AEROSPACE RECOMMENDED PRACTICE	ARP1925™	REV. B
	Issued 1986-10 Revised 2001-03 Reaffirmed 2021-08 Superseding ARP1925A	

Automated Brush Deburring

RATIONALE

ARP1925B has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

1.1 This recommended practice establishes a procedure for the application of long string abrasive monofilaments to machined aircraft structures for the purpose of removing burrs produced during the machining operations. This procedure is typically applicable to aluminum, titanium, and steel, but usage is not limited to such applications.

1.2 The process is applicable to the removal of light machining burrs but will not remove burrs that have been extruded by dull cutting tools.

1.3 The process described responds to an automated brush deburring method that lends itself to machine automation and robotic applications and is applicable to a wide range of part geometry variables.

1.4 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this document may involve the use of hazardous materials, this document does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

2.1 NFPA Publications:

Available from the National Fire Protection Association, Battery March Park, Quincy, MA 02269.

Code 65 National Fire Protection Association
Code 481 National Fire Protection Association

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

For more information on this standard, visit
https://www.sae.org/standards/content/ARP1925B/

3. TECHNICAL REQUIREMENTS:

3.1 Process Description:

3.1.1 Deburring of aircraft parts has historically been accomplished primarily by hand methods due to the size, complexity, and part volume variability. This document describes a process which offers a simplified approach to the automation of the deburring operation. The process is based on the use of ultra-long string abrasive brushes as the deburring media.

3.1.2 It is a departure from current industry practice of using only the brush tips as the primary deburring mechanism. The brush filaments are lengthened and fabricated into a cylindrical brush. The centrifugal force, imparted by the rotational speed of the brush, results in the deburring and the rounding of the part edges by the surface of the filaments in a draw and file action. The flexible filaments wrap around and deburr the edges of the part, concentrating their force on the edges without adversely affecting other part features.

3.2 Selection of Equipment:

The selection of equipment to be used in the application of the process is determined primarily by the size and part complexity. Complex irregular shaped parts (e.g., aircraft bulkheads and landing gear struts) are candidates for robotic application, while long rectilinear and integrally stiffened parts (e.g., spars and wing planks) are candidates for automated machinery.

3.3 Brush Material:

3.3.1 The filament material used in the construction of a long string brush deburring head consists of an extruded nylon monofilament containing abrasive particles of aluminum oxide or silicon carbide dispersed throughout the filament and exposed on the surface.

3.3.1.1 New particles are exposed as the filament wears.

3.3.2 The filament material is available in many combinations of grit size and filament diameters. Available grit sizes range from 600 to 46, with the larger grit sizes available in the larger filament diameters. Diameters range from 0.012 to 0.060 inch (0.30 to 1.52 mm).

3.3.2.1 Grit size for this process should be no coarser than 120 (125 µm). Filaments containing abrasive grit coarser than 80 (180 µm) grit are not as effective in material removal, due to the larger particle size, providing fewer cutting edges on the surface of the filament.

3.3.2.2 The filament material is currently available in choices of grit loadings from 20% to 40% abrasive with 60% to 80% nylon.

3.3.2.3 The filament is also available in nonround shapes, one being rectangular shaped, 0.045 by 0.090 inch (1.14 by 2.29 mm) with similar grit content as round materials. Grit sizes in rectangular filaments range from 320 to 80 mesh.

3.3.3 The filament material is available from the brush manufacturers in low, medium, and high density filament concentrations. This is a measure of the amount of filament placed in a given length of brush strip.

3.3.4 The brushes are currently available in three basic types:

3.3.4.1 Straight and spiral strip brushes, where the strips of brushes are located along the axis of rotation.

3.3.4.2 Parallel order and continuous spiral wrap brushes, where the strips are wrapped in a loose or tight pitch around the axis of rotation.

4. RECOMMENDED BRUSH CONSTRUCTION:

4.1 The following recommended brush construction is based on the best results obtained in the configurations tested and does not imply that all possible combinations have been reviewed.

4.2 Abrasive Media:

Silicon carbide provides better deburring effectiveness and longer surface abrasive life than aluminum oxide.

4.3 Grit Loading:

Optimum loading is 60% nylon carrier to 40% abrasive material. This combination provides better deburring effectiveness than a lower abrasive content.

4.4 Brush Pack Density:

A medium density brush fill is recommended as an economic optimum. The heavy density brush is more aggressive but not enough to offset the increased material cost.

4.5 Brush Trim Length:

The brush trim length is the effective length of the filament from the mandrel diameter and should be not less than 3 inches (76 mm) longer than the highest edge from the base of the part to be deburred.

4.6 Type of Brush:

The type of brush construction is primarily dictated by the part configuration and the degree of deburring aggressiveness required. The strip type is recommended for deburring the under edge of protruding surfaces where maximum wrap-around is required. The continuous tight spiral wrap is recommended where maximum deburring aggressiveness is required on parts without overhanging edges.

5. PROCESS PARAMETERS:

5.1 Deburring Angle:

The deburring angle is defined as the angle of the edge being deburred to the rotational axis of the brush.

5.1.1 The recommended angle is 45° with respect to the edge being deburred. The tests results indicate that the material removal rate remains relatively constant between 0° and 30°, decreases slightly between 30° and 45°, and declines rapidly beyond 45°.

5.2 Brush Speed:

Speeds between 400 and 500 rpm provide acceptable material removal rates and edge radiusing between 0.010 to 0.040 inches (0.25 to 1.02 mm). Speeds above 600 rpm are not recommended with the long string process. Speeds above 600 rpm result in very rapid fatigue failure of the brush filaments with little increase in deburring effectiveness. Higher speeds also decrease the brushes' conformity to part geometry, as well as leading to overheating of the filaments and a tendency for smearing of the nylon onto the work surface.

5.3 Lubrication:

The use of water or other liquid coolant media is not recommended with the long string deburring process. Water decreases the deburring effectiveness. The flexibility of the brushes, coupled with the low brush speed, does not cause excessive heating of the surface.

5.4 Brush Oscillation:

Brush oscillation is not recommended in this process. This process is based on a draw and file action of the filaments, requiring the filament to remain in contact with the edge during the process. Oscillation tends to pull the filaments away from the edge, decreasing the deburring effectiveness.

5.5 Deburring Effectiveness:

The deburring effectiveness is directly related to the grit size, brush density, brush rpm, material, and feed rate.

5.5.1 The material removal rate decreases as the abrasive wears flush with the filament diameter and then remains constant until the filaments wear out. In-process inspection is recommended. Feed rates shall be regulated to maintain acceptable deburring levels.

5.5.2 The deburring rate on 7075 aluminum alloy (with the process conditions the same) is approximately twice that for titanium or steel.