which actually refers to the concentration of ions of calcium, magnesium, sodium, and potassium.

The pH of new concrete will be approximately 12 to 13 mostly due to its calcium hydroxide, which is a normal by-product of cement hydration. As a concrete surface reacts with carbon dioxide in the air, the pH of the surface is reduced gradually to about 8.5 through a process called carbonation. A dry, normally carbonated concrete surface is ideal for flooring installation and adhesive performance. A high pH surface with excessive moisture can damage floor coverings and break down adhesives, leading to flooring failures.

In the presence of a continuing water source, dissolved alkalies and hydroxides can be carried to the surface of a concrete slab. Therefore, if testing shows a high pH value, it is important to determine the cause.

Alkaline salts in solutions with moisture, which exude from concrete or work their way up from the earth into on-grade or below-grade concrete slabs, have a tendency to destroy satisfactory bonding of adhesives by sheer physical displacement. They can leave unsightly salt deposits at the seams of sheet materials and joints of tiles. They can also have a deteriorating effect on the overall installation.

Concrete floors should be tested for pH following the procedures outlined in ASTM F710 before installing Armstrong resilient flooring. pH readings must be less than 9 to proceed with flooring installation. Distilled water is placed on the slab for 60 seconds and a pH indicator strip is placed into the water. A chart normally supplied with the strips allows you to determine the pH based on the color change of the test strip.



Rinsing and vacuuming with potable water is the best way to lower pH, but it cannot prevent the future deposit of salts on the surface of the slab. Do not use acid rinses to “neutralize” a high-pH concrete surface. The acid will deposit unwanted salts and can attack interior building finishes and be detrimental to the final installation.

Allowable pH limits can be found in section ten. The testing of concrete for pH can show the pH only at the time the test is run and cannot be used to predict long-term conditions.

12. Bond Test

It is recommended that this test be used to determine the compatibility of resilient flooring adhesives to concrete subfloors after the removal of old adhesives*, curing agents, parting compounds, dust inhibitors, oil, grease, paint, varnish and other special surface treatments or conditions. Using the flooring material and recommended adhesives, install 3' x 3' panels spaced approximately 50" apart throughout the subfloor area. Select areas next to walls, columns or other light traffic areas. Tape edges of panels to prevent edge drying of adhesive. When testing where a curing agent has been used, the curing agent must be removed in some areas for bond testing.

If the panels are securely bonded after a period of 72 hours, you may conclude that the subfloor surface is sufficiently clean of foreign material for satisfactory installation of the resilient flooring.

13. Residual Adhesives

Some previously manufactured asphaltic "cutback" adhesives contain asbestos (see **WARNING** statement on page x). For removal instructions, refer to the Resilient Floor Covering Institute's publication "Recommended Work Practices for Removal of Resilient Floor Coverings."

The following guidelines for adhesive removal pertain to resilient flooring adhesives only. All other adhesives are to be removed 100%.

Degree of Removal	Products
100% of the overall area of the original substrate must be exposed.	• Linoleum • MEDINTECH, MEDINTONE, MEDLEY, ROYAL, SOLID, TIMBERLINE, Ambigu, StoneRun and Residential Fiberglass Reinforced Flooring • POSSIBILITIES Petit Point and Connection CORLON • Luxury solid vinyl flooring • Abode
80% of the overall area of the original substrate must be exposed.	• Residential Felt-Backed Flooring • RUBBER TILE • STAIR TREADS • TRANSITION STRIPS • SAFETY ZONE • EXCELON Static Dissipative Tile (SDT) • Residential Tile **Subfloor must be porous when installing SDT**
Adhesives must be left so that no ridges or puddles are evident and what remains is a thin, smooth film.	• Bio-Based Tile and all vinyl composition tile except SAFETY ZONE and SDT

** Some previously manufactured asphaltic "cutback" adhesives contain asbestos (see warning statement on page x). For removal instructions, refer to the Resilient Floor Covering Institute's publication Recommended Work Practices for Removal of Resilient Floor Coverings.*

As an alternative to residual asphalt cutback adhesives, you can apply a cementitious underlayment, such as S-184 or S-194 as approved by the underlayment manufacturer. All warranties and/or performance guarantees concerning underlayment failure rest with the underlayment manufacturer and not with the manufacturer of the resilient flooring.

NOTE: Many adhesive removal products contain solvents that leave a residue within the subfloor. This residue can negatively affect the new adhesive and bleed through the new floor covering. The warranties provided by manufacturers of new floor covering materials will not cover instances where existing subfloor conditions damage their products or affect their installation.

The use of asbestos encapsulants or bridging materials over asphaltic adhesive is not recommended. These products may affect the bonding properties of the new adhesive.

14. Preparation of Concrete Subfloors

The surface of a concrete subfloor must be dry, clean, smooth, and structurally sound. It must also be free of depressions, scale, or foreign deposits of any kind. The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, residual adhesive, adhesive removers and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate they must be mechanically removed prior to the installation of the flooring material.

Many buildings built before 1978 contain lead-based paint, which can pose a health hazard if not handled properly. State and federal regulations govern activities that disturb lead-based painted surfaces and may also require notice to building occupants. **Do not remove or sand lead-based paint without consulting a qualified lead professional for guidance on lead-based paint testing and safety precautions.** For nonlead-based paint, a good paint remover for many concrete subfloors is a solution of trisodium phosphate and hot water, mixed and applied according to the manufacturer's instructions and recommended safety precautions. Paints with a chlorinated rubber or resin base that cannot be removed by trisodium phosphate may be removed by grinding with a concrete or terrazzo grinder. Armstrong does not recommend the use of solvents to remove paints or old adhesive residues because the solvents can remain in the concrete and negatively affect the new installation. Whenever sanding, be certain the work site is well ventilated and avoid breathing dust. If high dust levels are anticipated, use an appropriate NIOSH designated dust respirator. All power sanding tools must be equipped with dust collectors. Avoid contact with skin or eyes. Wear gloves, eye protection, and long-sleeve, loose fitting clothes.

After the concrete has cured and is dry, clean construction joints, saw cuts, score marks, and cracks, and fill with an underlayment such as S-184 or S-194 on any grade level. Repaired areas must be finished flush with the

surface of the concrete and allowed to fully dry before the installation of the floor covering.

Actual expansion joints or other moving joints with elastomeric fillers are designed to absorb movement in concrete slabs. Cementitious underlayments, patches, and resilient flooring installed across expansion joints often crack or buckle when the slabs move. Armstrong does not recommend flooring products be installed across expansion or isolation joints. Expansion joint covers are available for use with various floor coverings and should be specified by the architect.

Dusty concrete slabs may be primed with one coat of S-185 Primer. Sweep or vacuum the concrete and apply the S-185 with a 3/8" nap paint roller. You may also prime concrete subfloors with the recommended flooring adhesive for the material about to be installed. After sweeping/vacuuming, apply the adhesive using a smooth-edge trowel. When using adhesive as a primer, allow the adhesive to dry completely. After drying, install the flooring in accordance with the recommended installation system. **NOTE:** A dusty concrete floor on-grade or below-grade may be a sign of alkali salts.

A rough concrete floor can be ground smooth with a commercial diamond or carbide-equipped grinding machine. If the concrete subfloor is extremely rough or uneven, it may be too great a job to smooth this way. In this case, apply a cementitious underlayment such as S-184 or S-194. A smooth, flat, uniform surface is necessary as a good base for resilient flooring.

F. EXISTING RESILIENT FLOORS

Many Armstrong resilient floor products may be installed over a **single layer** of existing resilient flooring when the proper installation system is used for the new product and the existing resilient flooring meets the proper conditions. **Armstrong does not recommend installing new flooring over existing rubber or slip retardant floors**.

Existing Resilient Flooring Conditions:

- Not textured or embossed enough to show through the new installation.
- Only a single layer of flooring.
- Fully and firmly bonded on an approved subfloor and underlayment.
- Waxes, polishes, and other finishes must be properly removed with a recommended floor stripper. For existing linoleum, the stripper should not exceed a pH of 10.
- Indentations or damaged areas must be replaced or repaired.

NOTE: The responsibility for determining if the old resilient flooring is well-bonded to the subfloor and is not textured or embossed enough to show through the final installation rests with the retailer and the installer. Installation of rotovinyl over existing resilient flooring may be more susceptible to show-through than inlaid floors. Installations over existing resilient flooring may be more susceptible to indentations.

This chart provides Armstrong Installation Systems recommendations for installing over existing resilient flooring.

Installation System	Existing Resilient Floors: Resilient Tile – On Grade	Resilient Tile – Below Grade	Resilient Tile – Suspended	Asphalt Tile – On Grade and Suspended Only	Vinyl Plank – On Grade	Vinyl Plank – Below Grade	Vinyl Plank – Suspended	Sheet – Not cushioned or foam backed All Grade Levels
All Felt-Backed	X	X	X	X	X	X	X	X
Alterna (With or Without Grout)	X		X	X	X		X	X
BioBased Tile	X		X	X	X		X	X
Commercial LVT	X		X					X
Fiberglass-Reinforced	X		X				X	X
Heterogeneous and Inlaid	X		X				X	X
Linoleum			X	X			X	X
Lynx	X		X		X		X	X
Residential LVT Plank	X		X					X
Static Dissipative Tile	Not Recommended Over Existing Resilient Floors							
ToughGuard II			X				X	X
Vinyl Backed Sheet			X				X	X
Vinyl Composition Tile	X		X	X	X		X	X

S-194 Patch, Underlayment and Embossing Leveler mixed with S-195 Underlayment Additive can be used to smooth the embossed textures of approved existing residential resilient floors. S-194 mixed with S-195 must be used when installing fully adhered felt-backed floors over existing rotovinyl.

G. POLYMERIC POURED FLOORS, METAL, CERAMIC TILE, QUARRY TILE, TERRAZZO AND MARBLE

Installation System	**Substrates**					
		Metal				
	Polymeric Poured (Seamless) Floors (1)	Steel, Stainless Steel, Aluminum, Lead, Copper, Brass, Bronze (2)	Steel, Stainless Steel, Aluminum, Lead, Copper (2)	Steel, Stainless Steel, Aluminum (2)	Steel, Stainless Steel, Aluminum, Lead (2) When using S-240 Adhesive	Ceramic Tile, Quarry Tile, Terrazzo and Marble (3)
All Felt-Backed	X	X				X
Alterna (With or Without Grout)	X			X		X
BioBased Tile	X	X				X
Commercial LVT	X			X	X	X
Fiberglass-Reinforced	X			X		X
Heterogeneous and Inlaid	X			X	X	X
Homogeneous Sheet	X			X	X	X
Linoleum	X		X		X	X
Lynx	X	X				X
Residential LVT Plank	X			X		X
Static Dissipative Tile	X	X				X
ToughGuard II	X			X		X
Vinyl Composition Tile	X	X				X

Notes:

(1.) All Armstrong resilient flooring may be installed directly over polymeric poured floors. To install flooring over polymeric poured floors, the surface must be roughened and then a Portland Cement-type underlayment (such as S-194/S-195) applied. The S-194 would need to be mixed with the S-195 Underlayment Additive. A depth of at least 1/4" of S-194/S-195 must be applied to make it porous enough to install SDT.

Polymeric poured floors must be well cured, have no history of moisture related problems, and be free of any residual solvent, smooth, structurally sound, and well bonded to a concrete subfloor. Any loose or damaged areas must be completely removed and patched with S-184 or S-194 as necessary. Remove any “nubby” texture with wet,

sharp sand and a floor machine equipped with carborundum stones. Do not use a skim coat of latex underlayment to smooth the surface as it will not adhere reliably to the poured-on floor.

(2.) Armstrong commercial felt-backed sheet floors and tile may be installed directly to steel, stainless steel, aluminum, lead, copper, brass, and bronze substrates using the recommended adhesive for each specific flooring product and substrate (see Adhesives, Seam Treatments and Grout Chapter 5).

Armstrong commercial vinyl-backed and fiberglass-backed sheet floors may be installed directly to steel, stainless steel, and aluminum.

Armstrong linoleum may be installed directly to steel, stainless steel, aluminum, lead, and copper.

To install SDT over metal, the surface must be roughened and then a Portland Cement-type underlayment (such as S-194) applied. The S-194 would need to be mixed with the S-195. A depth of at least 1/4" of S-194 must be applied to make it porous enough to install SDT.

Metal substrates must be installed according to the manufacturer's recommendations and must be roughened and cleaned before the floor covering is installed. If there are low places, they should be leveled with S-194 mixed with S-195.

(3.) All Armstrong resilient sheet floors and tile may be installed directly over ceramic tile, quarry tile, terrazzo, or marble subfloors on all grade levels which are firmly bonded to a structurally sound substrate.

To install SDT over ceramic tile, quarry tile, terrazzo, or marble, the surface must be roughened and then a Portland Cement-type underlayment (such as S-194) applied. The S-194 would need to be mixed with the S-195. A depth of at least 1/4" of S-194 must be applied to make it porous enough to install SDT.

Clean the floor of all paint, varnish, oil, wax, and finishes. Roughen glazed or very smooth surfaces and repair badly fitted joints or cracks with S-184 or S-194. If the floors are badly worn or have low places, they should be leveled with S-184 or S-194.

H. TROWELABLE UNDERLAYMENTS, PATCHES AND LEVELERS*

1. S-184 Fast Setting Patch and Underlayment
2. S-185 Latex Primer and Additive
3. S-194 Patch, Underlayment and Embossing Leveler/S-195 Underlayment Additive

** See Work Site Environment statement at the end of Chapter II.*

S-184 Fast-Setting Patch and Underlayment

⚠ WARNING **S-184 INJURIOUS TO EYES**
CAUSES SKIN IRRITATION
RESPIRATORY HAZARD BY INHALATION

For following Commercial and Residential uses:

- Patching, skim coating and overall leveling concrete on any grade level, ceramic tile, quarry tile, marble and terrazzo (except metal terrazzo strips).
- Covering existing asphalt cutback adhesive over concrete only.
- Patching, repairing small voids and skim coating wood underlayments; may be used for overall leveling of approved suspended wood underlayments.

NOTE: Not recommended for use on strip wood floors.

Type:	Fast-setting, Portland Cement-type material mixed with plain water; does not require a separate additive
Color:	Gray
Trowel:	Smooth-edge trowel
Single Layer Application Range:	Up to 1/4"
Maximum Thickness:	1/2" (double application)
Units and Coverage:	3-pound box – 4 sq. ft. at 1/8" thick 10-pound box – 15 sq. ft. at 1/8" thick 25-pound box – 38 sq. ft. at 1/8" thick 40-pound box – 64 sq. ft. at 1/8" thick
Mix Ratio:	3 parts powder to 1 part water 1 pound (0.5 kg) powder to 5 ounces (148 ml) water
Pot Life:	20 minutes
Compressive Strength:	4500 psi after 28 days
Shelf Life:	One year, unopened
Freeze/Thaw Stable:	Yes, will not freeze

Floor Preparation: All surfaces must be clean and free of dirt, oil, grease, plaster, curing compounds, polish, wax, and other foreign matter. Old asphaltic "cutback" adhesive*, residue may either be removed or covered directly with S-184. Concrete floors must be free of excess moisture and/or alkali. Dampen concrete floors with clean water or prime with S-185 Latex Primer. Do not leave standing puddles of water or primer. Apply underlayment while floor is still damp with water or when primer is dry-to-touch. When filling small voids in wood floors, prime areas to be patched with S-185 for a superior bond. Allow primer to dry before underlayment is applied.

Mixing: Powder and water are easily mixed in a pail or mortar box. Mix 3 parts of S-184 to 1 part cool water. Mixing containers must be clean at all times, because unused material in the container will contaminate newly mixed underlayment. Mix to a smooth, lump-free consistency; do not over mix. S-184 should remain workable for 10 to 15 minutes. Do not add extra water after proper consistency has been achieved. If underlayment starts to set up before it is used, discard it. Do not attempt to remix.

** Some previously manufactured asphaltic "cutback" adhesives contain asbestos (see warning statement on page x). For removal instructions, refer to the Resilient Floor Covering Institute's publication Recommended Work Practices for Removal of Resilient Floor Coverings.*

Application: Pour the thoroughly mixed S-184 from the mixing container and apply using a smooth-edge trowel. Finish flush with the adjacent subfloor. Apply sufficient pressure to the patch with the trowel to secure adequate bonding to the cleaned, damp-mopped, or primed subfloor surface. During troweling, it is helpful to dip the trowel in clean water from time to time to keep the mix from sticking to the trowel. S-184 may be applied in a single layer of a maximum thickness of 1/4" or the total of two layers (up to 1/4" each) not to exceed a thickness of 1/2". Allow the first layer to dry for at least 60 minutes before applying the second layer.

S-184 Over Existing Cutback Residue: Remove all ridges, puddles, and high spots to a point that the adhesive looks like a stain on the surface of the concrete. Using the S-184 mixed with **water**, apply the underlayment using a 1/8" x 1/8" x 1/8" square-notched trowel over the cutback adhesive residue. Let dry completely. Again using S-184 mixed with **water**, apply a second coat of underlayment using a smooth-edge trowel, filling in the recessed areas to provide a smooth finished substrate and covering the cutback completely to prevent bleeding through to the new flooring.

Clean Up: Clean tools with water frequently and dip trowel in water often to make finishing easier.

Precautions:

1. Most water-based adhesives applied over S-184 will exhibit shorter working times than expected. This can be corrected by the application of S-185 Latex Primer to the surface of the underlayment before spreading the adhesive.
2. Warm or hot water will shorten the working time of S-184.

S-185 Latex Primer

⚠ WARNING **S-185 EYE AND SKIN IRRITANT**

For the following commercial and residential uses:

- As a primer with all Armstrong patches, underlayments, and latex-based adhesives.
- Can be used on all grades of concrete, poured in place of gypsum underlayments, approved wood underlayments, ceramic tile, quarry tile, terrazzo, and marble.
- Primer for wood and concrete with self-adhering tile.

Type:	Latex-based liquid primer
Color:	White
Applicator:	Short nap paint roller or coarse fiber brush
Units and Coverage:	Gallon - 400 sq. ft. Coverage depends on the porosity of the subfloor
Shelf Life:	One year, unopened
Freeze/Thaw Stable:	No, keep from freezing
Floor Preparation:	All surfaces must be clean and free of dirt, oil, grease, plaster, curing compounds, old adhesive*, and other foreign matter. Concrete floors must be free of excess moisture and/or alkali.
Application:	Apply S-185 liberally with a short nap paint roller or a coarse fiber brush. Avoid puddling. Use at full strength. Do not dilute. Do not apply at temperatures below 32°F (0°C) or above 100°F (38°C). **Allow to dry thoroughly** before applying patches, underlayments, or latex adhesives. Drying time will vary with job site conditions. Use this product with positive fresh air ventilation. A slight odor of latex may be present until material dries.
Clean Up:	Clean tools with water frequently before material dries.
Advantages:	Nonflammable Ammonia-free and low odor Contains few or no organic solvents Contains no reportable hazardous substances (per current regulations)

** Some previously manufactured asphaltic "cutback" adhesives contain asbestos (see warning statement on page x). For removal instructions, refer to the Resilient Floor Covering Institute's publication Recommended Work Practices for Removal of Resilient Floor Coverings.*

S-194 Patch, Underlayment and Embossing Leveler/S-195 Underlayment Additive

⚠ WARNING **S-194 INJURIOUS TO EYES**
CAUSES SKIN IRRITATION
RESPIRATORY HAZARD BY INHALATION

For the following commercial and residential uses:

- Patching, skim coating, and overall leveling of concrete on any grade level, ceramic tile, marble, quarry tile, and terrazzo (except metal terrazzo strips) when mixed with water or S-195.
- Patching, skim coating, and overall leveling of all grade levels of steel, stainless steel, brass, and lead when mixed with S-195.
- Covering existing asphalt cutback adhesive residue over concrete only, when mixed with water.
- Patching, repairing small voids, and skim coating wood underlayments; may be used for overall leveling of approved suspended wood underlayments when mixed with S-195.
- Filling and leveling the embossing of single-layer existing resilient flooring prior to the installation of new **residential** resilient flooring when mixed with S-195.

NOTE: Not recommended for use on strip wood floors or overall leveling of wood floors.

Type:	Fast-setting, portland cement-type material mixed with plain water; does not require a separate additive
Color:	Gray
Trowel:	Smooth-edge trowel
Single Layer Application Range:	Up to 1/2"
Maximum Thickness:	1" (double application)
Units and Coverage:	S-194: 10-pound box – 16 sq. ft. at 1/8" thick 25-pound bag – 40 sq. ft. at 1/8" thick S-195: Quart or Gallon 10 lbs. powder to 2 quarts S-195 covers 580-815 sq. ft.
Mix Ratio:	3 parts powder to 1 part water 1 pound (0.5 kg) powder to 5 ounces (148 ml) water 2-1/2 parts powder to 1 part S-195 1 pound (0.5 kg) powder to 6.5 ounces (192.2 ml) S-195 10 pounds (4.54 kg) powder to 2 quarts (2.27 l) S-195 25 pounds (11.34 kg) powder to 5 quarts (4.73 l) S-195

Pot Life:	12-20 minutes at 73°F (23°C) when mixed with water 14-20 minutes at 73°F (23°C) when mixed with S-195
Compressive Strength:	> 5000 psi after 28 days
Shelf Life:	One year, unopened
Freeze/Thaw Stable:	S-195 Underlayment Additive: No, keep from freezing
Floor Preparation:	All surfaces must be clean and free of dirt, oil, grease, plaster, curing compounds, polish, wax, and other foreign matter. Old asphaltic "cutback" adhesive* residue may either be removed or covered directly with S-194. Concrete floors must be free of excess moisture and/or alkali. Dampen concrete floors with clean water or prime with S-185 Latex Primer or S-195 Underlayment Additive. Do not leave standing puddles of water or primer. Apply underlayment while floor is still damp with water or when primer is dry-to-touch. When filling small voids in wood floors, prime areas to be patched with S-185 for a superior bond. Allow primer to dry before underlayment is applied. For a superior bond when flashing and skim coating, mix S-194 powder with S-195. Do not prime existing resilient flooring.
Mixing:	**As a Patch or Underlayment:** Powder and water or latex are easily mixed in a pail or mortar box. Mix 3 parts of S-194 to 1 part cool water or mix 2-1/2 parts of S-194 to 1 part S-195. Mixing containers must be clean at all times because unused material in the container will contaminate newly mixed underlayment. Mix to a smooth, lump-free consistency. Do not over mix. To extend the pot life, periodically continue stirring the unused patch in the mixing container. Do not add extra water after proper consistency has been achieved. If underlayment starts to set up before it is used, discard it. S-194 must be mixed with S-195 when used over wood underlayments, filling wood underlayment joints, and over metal substrates. Flooring can be applied after the underlayment has dried 60 to 90 minutes. **As an Embossing Leveler:** Mix 2-1/2 parts powder by volume to 1 part S-195 using a clean mixing container at all times. Mix to a smooth, lump-free consistency. Do not over mix. Do not add extra latex additive after proper consistency has been achieved. If embossing leveler starts to set up before it is used, discard it.

** Some previously manufactured asphaltic "cutback" adhesives contain asbestos (see warning statement on page x). For removal instructions, refer to the Resilient Floor Covering Institute's publication Recommended Work Practices for Removal of Resilient Floor Coverings.*

Application:

As a Patch or Underlayment: Pour the thoroughly mixed S-194 from the mixing container and apply using a smooth-edge trowel. Finish flush with the adjacent subfloor. Apply sufficient pressure to the patch with the trowel to fill defects and to feather-edge the patch to the subfloor. During troweling, it is helpful to dip the trowel in clean water from time to time to keep the mix from sticking to the trowel. S-194 may be applied in a single layer of a maximum thickness of 1/2" or the total of two layers (up to 1/2" each) not to exceed a thickness of 1". Allow the first layer to dry for at least 60 minutes before applying the second layer.

S-194 Over Existing Cutback Residue: Remove all ridges, puddles, and high spots to a point that the adhesive looks like a stain on the surface of the concrete. Using the S-194 mixed with **water**, apply the patch using a 1/8" x 1/8" x 1/8" square-notched trowel over the cutback adhesive residue. Let dry completely. Again using S-194 mixed with **water**, apply a second coat of patch using a smooth-edge trowel and filling in the recessed areas to provide a smoothly finished substrate and covering the cutback completely to prevent bleeding through to the new flooring.

S-194 Over Metal: Metal substrates must be cleaned and roughened before applying the S-194. Using the S-194 mixed with S-195, apply the patch over the metal and allow the patch to dry completely before installing the floor covering.

As an Embossing Leveler: For best results, pour the S-194 from the bucket immediately after mixing. Although the working time is 25 minutes, when mixed with S-195, S-194 has a pot life of 14-20 minutes at 73°F (23°C). After placing the S-194 on the substrate, fill the embossed areas of the existing floor while removing most of the S-194 from the unembossed areas using a smooth-edge trowel. Hold the trowel on a 60° angle and apply the leveler with the same motion as spreading a conventional adhesive, troweling at a 45° angle to the embossing. This product should not be over troweled or retroweled. Clean your tools frequently with water and a coarse cloth. Drying time is approximately 1-1/2 to 2 hours, depending on temperature and humidity. To achieve proper bonding, S-194 must be completely dry. Trowel ridges and unevenness in the S-194 can be removed by scraping with a wallpaper scraper or the front edge of a smooth-edge trowel. Under most conditions, one application of S-194 will level the existing resilient flooring sufficiently. Inspect the existing resilient flooring and S-194 for smoothness after the S-194 has dried completely. At that time, you may determine that you will need a second application. The second application will normally dry faster, in approximately 1 hour. Make sure the S-194 is completely dry before proceeding.

Clean Up: Clean tools with water frequently before material dries.

Precautions:

As a Patch or Underlayment:

1. Most water-based adhesives applied over S-194 will exhibit shorter working times than expected.
2. Warm or hot water will shorten the working time of S-194.

As an Embossing Leveler:

1. When applying Armstrong adhesives over S-194, use the fine notching of the S-891 or S-892 Notched Steel Trowel.
2. Most adhesives will exhibit shorter working times over S-194 used as an embossing leveler.