3M™ Surface Pre-Treatment AC-130-2

Hold Fast

A high-performance bonding surface preparation

- Saves time over comparable processes
- Easy field repairs
- Water-based and non-chromate

3M

Promote strong bonds. Replace chromate containing materials.

Adhesive bonding of aircraft components requires high-performance surface preparation. Common processes such as phosphoric acid anodizing (PAA) or sulfuric acid-sodium dichromate etchings involve hazardous materials and can be difficult to perform in the field. Now, 3M offers a high-performance surface pre-treatment that delivers equivalent performance to PAA – in less time.

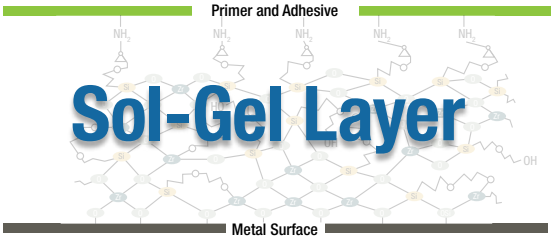
3M™ Surface Pre-Treatment AC-130-2

3M Surface Pre-Treatment AC-130-2 is a high-performance surface preparation for adhesive bonding of aluminum alloys, steel and titanium. AC-130-2 may address concerns about economical and environmental issues found in other conventional processes.

Water-based and non-chromated, 3M AC-130-2 may help reduce the amount of hazardous materials and waste typically generated by the bonding surface preparation process. It is also faster and easier to apply, even in the field.

- **Saves time –** faster than grit blast, Phosphoric Acid Containment System (PACS) and Phosphoric Acid Non-Tank Anodizing (PANTA) processes.
- **May help reduce hazardous materials –** eliminates chromates from surface treatment process.
- **Easy to use –** 2-part system can be applied by multiple methods and during field repairs. No heat cure or rinsing required.

Figure 1. 3M AC-130-2 is a solution gelation, or sol-gel, system. It promotes enhanced adhesion as a result of the chemical interaction at the interfaces between the metal, the AC-130-2 layer and the primer.



Application Process

Figure 2 shows the general surface preparation process incorporating 3M AC-130-2 pre-treatment. Successful bonding requires thorough deoxidation and preparation of the metal surface. 3M AC-130-2 may be applied by brush, spray or immersion, followed by an ambient temperature dry. Surfaces may then be primed prior to bonding, if substrate bondline corrosion protection is required. Refer to the Application Guidelines for details.

Figure 2. Surface treatment process using 3M AC-130-2

1. Clean and deox alloy surface
2. Mix AC-130-2 Sol-Gel Kit (Induction Time: 30 minutes)
3. Brush/spray apply 3M AC-130-2 (Dry Time: 60 minutes)
4. Brush/spray apply adhesive primer
5. Pre-cure or co-cure with adhesive

Technology Comparison

The most common surface preparation techniques used to provide acceptable surfaces for bonding (i.e., phosphoric acid anodizing or sulfuric acid-sodium dichromate etchings) generate hazardous materials and waste that require special handling, control and disposal methods. When used with the leading adhesive primers and adhesives, 3M AC-130-2 provides an economical alternative to these more costly processes.

Testing of 3M AC-130-2 coated surfaces has demonstrated the long-term durability of adhesion to metal. In addition, test data shows that AC-130-2 provides equivalent or better moisture durability than many of the currently used surface preparations for on-aircraft repairs.

Testing

Testing by the wedge test described in ASTM D3762 on aluminum substrates shows that 3M AC-130-2* pre-treatment performs comparatively to the more traditional grit-blast silane procedure. When grit-blast is used with the 3M AC-130-2, the sol-gel process has shown wedge test results similar to PAA (Phosphoric Acid Anodizing). The grit-blast and 3M AC-130-2 pre-treatment process also provided acceptable test results on titanium, stainless steel, and nickel alloys in the same test compared to standard controls.

The grit-blast surface preparation process used prior to application of 3M AC-130-2 has been shown to provide a more durable bond than the nylon pad process in the wedge test at 140°F (60°C) and 95–100% RH. However, the nylon pad process provides an adequate bonding surface, is quicker to perform in the field, and does not require the painstaking containment and subsequent cleaning of residual grit.

* Testing was performed using a four part sol-gel kit that is no longer commercially available from 3M. AC-130-2 exhibits equivalent performance characteristics to the test material.

[1] Boegel-EPII is the name of the developmental material on which the AC-130-2 formulation is based.
[2] BR® 6747-1 Water-based Adhesive Bonding Primer System
[3] 3M™ Scotch-Weld™ Structural Adhesive Film AF 163-2M
[4] Scotch-Brite™ Disc, Fine
[5] Semco® Pasa-Jell 105
[6] Scotch-Brite™ Hand Pad, Brown
[7] Turco® Surface Pretreatment
[8] BR® 127 Corrosion Inhibiting Primer
[9] FM® 73 Epoxy Film Adhesive
[10] FM® 94 Modified Epoxy Film

Source, Figures 3, 4 & 5: *Sol-Gel Technology for Surface Preparation of Metal Alloys for Adhesive Bonding and Sealing Operations*, U.S. Air Force Research Laboratory, March, 2001 (www.dtic.mil/dtic/tr/fulltext/u2/a419256.pdf).

Wedge Crack Exposure Data

Figure 3. Aluminum Bonding 2024-T3

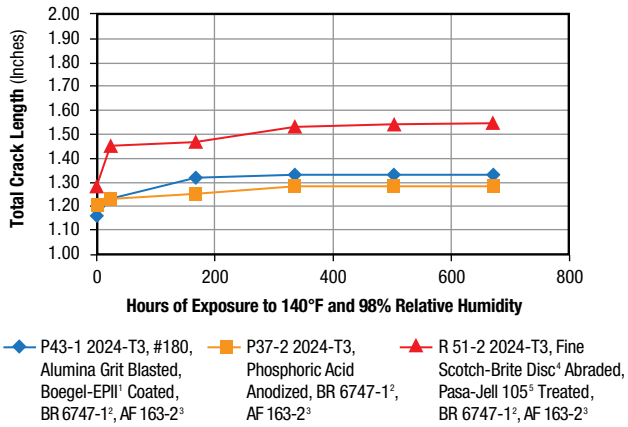


Figure 4. Titanium Bonding Ti-6A1-4V

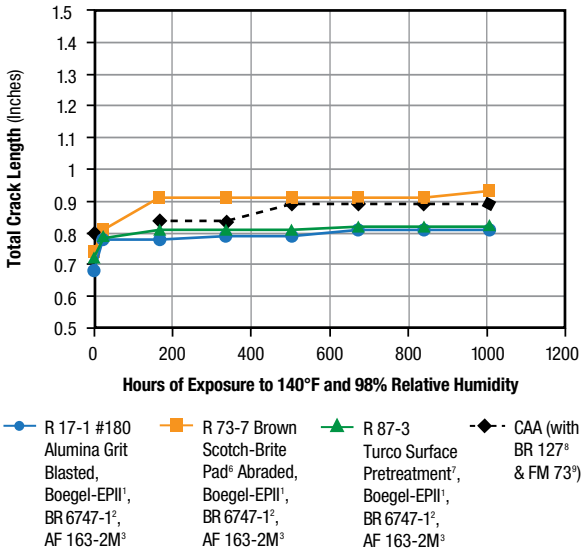
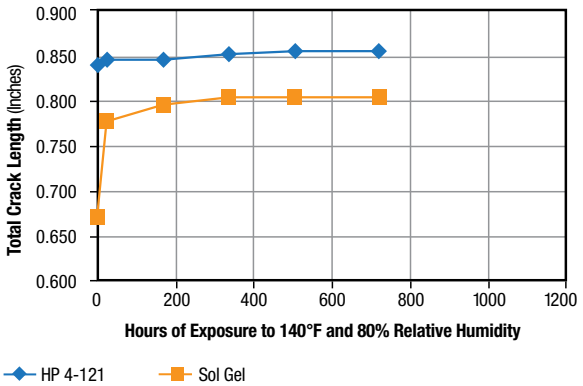


Figure 5. Steel Bonding AM355 Stainless



Note: Bonded with BR 6747-1[2] primer and FM 94[10] adhesive.
Note: HP 4-121 is a ferric chloride (FCHAE) etch process.

Typical Physical Properties

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

3M™ Surface Pre-Treatment AC-130-2

Configuration	2-part
Color	Slightly opaque, un-tinted
Induction Time	30 minutes
Pot Life	10 hours after mixing

Standard Package Sizes and Coverage

Kit Designation	Minimum Coverage, ft² (m²)
50 mL	2.5 (0.23)
100 mL	5.0 (0.50)
500 mL	25 (2.3)
1,000 mL	50 (4.6)
1,500 mL	75 (6.9)
1 Gallon	189 (17.4)

Health and Safety

3M AC-130-2 pre-treatment is safe to use and apply when recommended precautions are followed. Before using this product, read and understand the Safety Data Sheet (SDS), which provides information on health, physical and environmental hazards, handling precautions and first aid recommendations. A product SDS is available on request or at **www.3M.com**.

Application Guidelines

The following process is commonly used to facilitate adhesive bonding to aluminum, titanium, stainless steel and nickel alloys in the following forms: sheet, plate, foil, forging and honeycomb core. This formulation is applicable for parts subsequently bonded with epoxy-based adhesive systems.

Materials

- 3M™ Surface Pre-Treatment AC-130-2
- Wipers, cheesecloth, gauze or clean cotton rags
- Abrasive paper/discs, #180 grit
- Scotch-Brite™ Roloc™ Discs, 2 or 3 in., medium grit
- Aluminum oxide abrasive grit, 50-80 micron (#180– 280 grit)
- Scotch-Brite™ General Purpose Hand Pad 7447
- Solvents, in order of preference: acetone; methyl ethyl ketone (MEK); methyl propyl ketone (MPK); a blend of MEK and MPK; isopropyl alcohol (IPA)
- Bonding primer and/or adhesive

Definitions

The following definitions apply to terms that are uncommon or have special meanings as used in these guidelines:

Water-Break-Free Surface: A surface that maintains a continuous water film for a period of at least 30 seconds after having been spray- or immersion-rinsed in clean water at a temperature below 100°F (38° C).

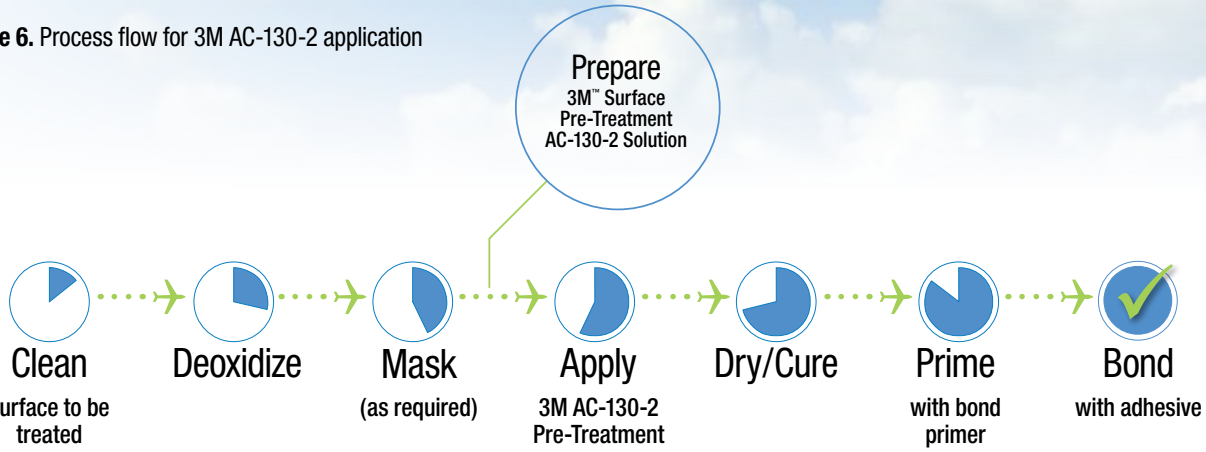
Spray-Drench: Spray the surface with 3M AC-130-2 solution so that the entire sprayed surface remains consistently wet over a controlled period of time. There may be a small amount of excess material that will run off of the part during this application.

Homogeneous: Of a uniform or similar nature throughout. A homogeneous solution will have the same uniform consistency throughout the mixture.

Induction Time: The period of time that freshly mixed 3M AC-130-2 must sit to initiate the polymerization reaction prior to application. Do not treat the part with the solution before the induction time is complete.

Pot-Life: The limited time period, after all of the 3M AC-130-2 components have been mixed, within which the coating material must be used. Do not treat the part with the solution after the pot-life has expired.

Figure 6. Process flow for 3M AC-130-2 application



Manufacturing Control

Warning: This process involves the use of chemical substances that are hazardous. Please refer to the product SDS and employer's safety instructions. For disposition of hazardous waste materials, consult site environmental engineers for proper disposal methods.

Note: Consult local air quality regulations that may regulate solvent use.

General Processing Notes for 3M Surface Pre-Treatment AC-130-2

- Hardware to be processed should be racked or handled with minimal contact area and protected from oil, grease and fingerprints. Parts that have been contaminated during handling and transport should be cleaned before storing.
- Orient parts for processing to maximize drainage and minimize contact points during cleaning and application with 3M AC-130-2 solution.
- Parts must be water-break free before 3M AC-130-2 application.
- Mask dissimilar metals and neighboring regions where appropriate.
- Apply bond primer or adhesive within 24 hours of 3M AC-130-2 application. Cool parts to room temperature, prior to application of organic finishes.
- If necessary, contain grit and dust residues generated during the mechanical deoxidization processes.
- Examples of acceptable application equipment include HVLP guns, airless sprayers, Preval® sprayers, and conventional pump sprayers.

Facilities Control

- Air used for drying, air-water rinsing and blow-off should be treated and filtered so that it is free of moisture, oil and solid particles.
- 3M AC-130-2 and primer application should be conducted in an area with adequate ventilation. See product SDS for details.
- Recommended temperatures for application and cure are 57°F to 87°F (14°C to 31°C). Relative humidity should not exceed 85 percent.
- Grinders used should have a rear exhaust with an attachment to deliver the exhaust away from the part surface.
- Sanding tools should have a random orbital movement.

Cleaning & Surface Preparation

Remove all surface coatings and adhesive residues down to bare metal using approved procedures. Solvent clean (see Materials) or aqueously clean the part surface areas to be bonded and adjacent areas. Parts that have been aqueously cleaned should be checked for water-break free surfaces (see Definitions) during the final rinse step. If solvent cleaning, use a fresh portion of the wiper for each pass, and do not allow solvent to dry on the substrate. Visually check for complete removal of all contaminants. Dry parts before proceeding.

Caution: Proper protective equipment, such as protective gloves, respirators and eye protection must be worn during these operations.

Note: The following are suggested methods for achieving an acceptable bonding surface. The user should take into consideration part configuration, dimensional tolerances, alloy type, and any specification or drawing requirements and make modifications as needed.

Grit Blast Deoxidization

1. Using alumina grit (see Materials) grit blast a region slightly larger than the bond area. Use 30-80 psi oil-free compressed air or nitrogen. Slightly overlap blast area with each pass across the surface until a uniform matte appearance has been achieved. Ideal blast pressure is dependent on the angle of the nozzle to the surface and the speed at which the blaster traverses over the surface.
2. Remove loose grit residue with a clean, dry, natural bristle brush or with clean, oil-free compressed nitrogen or air.
3. Apply 3M AC-130-2 solution as soon as possible after completion of the grit blast process. Time between completion of grit blast deoxidization and application of 3M AC-130-2 should not exceed 8 hours. Avoid contamination of the freshly abraded surface.

Sanding Deoxidization

1. Connect sander or a high-speed grinder to an oil-free nitrogen or compressed air line. Thoroughly abrade the surface by sanding with abrasive paper (see Materials) for one to two minutes over 6" × 6" sections, covering the entire surface uniformly. A preferred method would be to guide the sander from side to side across the entire 6" × 6" area and then change the direction of travel by 90 degrees to achieve one cross coat. Change the sandpaper when it becomes worn, as evidenced by tears, seizing of the tool and clogging. At a minimum, use one fresh piece of sandpaper for each 6" × 6" area. Sanding speed should be adjusted in order to complete all passes within a one to two minute period over a 6" × 6" area. With proper airflow, the sanding disc should maintain free rotation with lightly applied pressure during the entire procedure. After the area has been abraded in sections, re-sand the entire surface using a fresh piece of sandpaper.
2. Remove loose grit residue with a clean, dry, natural bristle brush or with clean, oil-free compressed nitrogen or air.
3. Apply 3M AC-130-2 solution as soon as possible after completion of the sanding process. Time between completion of sanding deoxidation and application of 3M AC-130 Pre-Treatment should not exceed 8 hours. Avoid contamination of the freshly abraded surface.

Mechanical Deoxidization with Abrasive Disc

1. Connect high-speed grinder to an oil-free nitrogen or compressed air line. Thoroughly abrade the surface with a medium-grit abrasive disc (see Materials) for a minimum of one to two minutes over each 6" × 6" section, covering the entire surface uniformly. Change the abrasive disc when it becomes worn, as evidenced by seizing of the tool or clogging of the pad. Use a fresh disc for each 6" × 6" area. After the area has been abraded in sections, abrade the entire surface again using a fresh Roloc disc.
2. Remove loose grit residue with a clean, dry, natural bristle brush or with clean, oil-free compressed nitrogen or air.
3. Apply 3M AC-130-2 solution as soon as possible after completion of the mechanical abrasion process. Time between completion of mechanical deoxidization and application of 3M AC-130-2 pre-treatment should not exceed 8 hours. Avoid contamination of the freshly abraded surface.

Manual Deoxidization with Abrasive Pad

1. Thoroughly abrade the surface with an abrasive pad (see Materials) for a minimum of one to two minutes over each 6" × 6" section, covering the entire surface uniformly. Change the pad when it becomes worn. Use a fresh pad for each 6" × 6" area. After the entire area has been abraded in sections, abrade the entire surface again using a fresh pad.
2. Remove loose grit residue with a clean, dry, natural bristle brush or with clean, oil-free compressed nitrogen or air.
3. Apply 3M AC-130-2 solution as soon as possible after completion of the manual abrasion process. Time between completion of Scotch-Brite deoxidization and application of 3M AC-130-2 should not exceed 8 hours. Avoid contamination of the freshly abraded surface.

Application of 3M Surface Pre-Treatment AC-130-2

Prepare 3M AC-130-2 solution in accordance with the mixing instructions provided with each kit. Use the appropriately sized kit for the size of part and method of application (see Standard Package Sizes and Coverage table). The use of partial kits is not recommended. Use one of the following methods to apply 3M AC-130-2 solution.

Spray Application

1. Apply 3M AC-130-2 solution by spray-drenching the part surface. Spray solution generously, allowing excess to run off the surface. Keep part surface continuously wet with the solution for a minimum of 1 minute. Part surfaces must not be allowed to dry and should be drenched with solution at least one time during the solution application period. Ensure treated surface does not dry between spray coats. Treat larger surfaces in sections to prevent the part surface from drying between coats.

2. Allow the coated hardware to drain for 5–10 minutes. Excess 3M AC-130-2 solution may pool in crevices, pockets or other collection areas, including drip edges or fastener holes. If any 3M AC-130-2 has accumulated in such areas, use filtered compressed air to blow off excess solution while maintaining a wet surface. Minimize splattering of this excess solution onto adjoining part surfaces. Alternatively, a clean cloth pre-wetted with 3M AC-130-2 solution may be used to gently blot, not rub, the surface where the solution has pooled. Do not dry off areas of the part that are able to freely drain. The part may still be wet after 5–10 minutes of air-drying.
3. Let the coated parts dry under ambient conditions for a minimum of 60 minutes. Refer to Dry/Cure section for additional information.
4. Apply bond primer or adhesive within 24 hours of 3M AC-130-2 application. Keep part surface clean during entire operation.

Manual (Brush) Application

1. Apply 3M AC-130-2 solution liberally by brushing with a clean natural bristle brush or swabbing with a clean wiper, cheesecloth or gauze. Do not scrub with a brush or applicator. Apply solution generously, keeping the part surface continuously wet with the solution for a minimum of 1 minute. Brushes or wipers should not leave streaks on the surface. Part surfaces should be drenched with solution, must not be allowed to dry and should be wetted with fresh solution at least one time during the solution application period.
2. Allow the coated parts to drain for 5–10 minutes. If any surplus 3M AC-130-2 solution has pooled or collected in crevices, pockets or other contained areas, use the same methods described under Spray Application to remove the excess solution.
3. Let the coated parts dry under ambient conditions for a minimum of 60 minutes. Refer to Dry/Cure section for additional information.
4. Apply bond primer or adhesive within 24 hours of 3M AC-130-2 application. Keep part surface clean during entire operation.

Bath Application

1. Apply 3M AC-130-2 solution by submerging the part in 3M AC-130-2 pre-treatment. Allow the part to soak in the bath for a minimum of one minute, but not exceeding three minutes.
2. Remove the part from the bath and allow the part to drain for 5–10 minutes. If any surplus 3M AC-130-2 solution has pooled or collected in crevices, pockets or other contained areas, use the same methods described under Spray Application to remove the excess solution.
3. Let the part dry under ambient conditions for a minimum of 60 minutes. Refer to Dry/Cure section for additional information.
4. Apply bond primer and/or adhesive within 24 hours of 3M AC-130-2 application. Keep part surface clean during entire operation.

Drying/Curing of 3M Surface Pre-Treatment AC-130-2

Minimize or avoid contact with coated surfaces while drying, as the coating may be easily damaged or contaminated until fully cured. Exact drying times will vary depending on part configuration and ambient conditions.

1. Dry the solution-coated parts under ambient conditions for a minimum of 60 minutes.
2. Alternatively, after drying at ambient temperature for a minimum of 30 minutes, parts may be heated to 140°F (60°C) maximum for an additional 30 minutes minimum to facilitate drying.
3. After drying, coated surfaces should be protected from contamination prior to applying the bonding primer.

Acceptable Results

1. An acceptable 3M AC-130-2 coating is smooth and continuous without evidence of surface contamination.
2. Dark areas caused by draining and uneven drying of the sol-gel solutions are acceptable.

Storage

Materials included in this document that are considered to be time and temperature sensitive should be stored in accordance with manufacturer's instructions and in accordance with local requirements from time of receipt through use.

The shelf life of 3M AC-130-2 pre-treatment is 12 months, when stored in the original unopened containers between 40°F and 100°F (4°C and 38°C).

For Additional Information

In the U.S., call toll free 1-800-235-2376, or fax 1-800-435-3082 or 651-737-2171. For U.S. Military, call 1-866-556-5714. If you are outside of the U.S., please contact your nearest 3M office or one of the following branches:

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