STRIPPING OF ORGANIC COATING BY THE FLASHJET COATING REMOVAL PROCESS

1. APPLICATION

1.1 This Specification outlines the procedures and requirements for stripping all coating types from metallic and non–metallic materials by using the FLASHJET coating removal process. The process uses pulsed light energy, a dry ice particle stream, and effluent collection simultaneously to pyrolyze the organic coating, sweep away the residue, and trap any harmful effluents in disposable filters.

1.2 This Specification is applicable when called out by Engineering documents, by other Process Specifications, or when listed in a Specification Conversion Index.

1.3 This Specification is effective upon issue. At MDA–St. Louis, this Specification may be implemented at once, but it must be implemented by 10 Aug 1997. Subcontractors or vendors performing processing in accordance with the requirements of this Specification shall implement the Specification within 90 days after receiving this document. If compliance with this Specification cannot be effected within the designated lead time, a request for deviation must be submitted per P.S. 10000.

1.4 The Requirements and Procedures sections of this Specification are organized as follows:

1.5 This Specification supersedes and includes P.B. 2–351.

1.6 A glossary containing definitions of terms used in this Specification has been provided in Section 9.

2. APPLICABLE DOCUMENTS

2.1 NONGOVERNMENT DOCUMENTS – The following documents form a part of this Specification to the extent specified herein.

SPECIFICATIONS

McDonnell Douglas Aerospace

P.S. 10000	P.S. 12100	P.S. 20002
P.S. 23401	QASP 10.116	

Refer to the Process Specification Index for a complete title and the latest revision information on each specification. MDA personnel can obtain copies of specifications from Engineering Support Services – Manuals.

OTHER PUBLICATIONS

McDonnell Douglas Occupational Safety and Health Environmental Compliance Manual

Personal Protective Devices Manual (PPDM)

McDonnell Douglas Aerospace Engineering Report No. 93K0296 Rev. A – Qualification of Xenon Flashlamp/CO_2 Paint Removal Procedures for Use on Douglas Commercial Aircraft Components

Operation and Maintenance Manual 71E220001 – FLASHJET Coatings Removal Process for Gantry Robot System Installation

PROCEDURES

McDonnell Douglas Aerospace

GOP 01.062 – Guidelines for Production Process Certification and Operator Verification

3. MATERIALS AND/OR SOLUTIONS

3.1 Aluminum Foil Paper; Commercially Available

3.2 Tape, Aluminum Pressure Sensitive Adhesive, A–A–883, #232 (various widths); 3M Company, St. Paul, MN

3.3 Visual Temperature Indicators, 200 to 300°F (Suggested source: Hermet Visual Temperature Indicators, P/N 03200, Markal Co., Chicago, IL)

3.4 Temperature Laser Gun, Raytek PM Plus, Model No. RAYRPM 30L30, Raytek, Santa Cruz, CA, or equivalent device capable of remotely monitoring temperature within ±5%

3.5 HEARING PROTECTION

(a) Foam Ear Plugs, 25 dB Noise Reduction Rating (NRR) or greater, per PPDM

(b) Ear Muffs, 25 dB NRR or greater, per PPDM

3.6 UV PROTECTION

(a) Shaded UV Rated Glasses, ≥99% UV light absorption, meeting ANSI standard Z87.1–1989 (Suggested source: UVEX Ultra–Spec 2000, Model S028, UVEX Safety Inc., Smithfield, RI)

(b) Sunscreen lotion, SPF of 30 or more, Commercially Available

4. EQUIPMENT AND FACILITIES

4.1 EQUIPMENT

4.1.1 FLASHJET Coatings Removal System; McDonnell Douglas Aerospace–St. Louis. The following subsystems make up the FLASHJET Coatings Removal System:

(a) Stripping Head – An integrated unit consisting of the flashlamp module, dry ice delivery nozzle, proximity/motion and color sensors, and a light containment/noise abatement/effluent capture shroud.

(b) High Voltage Power Supply/Controller – A cabinet consisting of the power control module, charging capacitors, control computer/remote control pendant interface, and the flashlamp water cooling system.

(c) Dry Ice Pelletizer and Delivery System – A system consisting of an air compressor, liquid CO_2 storage tank, Cold Jet Model 65–200 pelletizer or equivalent pelletizer capable of delivering CO_2 pellet at up to 1,000 lb/hr, an air dryer, and dry ice particle delivery hoses.

(d) Effluent Collection System – A system consisting of a vacuum, particulate trap, high efficiency particulate air (HEPA) filters, pre–HEPA filters, and an activated charcoal scrubber. The particulate trap, HEPA and pre–HEPA filters have a combined efficiency of 99.7% for particulates in excess of 0.3 microns. The scrubber has an efficiency of 99% in removing organic compounds.

(e) Cell Controller – An assembly consisting of a console that houses both the cell controller and the color sensor computers, a programmable logic controller, an air conditioning unit, a power supply and associated software.

(f) Robot Manipulator System – This system is a gantry–style robot specifically configured to provide accessibility to parts being stripped. The overhead robot consists of raised structure, traversing carriage, rigid mast and vertical carriage, and offset arm and wrist.

4.1.2 Ancillary equipment/tools/fixtures/hoists/ etc.

4.2 FACILITIES

4.2.1 FLASHJET stripping cell which meets all local building codes and safety regulations.

4.2.1.1 Facility ventilation system to eliminate CO_2 buildup.

4.2.1.2 Welding Curtain, UV attenuation factor of 500 (Suggested source: J.C. Goss Co., Detroit, MI), used to enclose the FLASHJET coatings removal system stripping head [4.1.1(a)] and protect personnel in the cell from UV radiation in the event that the FLASHJET system is operating and personnel are without other personal protective measures specified in 3.6.

5. REQUIREMENTS

5.1 TRAINING

5.1.1 Current Requirements

5.1.1.1 Periodicity – Refresher required if operator has not operated FLASHJET within the past 12 months.

5.1.1.2 Type of Training

(a) Training shall be classroom and hands–on type.

(b) No prerequisite is necessary

(c) Course length is 40 hours

(d) Classroom training (16 hours) consists of providing a thorough understanding of theory of operation, equipment description, process operation,

and FLASHJET system set–up parameters. Scheduled inspection and maintenance procedures necessary to ensure peak FLASHJET performance are also included.

(e) Hands–on training (24 hours) consists of equipment familiarization, system set–up, system operation, and operator qualification tests in the FLASHJET facility to ensure a complete understanding of the equipment and its operation.

(f) McDonnell Douglas Aerospace will provide operation and maintenance training for the stripping head subsystem, the effluent capture system, and the cell controller. Each subsystem vendor will provide training for operation and maintenance of their equipment.

(g) Training materials include all documentation necessary referring to operating procedures and scheduled inspection and maintenance procedures.

5.1.1.3 Certification/License – Not applicable.

5.1.1.4 Records – McDonnell Douglas Aerospace Training Department shall retain test scores and a roster of qualified personnel.

5.1.2 Prerequisites/Related Training – Personnel performing FLASHJET coatings removal shall complete the OSEH training course in Hazardous Communication (Class #23293).

5.2 PROCESSING

5.2.1 Pre–Stripping Requirements

5.2.1.1 There are no pre–cleaning requirements associated with the FLASHJET process.

5.2.1.2 Acrylic plastic material, cabin windows, cockpit windshields, lenses, rubber and other items which could be affected by the FLASHJET process shall be masked with aluminum foil paper (3.1) or reflective aluminum templates (4.1.2) secured by fasteners or tape (3.2) along the perimeter of the foil or template. Tape, if used, shall be adhered to the substrate outside of the acrylic or item being protected, not the item itself.

NOTE: Pressure sensitive adhesives containing silicones are prohibited.

5.2.2 Controls and Sensors Requirements

5.2.2.1 FLASHJET system pre–determined control parameters shall be in agreement with those included in the individual part set–up parameter matrix. The predetermined controls have been optimized to provide the most effective stripping rates.

5.2.2.2 The dry ice pelletizer feeders shall be set at 40% pellet flow rate, equal to 300 lb/hr per nozzle.

5.2.2.3 The dry ice particle stream nozzle angle is not normally an adjustable parameter. The nozzle angle is set at 21°. The nozzle may require an increase in angle if traversing over a highly curved surface to minimize scatter of the CO_2 pellets outside of the stripping head area.

5.2.3 Performance Requirements

NOTE: These performance requirements have been tested for and been met during the development of acceptable stripping parameters, and require only periodic surveillance.

5.2.3.1 Stripping parameters selected shall not induce mechanical stress damage in parts as evidenced by less than 0.001 inch almen strip deflection when tested with MIL–S–13165 Test Strip N, made from 2024–T3 aluminum alloy, regardless of the number of stripping passes.

5.2.3.2 The proper stripping parameters (CO_2 flow, traverse rate, input voltage, and flash frequency) selected shall control substrate temperatures to less than or equal to 200°F when stripping the topcoat and leaving some amount of primer intact, as evidenced by visual temperature indicator strips (3.3) applied to the backside of the substrate being stripped and/or by use of a temperature laser gun (3.4) directed on the stripped side of the substrate immediately after being exposed to the FLASHJET head.

5.2.4 Stripped Surface Requirements

5.2.4.1 Metallic surfaces shall be stripped so that some degree of primer remains intact. It is not necessary to remove the coating to the bare substrate, as the adhesion between existing primer and new topcoat is excellent. Some stripped surfaces may show blends of remaining primer and topcoat which is acceptable as long as the remaining paint film is smooth. With a remaining paint film, subsequent repaint only requires a tie–coat application of primer followed by a normal application of topcoat, per the applicable paint specification.

5.2.4.1.1 If the paint film is not continuous, clean and treat the substrate per the Engineering drawing and the applicable paint specification prior to painting.

5.2.4.2 Composite surfaces shall be stripped to the primer unless otherwised specified. The appearance will differ from that of the stripped metal surfaces however, in that the resultant stripped surface will show blends of base surface, primer and topcoat. This is acceptable within 7.3.2 provisions.

5.2.4.3 All primer shall be removed if specified on the control documentation.

5.2.5 Post–Stripping Requirements

5.2.5.1 Spot stripping per P.S. 12100 shall be performed if necessary to remove paint from areas where FLASHJET cannot reach.

6. PROCEDURES

6.1 FLASHJET strip organic coatings using equipment (4.1) per the FLASHJET system Operation and Process Control Standard (10.1 Appendix B) and the following:

6.2 FLASHJET SYSTEM SET–UP

6.2.1 Measure the thickness of the surface coating using techniques which are nondestructive to the substrate. On metallic substrates, an eddy current process gives excellent results. On composite substrates, microwave technologies can be used.

6.2.2 Select the FLASHJET pre–determined operating parameters for the specific coatings type and color, and substrate type. These parameters are documented in Section 2 of Report No. 93K0296 (2.1) or the individual part set–up parameter matrix, and consist of the following:

(a) High Voltage Supply Setting – Made with the FLASHJET control computer.

(b) Lamp Control Settings – Includes flash mode, flash frequency, and number of flashes per burst, and are made with the FLASHJET control computer.

(c) Dry Ice Particle Stream Settings – Includes input pressure and flow rate, and are made with the Cold Jet Model 65–200 control panel.

(d) Stripping Head Traverse Rate and Standoff Distance – Traverse rate is made with the FLASHJET control computer, and stripping head standoff distance is controlled by the frame mounted laser sensor assemblies.

6.2.3 Select the correct dry ice particle nozzle setting for the substrate being stripped as specified in 5.2.2.2.

6.3 FLASHJET SYSTEM OPERATION

6.3.1 Select the individual part stripping program to perform and complete the actual coatings removal operation. In the robotic mode, the FLASHJET process is automatic until the selected stripping program is complete.

6.3.2 Monitor sensor feedback and indicators on the cell controller during the process. The FLASHJET system contains a series of interconnected sensing devices/interlocks which ensure personnel safety and prevent damage to the equipment and to the substrates being stripped.

(a) If dry ice particle stream flow is interrupted, the flashlamp control will automatically be placed in a standby mode.

(b) If the pulsed light energy is disrupted, the dry ice delivery system will be placed in a standby mode.

(c) If the effluent collection system vacuum is disrupted, both flashlamp and dry ice delivery systems will be placed in a standby mode to prevent exposure of personnel to harmful effluents.

(d) If the stripping head is not moving within the predetermined rates, the flashlamp will not be allowed to operate in order to prevent substrate damage.

(e) On–line color sensor monitoring determines if the flashlamp is allowed to be fired or is to be placed in the standby mode until the correct color is sensed. When multiple layers of alternate topcoat/primer coatings are being removed, the color vision system can be over ridden by the operator until the desired layer is exposed. Measurement of the coating thickness before and after the first stripping pass will indicate how much paint was removed at a particular power setting and will indicate how many more passes are necessary before the color vision sensor is engaged.

(f) The high voltage power supply/controller has several safety features which will not allow the unit to operate unless all the interlocks are satisfied.

The power supply will not operate if there is any disruption of cooling water flow to the flashlamp, a low water indication in the flashlamp cooling water reservoir, any airflow blockage or disruption of any component cooling system, or any open or unlatched door. The internal capacitors and inductors are automatically discharged upon system shut–down.

(g) The pelletizer hydraulic system will automatically shut down in the event of an over–pressure condition, low fluid level condition, or fluid over–temperature condition.

(h) The pelletizer liquid injection system will automatically shut down in the event of several over–pressure conditions.

6.3.3 If a sensing device has triggered an interruption in the FLASHJET stripping process, identify the cause and provide the appropriate response actions in accordance with the operation and maintenance manual (2.1) to continue the stripping process.

7. QUALITY ASSURANCE PROVISIONS

NOTE: The following policy is applicable only to MDA Companies/Components performing processing in accordance with this Specification.

(a) Quality Assurance Management has the Responsibility, Authority and Accountability (RAA) to ensure the quality requirements of this Specification are met.

(b) Frequency intervals defined in this Specification for "inspection," "test," "witness," "surveillance" and "verification" may be modified at the discretion of Q/A Management based upon:

(1) Implementation of a Process Control Plan

(2) Quality Planning Analysis

(3) Quality Performance

(4) Maturity of the Manufacturing Process Control

(5) Risk Analysis

(c) When utilized, Operator Verification (OV) shall be implemented in accordance with GOP 01.062.

(d) Surveillance Inspection shall be in accordance with QASP 10.116.

(e) Where conflicts exist between controlling documents, defining Q/A policy/inspection, the order of precedence is as follows:

(1) Contract

(2) Build–To–Package

(3) Process Control Plan

(4) GOP 01.062

(5) QASP 10.116

7.1 PROCESS APPROVAL

7.1.1 FLASHJET processing equipment shall be certified per P.S. 23401.

7.1.2 Stripping of coatings by the FLASHJET coating removal process shall be performed by qualified personnel as specified in 5.1.1 and a list of qualified personnel maintained.

7.2 PROCESS CONTROL

7.2.1 Maintain surveillance to assure conformance to the requirements of this Specification regarding personnel, pre–strip masking, FLASHJET system parameter selection and performance.

7.3 ACCEPTANCE INSPECTION

7.3.1 Parts stripped shall be visually inspected to determine:

(a) That the surface conforms to the requirements of 5.2.4.

(b) That the areas stripped have a smooth, clean and uniform surface condition.

(c) That any masked areas of parts have been properly protected from the effects of FLASHJET stripping.

7.3.2 Parts stripped shall be visually inspected to determine that parts are free from distortion, warpage, or other defects, such as broken fibers or resin erosion on non–metallic parts.

8. SAFETY

8.1 RESPONSIBILITY

8.1.1 The enforcement of and adherence to safety regulations and procedures is the responsibility of the supervisory personnel in the department involved. Occupational Safety and Environmental

Health (OSEH) shall monitor MDA areas to ensure proper procedures are available and advise personnel and supervision in the area on procedural compliance and safety practices.

8.1.2 McDonnell Douglas subcontractors will provide their employees with the necessary training, procedures and personal protective equipment to comply with the applicable local and Federal safety requirements.

8.2 CHEMICAL SAFETY

8.2.1 Information on any of the chemicals listed in this Specification may be found in P.S. 20002 or in the Material Safety Data Sheets (MSDS).

8.2.2 Material Safety Data Sheets (MSDS) are required to be furnished by the supplier of the material by OSHA Regulation 29 CFR 1910.1200 HAZARD COMMUNICATION.

8.3 PROCESS SAFETY

8.3.1 Hearing protection (3.5) is required for personnel in the immediate operating area when the FLASHJET system is operating. Either ear plugs or ear muffs are required.

8.3.2 Adequate UV protection is required for personnel who are in the area when the FLASHJET system is operating. Adequate protection includes a long–sleeved shirt or lab coat, sunscreen [3.6(b)] and safety glasses [3.6(a)]. Use sunscreen on exposed skin whenever in close proximity to the quartz lamp. The protective plastic curtain (4.2.1.2) provides UV protection, so that personnel behind the curtain are not at risk.

8.3.3 Warning signs shall be posted in the cell area to caution personnel that hearing protection and UV protection are required.

9. NOTES

9.1 PROCESS RESTRICTIONS – There are no known restrictions preventing FLASHJET coatings removal process application on all aircraft surfaces coatings/substrates other than the process effect on acrylic plastic cabin window material which may be susceptible to crazing , and lenses, rubber, or other items not intended to be stripped.

NOTE: Programs may limit the use of FLASHJET.

9.2 GLOSSARY – The following words/terms are used within this document and are defined here to aid the reader of the text.

(a) Color Sensor – Indicates that the coating color to be removed is present, as directed by operator input from the FLASHJET system set–up matrix.

(b) Effluent – The flowing decomposed coating material.

(c) Flashlamp – A quartz tube filled with xenon gas.

(d) Matrix – A table of numeric values used to optimize system parameters (system set–up numbers).

(e) Motion Sensor – Indicates stripping head movement within a predetermined stripping head rate of travel, as directed by operator input from the FLASHJET system set–up matrix.

(f) Pelletizer – A machine that makes CO_2 pellets.

(g) Proximity Sensor – Indicates that proper focal stand–off has been achieved and the effluent collection shroud is in proper position.

(h) Pyrolysis – Thermal degradation and decomposition of substance.

(i) Qualification or Certification – The process of determining whether a person is capable of performing an identified task at a skill level which is acceptable to MDA–St. Louis.

(j) Qualified Personnel – A person who has demonstrated by passing written and/or performance evaluation test(s) that the person has the skills and job knowledge to perform in accordance with MDA–St. Louis standards.

(k) Scrubber – An activated charcoal filter to trap hazardous vapors.

(l) Sniffer – A detector used to determine when scrubber filters are full and need to be changed.

(m) Substrate – Underlying layer of material.

(n) Trained Personnel – A person who has successfully completed a course of classroom or on–the–job training in a specific task or operation.

(o) Xenon Gas – A colorless gas that radiates heat when electrically energized

9.3 Vendors or subcontractors needing a copy of this Specification should direct their request for copies to the attention of Purchasing or Subcontracting, as applicable. Information pertaining to the technical aspects of this Specification can be obtained from MDA–St. Louis Material and Process Department.

10. REFERENCE PUBLICATIONS

10.1 Douglas Process Standard DPS 9.316 – Stripping of Organic Coatings

10.2 Douglas Aircraft Company Customer Service Document (CSD) No. 7 – Paint Stripping Using Xenon Flashlamp/CO_2 Pellet Paint Removal Process (FLASHJET)

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