



AN ERGONARMOR COMPANY

**TECHNICAL INFORMATION**

**CES-350**

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## ***SPECIFICATION FOR INSTALLATION***

### ***PENNGUARD<sup>®</sup> BLOCK LINING SYSTEM***

**NOTE:** The PENNGUARD Block Lining System is a sophisticated lining and should only be installed by industrial contractors familiar with industrial lining practices.

#### **1. SCOPE / USE AREA**

- 1.1 This specification covers the recommended installation, quality control, and inspection guidance for the successful installation of the PENNGUARD Block lining system on metal, concrete, brick, and FRP surfaces.
- 1.2 At coal burning power plants, the PENNGUARD Block Lining System is used to protect carbon steel liners, breechings, heat recovery equipment, and inlet/outlet ductwork of wet FGD scrubbers from condensate permeation and acid corrosion. It is used in flue gas conveying equipment such as stacks and ductwork serving the power, chemical, metallurgical, petrochemical, pulp & paper and municipal waste incineration/sludge burning industries, to protect the substrate structures from acid corrosion.
- 1.3 FRP-constructed stacks, ducts, and other equipment, when lined with the PENNGUARD Block Lining System, can operate at higher temperatures due to the insulation characteristics of this lining system.
- 1.4 The PENNGUARD Block Lining System offers an acid corrosion resistant, lightweight, highly insulative lining for steel and concrete tanks and vessels including the covers of molten sulfur pits, acid pickling tanks, and acid storage tanks.
- 1.5 The PENNGUARD Block Lining System may be used as a chemical resistant backup to refractories and chemically resistant masonry/monolithic linings in such areas as hot gas inlets to chemical vessels, petrochemical heaters and furnaces.

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**2. GENERAL**

- 2.1 This specification is organized to first cover steps that are the same independent of the substrate type or design. The later sections provide information specific to a particular substrate design or component.
- 2.2 The PENNGUARD Block system can be applied to many different surfaces. The system has been used successfully in power plant applications in flue gas ducts and chimneys that are constructed of many types of materials with varying designs.
- 2.3 Care in handling and storage of PENNGUARD Block must be followed since it is a glass material. The Block pieces are glass, and therefore can be susceptible to damage if care is not taken to prevent such damage during handling and installation.
- 2.4 The lining system when properly installed and cured is quite strong. However, excessive particulate loading, gas velocities exceeding 80-100 feet per second (24-30 m/s), and potential for mechanical damage during routine outages and inspections, must be designed for. Consult Corrosion Engineering or its representative for specific applications if any doubt exists as to concerns. Although high velocities are not typically a problem when the lining is installed in a direction the same as the gas flow, areas such as turning vanes and sharp changes of direction may require special treatment. Also, note details in section 16.2.2 of this specification for specific concerns in some horizontal floor applications.
- 2.5 When construction and maintenance activities will take place near or on a lined surface, efforts shall be made to cover the surface to prevent mechanical damage. Areas of known risk of mechanical damage such as near routine maintenance activities should be covered with a permanent layer to prevent damage to the liner. Coverings such as TUFCEM® Silicate Gunite, TUFCEM Silicate Concrete Foundation Grade or TUFCEM Silicate Concrete Trowel Grade have been used effectively for such areas.
- 2.6 When appropriate, the following sign shall be posted on the exterior of the structure during and after lining application. "LINED EQUIPMENT, NO WELDING OR BURNING".
- 2.7 Do NOT impale the installed PENNGUARD Block Lining System with welding rods or other sharp or pointed devices as a convenient way to hang cords or wires for temporary lighting during outages or other maintenance activities.

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**3. EQUIPMENT / SUPPLIES**

- 3.1 Heavy duty variable speed drills, having 3/4" (16-18 mm) chucks with sufficient torque to deliver a minimum speed of 230 rpm under load. For mixing, Corrosion Engineering recommends the use of a Jiffler mix blade - Model DC312 with 2 x 6.5" (165 mm) propeller blades to mix the Adhesive/Membrane. Blades shall be set with dimensions of 5" (125 mm) from the base of the bottom of the blade (sitting on a flat surface) to the top of the ferrule on the top blade. Jiffler mix blades with preset and welded propeller blades are available from Corrosion Engineering +1-610-833-4000. Use of other mixing equipment may adversely affect mix results and product performance. Use of any other equipment shall only be authorized following consultation and written approval of Corrosion Engineering.



- 3.2 Insulation saws and rasps, to cut and sculpt the PENNGUARD Block.
- 3.3 Masons' trowels of a size approximately 8" (200 mm) long x 3.25" (83 mm) at the heel with end blunt to approximately 3/4" (20 mm) radius to apply the Adhesive/ Membrane.
- 3.4 Lanolin based waterless hand cleaner (for example: Boraxo or Go-Jo).
- 3.5 4" (100 mm) wide stiff bristled paint brushes, paper coveralls, Playtex dish-washing gloves, rags, wire brushes.
- 3.6 Use mineral spirits for cleaning and soaking trowels, etc., for loosening cured PENNGUARD Adhesive/Membrane.
- 3.7 Set of installation specifications, and latest product information sheets for all lining materials of construction.
- 3.8 Sling psychrometer or dewpoint meter, calibrated electronic temperature meter, lights, surface thermometers, white (non-wax) marking chalk or white spray paint.

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**4. TEMPERATURES**

- 4.1 The product and substrate temperatures are critical. In cold winter conditions it is recommended that the product storage and construction area be heated to achieve and maintain the temperatures identified in sections 4.2 and 4.3. The heat source chosen shall not result in deposits on the surfaces to be coated.
- 4.2 At the time of mixing and application the temperature of the components should be approximately 70°F (21°C).
- 4.3 The temperature of the prepared surface shall be at least 5°F (3°C) above the moisture dew point and at a temperature between 50°F (10°C) and 90°F (32°C) at the time the PENNGUARD Block Lining System is applied.
- 4.4 Be aware of the temperature of the substrate to be sure that the PENNGUARD Adhesive/ Membrane does not set up too quickly and, hence, lose its wet tack. When properly mixed and applied PENNGUARD Adhesive/Membrane will remain tacky for approximately four (4) hours at an ambient air temperature and substrate temperature of 70°F (21°C) and no more than one hour at 90°F (32°C). Wet tack is if Membrane comes off onto the finger when touched.
- 4.5 Weather protection of the work site is necessary. The prepared substrate must be protected from the elements until the lining work is completed.
- 4.6 In addition to protecting the work area from the elements, the cartons of PENNGUARD Block and containers of PENNGUARD Adhesive/ Membrane and Primer, shall also be protected.

**5. MIXING**

- 5.1 Remove the lid from the PENNGUARD® Adhesive/ Membrane can. Inspect for damage incurred during transit.
- 5.2 Insure that there are no leaks in the Component B container and that there is no water present on or in Component A.
- 5.2 Utilizing a drill, delivering sufficient torque to achieve a shaft rotation of a minimum 230 rpm, and the proper mixer blade as specified in section 3.1, pre-mix Component A by itself for a minimum of one minute. If temperatures are below 65°F (18°C), mix component A for a minimum of 2 two minutes.
  - 5.2.1 A good manual mixing technique involves movement of the rotating blade within the pail. Move the blade around the base of

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the pail in a circular motion and also lift the blade from the base of the pail without bringing the blade above the surface of the compound and continue the circular motion around the side of the pail. During mixing also hold the mix blade occasionally at a 30 to 45 degree angle within the mixture, to insure all contents of the pail are thoroughly mixed, paying close attention to contact all surfaces of the sides of the pail with the mix blade.

5.2.2 Automated mixing machines specifically designed for this purpose can also be used to mix PENNGUARD Adhesive/Membrane. Consult Corrosion Engineering or its representative for more details.

- 5.3 Open Component B. Continue to mix Component A at the recommended speed. Begin pouring Component B into the vortex created by the mixer in Component A. Total elapsed time for the addition of the component B should be 15 to 20 seconds while mixing.
- 5.4 When the material temperature is 65°F (18°C) or higher, mix for at least three (3) minutes using a good mixing technique to yield a uniform mix. When the temperature of the components is 65°F or below (18°C), mix for at least five (5) minutes using a good mixing technique to yield a uniform mix.
- 5.5 The PENNGUARD Adhesive/Membrane is a thixotrope i.e. - it will thicken if allowed to sit after the components have been mixed together. Material is generally ready for use immediately after mixing.
- 5.6 Never allow moisture or other contaminants to come in contact with either membrane component or the wet mix.
- 5.7 Improper mix techniques and/or use of mixing equipment other than recommended in section 3.1 may adversely affect mix results and products performance. Use of any other equipment or mixing techniques shall only be authorized following consultation with and written approval of Corrosion Engineering or its representative. Note carefully sections 5.2.1 and 5.2.2.

## **6 INSTALLATION**

- 6.1 Before applying Block, the contractor shall check the flatness of the prepared substrate in any area which visually may indicate a seating problem. This shall be performed by taking a straight edge of the specified size of the Block to be installed and placing it dry against the prepared surface in an orientation similar to that which will be followed in the installation. If there are any gaps between the substrate and the back of the Block greater than 1/8" (3 mm) or if the block

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does not sit firm against the surface, but rocks on a high point, properly mark the area. Either remove the imperfection in the substrate or cut the standard size block being used which, in turn, will minimize the effect of the substrate variation and allow a full bond of the block to the substrate surface using the PENNGUARD Adhesive/Membrane. A comparable check shall also be applicable to lining curved surfaces.

- 6.2 Trowel apply a minimum 1/16" (1.5 mm) thickness of PENNGUARD Adhesive/Membrane onto the substrate with a suitable trowel carrying the coverage to approximately 2" (50 mm) beyond the area the PENNGUARD Block will cover when it is placed in position. The size of the area to which the PENNGUARD Adhesive/ Membrane is applied at any one time shall be no greater than will allow the area to be lined with the PENNGUARD Block before the PENNGUARD Adhesive/Membrane on the substrate loses its tackiness. **DO NOT TROWEL TO LESS THAN 1/16" (1.5 mm) THICKNESS. THE SUBSTRATE MUST BE FULLY LINED.**
- 6.3 Trowel a minimum of 1/16" (1.5 mm) thickness of the PENNGUARD® Adhesive/ Membrane onto the back, and all sides of the PENNGUARD Block to be installed. In positioning the PENNGUARD Block against the Adhesive applied to the substrate surface, move the Block back and forth at least 2" (50 mm) a couple of times as it is being slid into place against the adjacent block so as to remove voids between the block and the surface. Be sure to maintain a minimum of 1/8" (3 mm) thickness block to block, and block to substrate. PENNGUARD Adhesive/Membrane shall totally fill side joints, and shall be seen to 'bead' along edges. Strike clean the surfaces of joints of PENNGUARD Adhesive/ Membrane squeezed out during placement of the block. Listen for the sound of Block scraping against Block or the substrate. This is a sure indication of insufficiently filled side joints.
- 6.4 In placing successive PENNGUARD Blocks, it is acceptable to leave one or more sides without PENNGUARD Adhesive/Membrane and subsequently apply the Adhesive/Membrane to these sides when they are on the substrate prior to placing the next block up against this Block edge. The intent is to utilize a double buttering technique. No block surface is to be put into final position without Adhesive/ Membrane applied with a trowel on that surface first.
- 6.5 It is very important that the PENNGUARD Block, coated with PENNGUARD Adhesive/ Membrane, has full contact with the Adhesive/ Membrane applied to the substrate surface, whether it be flat floors, side walls, overhead areas, curved surfaces, nozzles, etc. No voids shall be left between the Block and the substrate. Cut the Block and create an extra joint when necessary and/or increase thickness of the PENNGUARD Adhesive/ Membrane back joint. Side and back joints must be full joints, and shall not be less than 1/8" (3 mm) thick.

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- 6.6 Installer shall exhibit care in the handling and placement of the Blocks so as to minimize the presence of excess Adhesive/Membrane on the face of the Block. Side joints shall be struck clean after installation, with attention to removing excess material from the face of the Block. Before moving to a new work area or at appropriate times such as shift changes or scaffold/platform movements, inspectors shall thoroughly inspect surface to detect presence of any excess Adhesive and direct that it is to be removed promptly.
- 6.7 If the applied PENNGUARD Adhesive/Membrane is still tacky to the degree that when touched it blackens a gloved finger, additional Adhesive/Membrane can be applied over it, to continue installing Pennguard Block. If however it has cured to the point of not staining a glove when touched, it must be removed. This can be accomplished by using scrapers to remove as much remaining PENNGUARD Adhesive/Membrane as practical. Use care to confirm scraping does not damage the block. This procedure is critical since wet PENNGUARD Adhesive/Membrane will not bond well to cured PENNGUARD Adhesive/Membrane.
- 6.8 As noted in section 6.7, wet PENNGUARD Adhesive/Membrane does not bond well to cured PENNGUARD Adhesive/Membrane. The gloved finger tack test outlined in section 6.7 should be utilized to determine if work can carry on after a work stoppage without further treatment. Cured Adhesive/Membrane that does not pass the gloved finger wet tack test must be abraded to roughen the surface and remove surface gloss. Dry remnants of cured PENNGUARD Adhesive/Membrane remaining on a block surface at the end of a shift shall be dealt with by cutting back the block surface to expose a clean cell structure on the leading edge of the block.
- 6.9 When work stoppage is anticipated, remove as much of the PENNGUARD Adhesive/Membrane as practical from the substrate and edges of the completed lining that will have additional lining when the stoppage ends.
- 6.10 Do not install Blocks that are cracked, have gouges, or other imperfections in them. Also, do not install blocks with cracked corners, etc.
- 6.11 Staggered or broken bond construction is recommended to minimize four corners meeting and the possibility of a corner void. Running bond may be more desirable for gas flow purposes. Consult Corrosion Engineering or its representative if this is a concern.
- 6.12 If partial Blocks are used, the minimum size shall be a one third (1/3) piece of block. If the remaining gap is less than a half block, adjust the dimension of the final two blocks.

**7. ABRASION RESISTANT TOPCOAT**

- 7.1 Consult Corrosion Engineering or its representative for details on specifying additional topcoats on the Block for abrasive service.

**8. STOP BARS**

- 8.1 The PENNGUARD Block Lining System should not be finished to a free edge. It is recommended to install proper retaining (stopper) angles or flat bars to ensure proper installation. The height of the stopper should be the full lining thickness. The stop bar shall be of an alloy grade suitable for the anticipated service. Stop bars should be used if the PENNGUARD Block Lining System is to be installed immediate to man way openings, expansion joints, dampers, pipe stubs, sample ports, gunites, or castable linings.

**9. CURING**

- 9.1 Intended operating service conditions of the lined component may contribute to the cure of the system.
- 9.2 In general the lining may be placed into service after curing for two days at 90°F (32°C) or for 72 hours at 70°F (21°C), or for 7 days at 50°F (10°C).
- 9.3 PENNGUARD Adhesive/Membrane cures by chemical reaction. At a curing temperature of 70°F (21°C), the applied PENNGUARD Adhesive/Membrane will develop full strength at 14 days at 70°F (21°C).
- 9.4 Contact Corrosion Engineering or its representative for special cure schedules if down time does not allow sufficient curing of the lining as outlined in section 9.2 above.
- 9.5 Consult Corrosion Engineering or its representative if initial start up temperatures may exceed 250°F (120°C).

**10. INSPECTION / QUALIFICATION**

- 10.1 The mixing, curing, and adhesion characteristics of PENNGUARD Adhesive/Membrane shall be evaluated by applying it onto a test area of the same material and surface preparation of the production substrate. Work life and initial set time may be visually observed. Work life is the maximum time the PENNGUARD® Adhesive/Membrane remains trowelable. Initial set time is defined as the time between mixing PENNGUARD Adhesive/ Membrane and



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when it begins to exhibit cohesiveness, i.e. the time when the surface of the PENNGUARD Adhesive/ Membrane is no longer wet to the touch. Cure must be uniform.

- 10.2 The installation procedure of the lining system shall be verified by using Cure Verification Cards as supplied for the project. Cards should be retained throughout the duration of the project to insure cure of all applied batches.
- 10.3 Inspectors shall determine the frequency of random site checks to determine back joints have complete contact by pulling random Blocks while the Adhesive/Membrane is still wet and visually verifying the back joint and side joints are completely full.

**11. RECORDS**

- 11.1 Cure Verification Cards as outlined in section 10.2 should be retained throughout the duration of the project to insure cure of all applied batches.
- 11.2 Inspector shall sketch areas lined and which he inspected, and note his observations.
- 11.3 A photographic history of surface preparation, primer application, Adhesive/ Membrane application, and Block installation is suggested.

**12. REPAIR OF MECHANICALLY DAMAGED AREAS**

- 12.1 Experience indicates that repair of an area smaller than a standard size block requires more effort than a larger area.
- 12.2 Cut out a minimum of a full block down to membrane on substrate. Remove remaining Membrane on substrate as best as possible to expose underlying substrate. Clean the PENNGUARD Adhesive/ Membrane per Section 6.8 and 6.9. Install Block(s) per Section 6.2 and 6.3.

**13. SPECIFIC SUBSTRATE - METAL, CARBON STEEL, STAINLESS STEEL, NICKEL ALLOYS**

13.1 Surface Preparation

- 13.1.1 All welds shall be continuous. Intermittent or spot welding shall not be permitted.

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- 13.1.2 All weld spatter slag and old anchor welds shall be removed from the substrate, and the area ground flush with the parent metal.
- 13.1.3 Gross pinholes, pits, blind holes, porosity, undercutting, or similar depressions should not exist in the finished surface of the weld before or after blast cleaning.
- 13.1.4 All edges and fillets and similar abrupt contours shall be rounded off smoothly by grinding or machining. A 1/8" (3 mm) radius is preferable. Smooth ripple finished welds are acceptable.
- 13.1.5 Plates welded together shall be properly aligned; butt welded joints are preferred.
- 13.1.6 Lap welded joints should be avoided wherever possible. If lap-welded joints are used, they must be fully welded on the inside.
- 13.1.7 All connections to the equipment being lined shall be flanged.
- 13.1.8 Structural reinforcement members should be installed on the vessel exterior, if possible. However, if such members are installed internally, they should be fabricated of simple shapes such as smooth round bars or pipe for ease of applying the lining material. The use of angles, channels, I-beams, and other complex shapes should be avoided. If they must be installed internally, these members shall be fully seal welded and edges ground.

### 13.2 Surface Cleaning

- 13.2.1 Unless otherwise specified in writing by Corrosion Engineering or its representative, a near white metal blast finish (as specified by most current revisions of SSPC-SP10, NACE #2, ISO 8501-1 or SA 2.5) is required for preparing carbon steel surfaces to receive the lining.
- 13.2.2 New stainless titanium and nickel alloys (metal surfaces) must be abrasive blast cleaned to achieve a minimum profile of 0.0015" (35 microns) and to remove any oxidation layer. Deteriorated, pitted, corroded stainless and nickel alloys must be cleaned and prepared to a sound base. All surfaces must be dust, dirt, and grease free. Any foreign material which will interfere with adhesion must be removed.

### 13.3 Primer For Steel Substrates - PENNGUARD® Block Primer

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- 13.3.1 To prohibit the formation of re-rusting after blasting and rust bloom, carbon steel should be primed with PENNGUARD Block Primer. All stainless titanium and nickel alloys shall also use Primer for best adhesion.
- 13.3.2 Mixing instructions: PENNGUARD Block Primer is mixed in a normal ratio of 1 Part "A" to 1 Part "B." It is packaged in pre measured containers.
- 13.3.3 Thoroughly mix the contents of the Part "A" component. Thoroughly mix the contents of the Part "B" component.
- 13.3.4 Pour the entire contents of the Part "B" container into the Part "A" component. Thoroughly mix the combined Part A/B mixture and allow it to stand for 15 minutes.
- 13.3.5 Thoroughly stir the mixture before starting application.
- 13.3.6 The primer has a pot-life greater than 8 hours. Mix only enough primer for use during an 8-hour period.
- 13.3.7 All abrasives and dust must be removed from the substrate in accordance with the most recent revision of ISO 8502-3 prior to priming. The use of a power vacuum is recommended.
- 13.3.8 Spray application is preferred, although brush or roller application is acceptable. Consult manufacturer if temperatures during spraying are over 90°F (32°C).
- 13.3.9 Application should be accomplished in a single wet pass with a 50% overlap
- 13.3.10 Hold the spray gun at right angles to the surfaces and about 8-12" away from the substrate.
- 13.3.11 Make even, parallel passes applying Primer at a rate of 225/250 sf/gal (22 sm per gallon) insuring substrate is uniformly covered. WFT (Wet Film Thickness) testing is not practical with Pennguard Wash Primer. A visual check along with consumption monitoring is the best method to determine correct coverage.
- 13.3.12 Suggested spray equipment (or equivalent) and conditions

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	<b>BINKS</b>	<b>DEVILBISS</b>	<b>GRAYCO</b>
		<b><u>SIPHON FEED</u></b>	
Gun	62	JGA 502	208-615
Fluid Tip	63 (.070")	AV-1115-EX (.070")	172-041 (.070")
Needle	365	JGA-402-DEX (.70")	208-483 (.070")
Air Cap	66 SH	No. 30 (MB-4039-30)	208-765
Atomizing Pressure	40-50 psi (276-345 N/mm <sup>2</sup> )	40-50 psi (276-345 N/mm <sup>2</sup> )	40-50 psi (276-345 N/mm <sup>2</sup> )
		<b><u>PRESSURE POT</u></b>	
Gun	62	JGA 502	208-477
Fluid Tip	63B	AV-1115-FX (.0425")	208-481 (.0425")
Needle	363A	JGA-402-FX (.0425")	172-039 (.0425")
Air Cap	63 PB	770 (AV-1239-770)	169-877
Fluid Pressure	30-50 psi (102-172 N/mm <sup>2</sup> )	15-25 psi (102-172 N/mm <sup>2</sup> )	15-25 psi (102-172 N/mm <sup>2</sup> )
Atomizing Pressure	30-50 psi (276-345 N/mm <sup>2</sup> )	35-50 psi (276-345 N/mm <sup>2</sup> )	35-50 psi (276-345 N/mm <sup>2</sup> )
		<b><u>AIRLESS SPRAY</u></b>	
Gun	No. 700 9-1860 (13½" Fan .018")	JGB-510 or JGN-502	205-591 or 208-663 163-415 (8" Fan .015" tip)
Fluid Tips	9-1540 (8" Fan .015") 9-1580 (13" Fan .015")	Tip 0815 (8" Fan .015" tip) Tip 1218 (12" Fan .018"tip)	163-614 12" Fan .014" tip) 163-616 (12" Fan .016" tip)
Pump	Model #98-901 Falcon 3A 30:1 or Model #98-903 Hawk 4B 30:1	Model #QFA 32:1	28:1, 30:1 President or 30:1 Bulldog
Air Pressure	65-100 psi (448-669 N/mm <sup>2</sup> )	Depending on viscosity 65-100psi (448-669 N/mm <sup>2</sup> )	Depending on viscosity 65-100 psi (448-669 N/mm <sup>2</sup> )

\*Depending upon viscosity of material to be sprayed; for higher viscosities, use large tip and needle combination.

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13.4 PENNGUARD Primer Clean-up procedures.

Equipment should be thoroughly cleaned with: MEK, Xylene, or Toluene after use. Read and follow manufacturer's MSDS's and safety precautions when handling these chemicals.

13.5 PENNGUARD® Block Primer cures quickly at temperatures between 65-75°F (18.3-23.9°C). High velocity air and good ventilation help to remove solvents and accelerate drying. High humidity slows curing. The Primer should dry to the touch in about 1 hour at 65°F (18.3°C) and will dry hard in 1½ to 2 hours depending on humidity and substrate temperature. Use a fingernail scratch test to insure Primer is cured hard before proceeding.

13.6 The Primer must dry hard before application of the PENNGUARD Block Adhesive/Membrane is allowed to begin as any solvents remaining in the uncured primer will affect the cure of the PENNGUARD Adhesive/Membrane.

**14. SPECIFIC SUBSTRATE - CONCRETE & BRICK SUBSTRATES**

14.1 Surface Preparation

14.1.1 The surface condition of new and/or existing concrete and brick liners can vary greatly. The surface should be thoroughly inspected to identify the condition and suitability of the surface to accept the PENNGUARD Block Lining system. An assessment and evaluation of the suitability of the surface and the unique circumstances found for the specific concrete or brick lining should precede quotations, procurement, or mobilization of installation crews. Any buildup, deposits, carry over, or mortar on concrete or brick faces must be removed.

14.1.2 When forms have been used for placing the concrete, they should be designed so as to yield a smooth continuous concrete surface to which the lining will be applied. See also section 14.1.6.

14.1.3 Concrete floors should have a single pass trowelled finish with special care being taken to avoid bringing laitance to the surface.

14.1.4 New concrete shall reach a minimum compressive strength of 3000 psi (20 MPa) and a surface tensile strength of 300 PSI (2.0 MPa) before the lining is applied. Curing compounds must either be removed or tested for compatibility before proceeding.

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- 14.1.5 Before acceptance for lining, all form marks and protrusions, such as prominent aggregate exposure, tie wires, reinforcing wire, stirrups, etc. must be cut off and ground flush with the surface.
- 14.1.6 All cavities, stone pockets, honeycombing, and bug holes greater than 1/4" (6 mm) depth shall be filled by repairing with appropriate materials.
- 14.1.7 Damage to the existing structure such as cracks or other structural damage is to be suitably repaired prior to the application of the PENNGUARD® Block Lining System.
- 14.1.8 Existing concrete surfaces to be lined with the PENNGUARD Block Lining system shall be tested for suitable strength and verified to be structurally sound.
- 14.1.9 For installations onto brick liners, if the offset between adjacent bricks is greater than 1/8" (3 mm), the nature and size of the surface irregularity will dictate the action to properly prepare the surface. For a corbeled area where individual brick courses are intentionally offset consult Corrosion Engineering or its representative for specific details.
- 14.1.10 If mortar joints exist in brick substrates that are not completely filled, but brickwork is structurally sound and joints are not greater than 1/4" (6 mm) then PENNGUARD Adhesive/Membrane can be used to fill those areas. Joints wider than 1/4" (6 mm) shall be appropriately addressed before proceeding.
- 14.1.11 Attachments to the brick substrate (i.e. liquid condensate collection (LC) systems and stop-bars) shall be installed without leaving any gaps in between the brick substrate and the attachment to be installed. A cementitious mortar shall be used to level the area behind attachments prior to final installation of such attachments. The leveled area behind LC systems shall have a vertical dimension greater than the width of the condensate collection plate to be bolted to the substrate.

## 14.2 Surface Cleaning

- 14.2.1 A brick liner surface to which the lining is to be applied shall be suitably high pressure water cleaned and abrasive blasted in order to clean the brick faces and mortar to provide a sound hard clean

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surface. Contaminants must be removed and the surface shall be pH neutral. Consult ASTM D4258 and D4262. The intent is to remove sufficient material to achieve a sound surface free of contaminants.

14.2.2 A concrete surface to which the lining is to be applied shall generally be prepared in accordance with ASTM D4259 (most current revision) "Abrading Concrete". The surface shall have a non-glazed appearance. The intent is to remove sufficient material in order to achieve a sound concrete surface free of laitance, glaze, efflorescence, and incompatible concrete curing agents or form release agents.

14.2.3 All surfaces must be dust, dirt, and grease-free. Any foreign material which will interfere with adhesion must be removed. All abrasives and dust must be removed from the substrate in accordance with the most recent revision of ISO 8502-3 prior to priming. The use of a power vacuum is recommended

14.3 Primer For Concrete and Brick Substrates

14.3.1 PENNTROWEL® Epoxy Primer is the recommended primer for all concrete and brick liner surfaces. It serves to seal and promote adhesion of PENNGUARD Adhesive/ Membrane. Consult Product Data Sheet CE-139 and Installation Specification CES 342 for complete product details.

**15. SPECIFIC SUBSTRATE - FRP SUBSTRATES**

15.1 Surface Preparation

15.1.1 Avoid or remove wax on surfaces to be lined. This may require grinding or sanding with a suitable grinding disc until a whitish surface has been achieved. Do not aggressively grind surface so as not to alter the surface profile. All remnants of dust from grinding or sanding shall be removed.

15.1.2 All edges and fillets and similar abrupt contours shall be rounded off smoothly by appropriate means. A 1/8" (3 mm) radius is preferable.

15.1.3 Panels joined together shall be properly aligned. Butt joints are preferred.

15.1.4 Lap joints should be avoided wherever possible. If lap joints are used, then they must be fully joined and sealed on the inside.

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15.1.5 All connections to the equipment being lined shall be flanged.

15.2 Surface Cleaning

15.2.1 All surfaces must be dust, dirt, and free of grease. Any foreign material which will interfere with adhesion must be removed. Wax is sometimes found on the surface of FRP structures (used in fabrication process); this will need to be removed.

15.3 Primer for FRP

15.3.1 Primer for FRP is not normally required, check with Corrosion Engineering or its representative for specific project requirements.

**16. INSULATION AND FLOOR PROTECTION**

16.1 Insulation

16.1.1 There is to be no external insulation on the structure being lined with PENNGUARD Block and Adhesive/Membrane unless specifically authorized in writing by Corrosion Engineering or its representative.

16.1.2 Thermal gradient calculations are to be performed to provide sufficient thickness of Block material to maintain the temperature of the membrane substrate interface below the recommended levels.

16.2 Floors

16.2.1 Designs of horizontal ducting and chimney floors shall incorporate a sufficient number and size of drains so as to insure condensate is removed and that drains do not plug.

16.2.2 PENNGUARD Block installed in areas such as horizontal ductwork may be subjected to mechanical damage caused by maintenance procedures such as removal of fly ash carry over. If this type of condition is anticipated, the floor area to be lined with the PENNGUARD Block Lining System may have a further protective layer installed over top of the PENNGUARD Block Lining System such as TUFCEM® Silicate Concrete to minimize mechanical damage. Consult Corrosion Engineering or its representative for details.

**17. APPLICABLE MATERIAL DATA SHEETS**

17.1 Materials mentioned in this specification as part of, or associated with the



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PENNGUARD System. Please refer to or request the specific product information for further details.

<b><u>PRODUCT NAME</u></b>	<b><u>DATA SHEET NUMBER</u></b>
PENNGUARD® 55 Block	CE-267
PENNGUARD 28 Block	CE-215
PENNGUARD Adhesive/Membrane	CE-220
PENNGUARD Block Primer	CE-227
PENNTROWEL® Epoxy Primer	CE-139
TUFCHEM Silicate Concrete FG	CE-252
TUFCHEM Silicate Concrete TG	CE-257

**18. SAFETY PRECAUTIONS**

- 18.1 Mixes and applications of this product present a number of hazards. Read and follow the hazard information, precautions and first aid directions on the individual product labels and material safety data sheets before using. While all statements, technical information, and recommendations contained herein are based on information our company believes to be reliable, nothing contained herein shall constitute any warranty, express or implied, with respect to the products and/or services described herein and any such warranties are expressly disclaimed. We recommend that the prospective purchaser or user independently determine the suitability of our product(s) for their intended use. No statement, information or recommendation with respect to our products, whether contained herein or otherwise communicated, shall be legally binding upon us unless expressly set forth in a written agreement between us and the purchaser/user. Please contact Corrosion Engineering for further information at +1-610-833-4000 or FAX +1-610-833-3040. [Contactus.corrosion@ergon.com](mailto:Contactus.corrosion@ergon.com). For all Terms and Conditions of Sale see [ergonarmor.com](http://ergonarmor.com).

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