INSTALLATION SPECIFICATION TUFCHEM™ SILICATE GUNITE

1. SCOPE

1.1 This specification governs the installation of CE-238 Tufchem Silicate Gunite.

1.2 This specification shall also be used in conjunction with information presented on all applicable product data sheets and any associated specifications or drawings referenced herein.

1.3 Guniting involves the dry powder being metered into the delivery hose or feed wheel within the gun. The material is carried by compressed air through the delivery hose to a special nozzle. The nozzle is fitted inside a perforated manifold through which liquid Tufchem Solution is sprayed under pressure and intimately mixed with the dry material jet. The mixed material is jetted from a nozzle at high velocity onto the surface to receive the lining.

1.4 Tufchem Silicate Gunite is a specialized gunite material and shall be installed only by contractors employing nozzle men and operators skilled in the art of guniting, and who must have adequate work experience of a similar nature.

2. ENVIRONMENTAL

2.1 At the time of application, the temperature of the material components should ideally be between 70°F (21°C) and 90°F (32°C). The temperature of the substrate surface, working area, air, and Tufchem Silicate Gunite components should all be maintained at a minimum of 60˚F (16˚C) during application and curing period. A minimum temperature of 70˚F (21˚C) is strongly preferred for optimal handling. Store materials at these temperatures for two days before use.

2.2 The temperature of the prepared surface shall be at least 5°F (3°C) above the moisture dew point and between 60°F (16°C) and 95°F (35°C) at the time materials are applied. If temperatures are below 60°F (16°C) consult Armor.

3. PERSONAL PROTECTION

3.1 Tufchem Silicate Gunite contains a reactive component in the powder. This component is a skin irritant, and care must be taken that especially the nozzle man and anyone else who may encounter the mixed material shall have adequate personal protection equipment (PPE). Consult SDS for PPE requirements. Pay particular attention to confirm the wrists, face, and neck areas are not exposed. If necessary, tape the wrist area to prevent dust and rebound from entering around the sleeve.

4. SURFACE PREPARATION

4.1 Steel substrate surfaces must be cleaned, and free from paint, rust, scale or any other material that will prevent bond. A commercial blast (SSPC SP6) is suggested in preparing the substrate to receive a gunite lining.

4.2 New concrete should be cured for a minimum of 14 days and must be free of any curing films or laitance. New concrete surfaces to be lined require an abrasive blast to create a roughened profile and remove any weak surface laitance. Repair bug holes and voids if first applying a membrane.

4.3 Existing concrete surfaces require water blasting and neutralizing as outlined in ASTM D4261 to achieve a neutral surface pH. Any contaminated or deteriorated concrete surface should be cleaned by either sandblasting, high pressure water blasting, or chipping to obtain a clean, structurally sound surface. Neutralize prepared surface to further remove contamination if present. Repair all cracks in accordance with good industry practice before proceeding.

4.4 Surfaces which are not to be gunned must be protected with plastic or other adequate means. Fine particles of gunite adhere to almost any surface. It is always less expensive to properly protect surfaces not to be covered than trying to remove dried over-spray.

4.5 Any contaminated or deteriorated concrete surface should be cleaned by either sandblasting, high pressure water blasting, or chipping to obtain a clean, structurally sound surface. Neutralize prepared surface to further remove contamination if present. New concrete should be cured for a minimum of 14 days and must be free of any curing films or laitance.

4.6 Certain installations will require the application of a membrane to the substrate before the gunite lining is placed. The membrane manufacturer shall be contacted for full instructions on the proper application of the membrane of his supply to both the substrate and anchorage system employed. Consult section 8 of this specification for more detail on membranes.

5. ANCHORAGE

5.1 A suitable anchorage system must be used to retain Tufchem Silicate Gunite linings against the substrate. The grade of metallic alloy, the size of the anchor, spacing orientation, mesh size, stud location, etc., shall be a function of the specific application and lining thickness and shall be as specified for the respective job. When guniting overhead, or where vibrational considerations are important, special considerations must be given to confirm adequate anchoring. Tufchem Silicate Gunite is usually used in corrosive environments; an alloy anchor is almost always suggested.

5.2 A nominal 2" (50 mm) lining thickness is the suggested minimum although acid proof gunite linings can also be applied thicker, and a 3” or 4” (75 or 100 mm) lining thickness is common. The typical anchor shape most used can be described as a long horn anchor. The anchor dimensions for a 2” (50 mm) thickness shall be 3.25" (81 mm) overall tine length. If drilled into a concrete substrate, the anchor foot should be sized to allow a depth of 2.25" (56 mm) and a hole using a hammer drill with a 1/4" x 6”, (6 mm x 150 mm) drill bit should be created. In all cases whether a concrete or steel substrate, the anchor height should sized to ensure at least ½" (13 mm) material coverage over the anchor tine.

5.3 Anchor spacing is a function of lining thickness and orientation, and shall follow good industry practice.

An approximate anchor count per square foot is as follows for the following examples:
9" spacing 1.89 anchors - therefore 10 sf (0.9 sm) x 1.89 = 19 anchors per 10 sf (0.9 sm)

8" spacing - 2.33 - therefore 10 sf (0.9 sm) x 2.33 = 23 anchors per 10 sf (0.9 sm)
6" spacing- 4.03 - therefore 10 sf (0.9 sm) x 4.03 = 40 anchors per 10 sf (0.9 sm)

Note: Insufficient anchor spacing or undersized anchors will result in the gunite lining cracking and falling away from the substrate. If in doubt install more anchors rather than fewer.

6. GUNITE EQUIPMENT

6.1 It is necessary that the compressor delivers the pressure required for proper mixing of Tufchem Silicate Gunite. It is recommended that the pressure at the nozzle be not less than 80 psi (5.5 bar) to allow proper mixing. A booster pump is suggested in the water (silicate solution) line to insure high pressure. Low pressure results in poor mixing at the nozzle.

6.2 Water ring size shall be determined by the preferences of the gunite contractor. Only experienced nozzle men shall be employed to shoot Tufchem Silicate Gunite. The amount of solution delivered through the water ring at a given time is determined by the number of holes, the size of the holes, and the pressure. With any water ring with a known number of holes and having a known diameter, one can accurately control the amount of Tufchem Solution flowing through the ring by controlling the pressure. For proper wetting, the solution must be intimately mixed with the powder during the brief period in which the powder and solution mixture moves beyond the water ring, through the nozzle, and to the surface being lined. Experience has shown a water ring with a greater number of smaller holes will work best with Tufchem Silicate Gunite. If material is too dry there will be excessive rebound and dusting. If the material is too wet, it will slump off vertical and overhead surfaces. Ideally the consistency of the gunite shall have a very slight sheen when wet.

6.3 With respect to the nozzle, Armor recommends a so-called "black double bubble nozzle" be used. The primary advantage in using this nozzle is that it is easier to dislodge buildup in the nozzle should it occur during the guniting operation by the nozzle man hitting it with his fist. The same problem with hard plastic nozzles or aluminum nozzle bodies, requires hitting them with a hammer to dislodge any buildup, which is not as convenient. However, the preference of the experienced nozzleman should prevail in this regard.

6.4 Ample air capacity for the material hoses, water pump, blow pipe, etc. is a necessity for a quality job. It is recommended that a 600-750 cfm (17-21 (m3/min) compressor be used in the equipment setup. It must be insured that the air is dried to remove moisture. Moisture in the lines can prematurely cause the powder to set, fouling equipment, and lead to plugs in the conveying hose.

6.5 Good communication between the nozzle man and the machine operator is important so instructions can be clearly understood by both parties.

6.6 It is also advisable to use a screen on top of the gunite machine to prevent any large foreign objects or pieces of paper or hard materials from getting into the chambers of the gunite machine which could result in hose plugs.

6.7 Predampening of Tufchem Silicate Gunite Powder is allowed to reduce dusting. Add water to the dry powder at a rate of 1.0-1.5 pints (.5-.7 l) per 50 lb (22.6 kg) bag of Powder. This can be achieved by mixing the Powder in a rotating blade mixer before dumping into the hopper. Do not over dampen as this will cause premature set of the material.

6.8 Pre-wet the solution supply hoses with Tufchem Silicate Gunite Solution before beginning the guniting operation. Solution used for this purpose can be recovered and reused.

6.9 Always insure that the immediate work area is well lit for the lining application. Lighting placed at an elevation above the nozzle man is preferred. Poor lighting is a significant hindrance to achieving a quality result.

6.10 It is recommended that safety goggles used by the workers have safety glass lenses as opposed to plastic lenses. Plastic lenses scratch too easily.

6.11 The wearing of quality dust masks is recommended for all workers involved in the operations, especially the nozzle man. There is a lot of dusting during the guniting. Consult the SDS for full details.

7. GUNITING

7.1 Before charging any gunite machine with Tufchem Silicate Gunite Powder, it is advisable to blow hoses with air pressure to confirm the lines are clean and free of any moisture.

7.2 It is recommended that the liquid pressure at the nozzle be not less than 100 psi (6.9 bar) to allow proper mixing. Do not undersize the water/solution pump.

7.3 The nozzle body and water ring assembly should be cleaned at least once per shift to insure that all holes are open.

7.4 The nozzle man should direct his nozzle perpendicular to the surface to which he is applying the lining.

7.5 The nozzle should be held 2 to 3 feet (.6-.9 m) from the surface being lined.

7.6 Care must be exercised to insure that rebound is not trapped, either behind or within the thickness of the applied lining. It is recommended that a blow pipe or air lance be utilized adjacent to the installation area for rebound removal.

7.7 The nozzle man should shoot target areas, measuring approximately 3 feet x 3 feet (1 m x 1 m) to the full lining thickness as opposed to trying to shoot over a wide area. This procedure minimizes the potential for laminations occurring in the lining thickness.

7.8 In guniting application, the work shall begin at the lowest part, i.e., with respect to vertical surfaces, work shall be from the bottom up.

7.9 No rebound shall be reused or mixed into any batch.

7.10 The lining shall be shot to the full thickness in one pass. In flues and chimneys, the gunite is placed in either circumferential bands or shot in panel construction.

7.11 The lining should be left as a natural "gunned" finish. Do not trim. The goal is not an aesthetic finish, but a functional finish. Trimming may disturb material that has begun to set. Some discretion is allowed here, if the gunned area is freshly gunned and needs attention.

7.12 In finishing off a particular area of lining such as between shifts, the gunite shall be shot to a

tapered edge (approximately 45 degree) over a width of approximately 2" (50 mm). The finished surface of this edge shall be blown clean, or brushed, to remove any laitance or rebound, and allowed to set. Before beginning the continuation of the gunite lining, this edge shall be cleaned with an air blast. This tapered edge shall then be covered with fresh gunite as soon as possible, and the gunned thickness built up accordingly.

7.13 Rebound is a material which ricochets from the gunned surface. It is mostly composed of larger particles of aggregate with a small portion of the binding material. It cannot be re-used. Hence rebound shall be removed from the work area. This is normally done using an auxiliary air jet (blow pipe), a trowel, broom, and/or a shovel. The blow pipe operator keeps the material out of the way from the nozzle pattern without disturbing sound gunite. Surging material leaves dry pockets in place (like rebound) which must be cut out and discarded. Loose materials are then swept up and removed by shovel, as necessary.

7.14 Whenever the gunning operation is shutdown always blow out the material hoses. If the shutdown is to be greater than two hours, then the machine should be cleaned out.

7.15 Do not use any more hose in the equipment setup than is necessary to reach the gunning area. Always make large radii in the hoses and avoid sharp bends and kinks in the hoses.

7.16 Should it be advantageous to cast (rather than gun) small or inaccessible areas, this is permissible. Mix the components at the ratio specified on the product data sheet.

8. CHEMICAL RESISTANT MEMBRANE

8.1 If a chemical resistant membrane is specified under the gunite it is suggested the membrane be applied after the anchors have been installed. The membrane should seal the substrate. This can be problematic with anchors due to shadowing under the anchor tine, leaving areas unsealed. Each individual anchor should be inspected. Dab wet membrane by brushing thoroughly around the base of each anchor to fully seal the substrate.

9. CURE TIME AND TEMPERATURES

9.1 The cure time is dependent on temperature of the substrate as well as the material temperature. Ambient air temperature may not be the temperature of the substrate; i.e. direct sunlight will heat steel to a higher temperature than ambient air. In winter, steel may be colder than ambient air. Consult the product data sheet.

10. CLEAN-UP

10.1 Use water to clean gunite tools and equipment. Use mineral spirits to clean Pacmastic™ 325 Membrane.

11. STORAGE AND SHELF LIFE

11.1 Consult individual product data sheets for specific shelf-life information.

12. SAFETY PRECAUTIONS DISCLAIMER CONTACT INFORMATION

12.1 Consult current Safety Data Sheets (SDS's) before commencement of work.

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