BOMBARDIER

Toronto Site

PROPRIETARY INFORMATION

PPS 31.04

PRODUCTION PROCESS STANDARD

DEGREASING PROCESSES

Issue 27
- This standard supersedes PPS 31.04, Issue 26.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS related questions to christie.chung@aero.bombardier.com or (416) 375-7641.
- This PPS is effective as of the distribution date.

Prepared By:	(Christie Chung)	November 21, 2017
	Core Methods, PPS Group	
Approved By:	(Stephen Mabee)	November 21, 2017
	Materials Technology	
	(Davor Filipovic)	November 22, 2017
	Quality	

TABLE OF CONTENTS

Sections **Page**

1 SCOPE 3
2 HAZARDOUS MATERIALS. 3
3 REFERENCES 3
4 MATERIALS AND EQUIPMENT 4
4.1 Materials 4
4.2 Equipment 4
5 PROCEDURE 5
5.1 General 5
5.2 Preparation and Operation of Vapour Degreasing Units 6
5.3 Vapour Degreasing Parts 7
5.4 Preparation of the Aqueous Degreasing Tank 7
5.5 Aqueous Degreasing Parts. 8
6 REQUIREMENTS 9
7 BOMBARDIER TORONTO SAFETY PRECAUTIONS 9
8 PERSONNEL REQUIREMENTS 10
9 MAINTENANCE OF EQUIPMENT AND SOLUTIONS 10
9.1 Maintenance of Vapour Degreasing Unit 10
9.2 Maintenance of Aqueous Degreaser Solutions 12

Tables

TABLE I - MAKE-UP OF AQUEOUS DEGREASING SOLUTION 8
TABLE II - ACID ACCEPTANCE VALUE TEST AND ACTION 11
TABLE III - CONTROL OF SOLUTIONS 13

Figures

FIGURE 1 - VAPOUR DEGREASER UNIT 5

1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for aqueous and vapour degreasing of aircraft parts and assemblies.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS shall be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.

1.1.2 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

1.1.3 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. do not supersede the procedure or requirements specified in this PPS.

2 HAZARDOUS MATERIALS

2.1 Before receipt at Bombardier Toronto, all materials shall be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact the Bombardier Toronto Environment, Health and Safety Department.

3 REFERENCES

3.1 EHS-OP-005 - Hazardous Materials Management - *Bombardier Toronto internal operating procedure*.

3.2 EHS-OP-009 - Confined Spaces - *Bombardier Toronto internal operating procedure*.

3.3 PPS 6.10 - Cleaning of Fluid System Components.

3.4 PPS 13.26 - General Subcontractor Provisions.

3.5 PPS 31.09 - Cleaning of Titanium and Titanium Alloys.

3.6 PPS 31.17 - Solvent Usage.

4 MATERIALS AND EQUIPMENT

4.1 Materials

4.1.1 Vapour degreaser:

- Leksol (n-Propyl Bromide), Amity UK Ltd.
  - Stabilizer, Lekstab, Amity UK Ltd.
  - Leksol pH Buffer, Amity UK Ltd.
- Vertrel SDG Specialty Fluid, Dupont.

4.1.2 Emulsion cleaners (aqueous degreasers):

- Brulin 815GD, the Brulin Company.
- Brulin 815GD-NF, the Brulin Company.
- Daraclean 212, W.R. Grace and Company.

4.1.3 Klenedraw W-4100 oil, Tower Oil and Technology Co.

4.2 Equipment

4.2.1 Emulsion tank, stainless steel equipped with heating, mechanical or air agitation and filtration equipment.

4.2.2 Rinse tank, stainless steel equipped with agitation or spray nozzles and heating equipment with an overflow to allow circulation of clean rinse water.

4.2.3 Forced air drying chamber.

4.2.4 Vapour phase degreasing unit equipped with a spray lance. Do not use degreasing units that are not equipped with spray lances unless they are capable of processing parts, including those with internal bores, to the specified cleanliness requirements. Refer to Figure 1 for a general description of a typical vapour phase degreasing unit.

4.2.5 Racks and baskets for supporting parts in cleaning solution. Racks shall have at least a 2 point pick-up for effective handling through all stages of cleaning. Baskets shall be capable of closing and rotating in the solution.

4.2.6 Overhead lifting equipment or internal elevator used for raising and lowering parts into the degreaser.

4.2.7 Stainless steel wire brush (e.g., Gordon Brush #15).

4.2.8 Scotch-Brite pads, Type A Fine, 3M Canada Limited.

4.2.9 Cotton gloves (e.g., DSC 422-1).

4.2.10 Neoprene or nitrile gloves (e.g., DSC 422-5 or DSC 422-8).

4.2.11 Bombardier approved protective goggles.

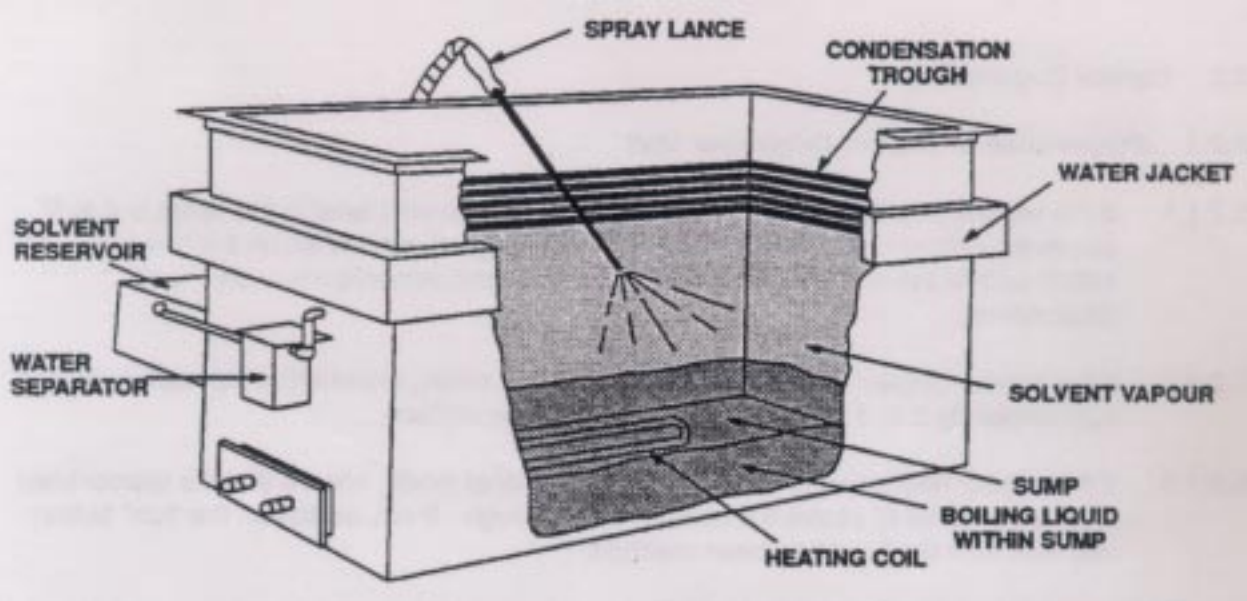

FIGURE 1 - VAPOUR DEGREASER UNIT

5 PROCEDURE

5.1 General

5.1.1 The vapour degreasing process involves the suspension of parts in a tank containing organic solvent vapour to remove oil, grease and other contaminants from the surface of the parts.

5.1.2 The aqueous degreasing process involves the immersion of parts in a tank containing a water-based emulsion solution which is generally heated and agitated to remove oil, grease and other contaminants from the surface of the parts.

5.1.3 Take care to prevent contamination of the degreaser tanks with metal chips, acid or soaps.

5.1.4 Wear clean cotton gloves when handling cleaned parts.

5.1.5 Clean oxygen lines according to PPS 6.10.

5.1.6 Vapour degrease titanium alloy parts **only** if necessary to remove petroleum based contaminants. If it is possible that vapour degreased titanium alloy parts will be subjected to temperatures above 550°F during subsequent processing, parts shall be cleaned according to PPS 31.09 immediately after degreasing.

5.1.7 Do not aqueous or vapour degrease the following parts:

- non-metallic materials
- chain assemblies
- assemblies containing oil impregnated bushings or bearings (unless such bushings are masked to prevent vapour from contacting the oil impregnated surfaces)
- cables and cable assemblies
- painted parts (unless the parts have been F19 primed and the engineering drawing or PPS specifies vapour or aqueous degreasing of these parts)

5.1.8 Do not aqueous degrease the following parts:

- anodized surfaces
- conversion coated aluminum
- electroplated surfaces
- metallic honeycomb core

5.1.9 Do not aqueous degrease or solvent clean the following parts:

- oxygen system tubing
- faying or sealed surfaces, or other parts having the potential to entrap liquid

5.1.10 Except as otherwise specified in section 5.1, in place of vapour or aqueous degreasing, it is acceptable to manually solvent clean according to PPS 31.17.

5.2 Preparation and Operation of Vapour Degreasing Units

5.2.1 If the vapour degreaser unit is off, ensure that the solvent level in the sump is 4" to 5" above the heater coil (up to the level of the grating). If not, switch on the “manual refill” button and fill the sump to the appropriate level and immediately notify Plant Engineering.

5.2.2 If the vapour degreaser is on and in the stand-by mode, ensure that the vapour level is approximately 2 to 3 feet above the liquid solvent surface.

5.2.3 If the vapour degreaser is on and in the operational mode, ensure that the vapour level is approximately 8" above the condensation trough. If not, switch on the “run” button and wait until the level has been reached.

5.2.4 The sump temperature shall be maintained at 158°F to 163°F for Leksol or 107°F to 120°F for Vertrel SDG solvent. If the solvent temperature range cannot be maintained, suspend the degreasing process and take corrective actions according to paragraph 9.1.2.1 prior to processing production parts.

5.2.5 Keep vapour degreaser units covered when not in use.

5.3 Vapour Degreasing Parts

5.3.1 Vapour degrease parts as follows:

Step 1. Ensure that all parts, racks, baskets, etc. are completely water free before placing them into the degreaser. Load parts in baskets or suspend them from racks in a position that promotes solvent drainage without entrapment in recesses or pockets. If the parts are tubular, rack them vertically.

Step 2. Ensure that the vapour level is approximately 8" above the condensation trough.

Step 3. Open degreaser cover and lower parts into the degreaser so that all parts are below the vapour line. Raise or lower parts at a maximum speed of 11 ft/min.

Step 4. Allow the load to remain in the degreaser until fluid condensation on the part surfaces stops.

Step 5. If necessary, spray rinse with warm solvent using the spray lance. Rinse the bores of tubular parts and the insides of formed parts with solvent. Always hold the tip of the spray lance below the vapour line when rinsing parts.

Step 6. Leave the parts in the degreaser until fluid condensation again stops indicating that the vapour cleaning cycle is completed.

Step 7. Raise the parts and allow them to drain while suspended well above the solvent vapour but within the degreaser tank (i.e., in the “freeboard” zone) until no solvent remains on the parts. Take care to prevent the escape of vapour from the parts into the work area.

Step 8. Cover vapour degreaser unit when not in use.

5.3.2 If there is evidence that the parts have not been properly cleaned following degreasing, suspend the degreasing process and take corrective actions prior to further processing production parts.

5.4 Preparation of the Aqueous Degreasing Tank

5.4.1 Prepare the cleaning solution as follows:

Step 1. Fill the tank with de-ionized water to 3/4 of the operating level.

Step 2. Add emulsion degreaser to the water in the tank according to Table I.

Step 3. Fill the tank up to the operating level with de-ionized water.

Step 4. Agitate the cleaning solution in the immersion tank.

TABLE I - MAKE-UP OF AQUEOUS DEGREASING SOLUTION

Solution	Tank Material	Bath Composition		Operating Temperature
		Chemicals (Note 1)	Water	
Brulin 815GD	Stainless steel with mechanical or air agitation and bag filtration for removal of contaminants during solution recycling	15% Brulin 815GD by volume	De-ionized	150 ± 5°F
Brulin 815GD-NF		10% Brulin 815GD-NF by volume	De-ionized	145 ± 5°F
Daraclean 212		10% Daraclean 212 by volume	De-ionized	125 ± 5°F

Note 1. It is acceptable for subcontractors to deviate from the specified make-up of solutions provided that the control requirements of Table III are met.

5.5 Aqueous Degreasing Parts

5.5.1 Ensure that all potential liquid collecting ducts or vents are capped or plugged before immersion to prevent entrapment of emulsion solution.

5.5.2 Rack or position the parts to prevent damage. Ensure good solution contact with all part surfaces. Minimize part contact with the rack and facilitate drainage of solution from parts.

5.5.3 Clean parts in the aqueous degreasing tank as follows:

Step 1. Place the parts on racks or in baskets in a position that provides free solution circulation to all parts surfaces. Rack parts having deep recesses or bores in a position that ensures proper solution drainage. Enclose and rotate baskets containing large numbers of small parts.

Step 2. Immerse the parts in the agitated emulsion solution for 5 to 20 minutes.

Step 3. Remove the parts from the cleaning solution. Allow the parts to drain above the immersion tank for approximately 30 seconds. Do not allow the emulsion solution to dry on the surfaces.

Step 4. Immerse the parts in an agitated tap water rinse (60°F to 130°F) for 5 minutes.

Step 5. If the parts are to be processed by another chemical operation (e.g., alkaline cleaning), do not allow the parts to dry after rinsing but continue with subsequent chemical processing immediately after rinsing.

Step 6. If no further wet processing follows degreasing, dry the parts in a forced air drying chamber. Ensure that the cleaned surfaces are kept free from all contamination.

6 REQUIREMENTS

6.1 Part surfaces shall be free from oil, grease and other contaminants after degreasing. However, a water break-free surface is not required.

7 BOMBARDIER TORONTO SAFETY PRECAUTIONS

7.1 The safety precautions specified herein are specific to Bombardier Toronto to meet Canadian Federal and Provincial government environmental, health and safety regulations. It is strongly recommended that subcontractors consider these safety precautions; however, subcontractors are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.

7.2 Observe standard plant safety precautions when performing the procedure specified herein.

7.3 Wear protective DSC 422-5 neoprene or DSC 422-8 nitrile gloves and protective goggles when degreasing.

7.4 Ensure that adequate ventilation is supplied to the immediate vicinity of all degreaser units.

7.5 Avoid skin contact with solvent. If skin contact occurs, wash the affected area thoroughly with soap and water.

7.6 Avoid ingestion of any of the material specified herein. Wash hands before smoking or eating. If ingestion occurs, obtain immediate medical attention and contact the Health Centre.

7.7 Do not use the vapour degreaser, aqueous degreaser tank or tap water rinse tanks for heating or cooling food or drink.

7.8 Do not smoke near degreaser units as the solvent fumes are highly toxic if inhaled through burning tobacco.

7.9 Remove all solvent liquid and vapour from a degreasing unit when servicing the tank interior. Wear apron, boots, gloves and respirator when working inside a degreaser tank.

7.10 When shutting down vapour degreasing equipment, in order to prevent solvent vapour from escaping the tank, ensure that the solvent temperature has dropped 10°F below the solvent vaporization temperature (i.e., 97°F for Vertrel SDG solvent) before turning off the cooling system which ensures vapour condensation in the upper area of the vapour degreasing tank.

7.11 Refer to PPS 31.17 for the safety precautions for handling and using solvents.

8 PERSONNEL REQUIREMENTS

8.1 Personnel responsible for degreasing processes shall have a good working knowledge of the applicable procedure and requirements as specified herein and shall have exhibited their competency to their supervisor.

9 MAINTENANCE OF EQUIPMENT AND SOLUTIONS

9.1 Maintenance of Vapour Degreasing Unit

9.1.1 General

9.1.1.1 It is recommended that the water separator be checked weekly, or more frequently if there is evidence of water contamination (white vapour or fog) of the solvent. If the solvent bath is contaminated, drain the water separator.

9.1.2 Leksol

9.1.2.1 If using Leksol as the vapour degreaser, perform a daily temperature check to ensure the temperature is between 158°F to 163°F. If the temperature is below 158°F or between 163°F to 170°F, investigate and take corrective action prior to processing production parts (i.e., rejuvenate a portion of the old solution with new Leksol solution). Re-analyse the solution within 24 hours of any adjustment. If the temperature is above 170°F, then this indicates that the level of oils and grease dissolved in the solvent has reached a level at which the solvent needs to be replaced with a new solution. Suspend the process and clean out the vapour degreaser and replenish with new Leksol solvent prior to processing production parts.

9.1.2.2 If using Leksol as the vapour degreaser, perform a weekly pH check to ensure the pH is between 5.5 to 7.5. If the pH value falls below 5.0 (Note: Do not allow the solution pH to fall below 4.5), add Leksol pH Buffer solution at a rate of approximately 1 mL per 50 L of Leksol solvent. It is recommended to dilute the Leksol pH Buffer solution in a small amount of Leksol solvent prior to the addition to the vapour degreasing unit as this may improve the distribution effect. Allow the pH to stabilize prior to any additional adjustments. Re-analyse the solution within 24 hours of any adjustment. If after the second adjustment, the pH is not between 5.5 to 7.5, suspend the process and take corrective actions prior to processing production parts.

9.1.2.2.1 Always perform any Lekstab Stabilizer addition as required according to the acid acceptance testing results as specified in paragraph 9.1.2.3 prior to checking and adjusting the pH value.

9.1.2.3 Once a week, obtain a sample of solvent from the vapour degreaser and the distillation unit and perform an acid acceptance test and action as follows according to the outcome.

TABLE II - ACID ACCEPTANCE VALUE TEST AND ACTION

SOLVENT	ACID ACCEPTANCE VALUE (%)	ACTION REQUIRED
Leksol	> 0.40	New Leksol solution - No action required.
	0.08 to 0.40	Normal Operating Range - No action required.
	0.04 to 0.08	Low value - Top up with fresh Leksol or add Lekstab stabilizer (Note 1). Daily sampling required (action accordingly) and records shall be kept readily available.
	< 0.04	Dangerously low - Replace immediately with new Leksol.
Note 1. Lekstab Stabilizer should be diluted 3:1 with Leksol, as applicable, before adding to the reservoir. This is important because if the Lekstab is added directly to the vapour degreaser without prior dilution it might just float to the top of the solvent and not go into solution due to its much lower specific gravity compared to Leksol solvent.		

9.1.3 Vertrel SDG Specialty Fluid

9.1.3.1 If using Vertrel as the vapour degreaser, perform a daily temperature check to ensure the temperature is between 107°F to 120°F. If the temperature is below 107°F or between 115°F to 120°F, investigate and take corrective action prior to processing production parts (i.e., rejuvenate a portion of the old solution with new Vertrel solution). Re-analyse the solution within 24 hours of any adjustment. If the temperature is above 120°F, then this indicates that the level of oils and grease dissolved in the solvent has reached a level at which the solvent needs to be replaced with a new solution. Suspend the process and clean out the vapour degreaser (at Bombardier Toronto, clean out vapour degreaser according to section 9.1.4) and replenish with new Vertrel solvent prior to processing production parts.

9.1.4 Bombardier Toronto Maintenance

9.1.5 Drain the water separator and/or clean the vapour degreaser unit as follows:

Step 1. Close the solvent return shut-off valve from the reservoir to the sump.

Step 2. Distill the used solvent present within the degreaser by boiling the material in the sump and collecting the distillate in a separate receiver. Distill the solvent from the tank until the solvent level is approximately 1" above the heating coil.

WARNING: Do not allow the degreaser sump fluid to fall below the level of the heating coils or severe damage may result.

Step 3. Turn off the source of heat to the degreaser and allow to cool.

Step 4. Drain the degreaser of remaining solvent and residue and discard, not forgetting liquid held in the water separator and auxiliary piping (e.g., according to EHS-OP-005).

Step 5. If the solvent needs to be replaced, dispose of the solvent in the tank (e.g., according to EHS-OP-005).

Step 6. Vent the inside of the degreaser and if applicable, the degreaser pit to remove solvent vapour before cleaning the degreaser sump.

Step 7. Clean all remaining residue and sludge from the sump and the heating coil. If necessary, brush the heating coil with a stainless steel wire brush and rinse with solvent.

WARNING: Sludge removal should be done externally. It is highly dangerous to enter a degreaser containing sludge/residue. At no time should any operator enter a vapour degreaser without full protection and proper supervision (e.g., according to EHS-OP-009).

Step 8. Dry the tank interior and re-assemble all parts, fittings and gaskets. Ensure the tank is fully ventilated to remove residual solvent.

Step 9. Open the solvent return shut-off valve to allow the distilled solvent to return to the sump and top up the degreaser to operating level with fresh solvent.

9.2 Maintenance of Aqueous Degreaser Solutions

9.2.1 Analyze samples of the emulsion cleaning solution and rinse water according to Table III.

9.2.2 Maintain the operating temperature of the aqueous degreasing solution according to Table I.

9.2.3 If the emulsion cleaning solution or rinse water fail to meet the requirements specified in Table III, suspend the aqueous degreasing process until the solution has been re-adjusted to meet these requirements. Re-analyze the solution within 24 hours of any adjustment.

9.2.4 Maintain records of the solution tests.

9.2.5 At least once a week, the aqueous degreaser solution shall be checked for cleaning ability and corrosion inhibitor performance. If a history of weekly checks indicate adequate cleaning ability and corrosion inhibitor performance for 12 consecutive weeks, it is acceptable to extend the check frequency to at least once every month; however, in the event of inadequate cleaning ability or inadequate corrosion inhibitor performance thereafter, checks shall once again be performed weekly until confidence has been restored as specified above. Check the aqueous bath solution cleaning ability and corrosion inhibitor performance as follows:

Step 1. Apply Klenedraw W-4100 oil to one side of a 3" x 6" 7075 aluminum alloy panel.

Step 2. Lightly abrade the other side of the panel with a Scotch-Brite pad.

Step 3. Immerse the panel into the aqueous tank for a minimum of 5 minutes.

Step 4. Immerse and rinse the panel in an agitated tap water rinse (60°F - 130°F) for 5 minutes.

Step 5. Check the panel to ensure that the Klenedraw W-4100 oil has been completely removed from the panel.

Step 6. Check the abraded side of the panel for pitting which results if the corrosion inhibitor in the tank is low.

Step 7. If the panel is not clean or shows signs of pitting, suspend the aqueous degreasing process and take appropriate corrective action.

TABLE III - CONTROL OF SOLUTIONS

SOLUTION	SOLUTION COMPONENT	CONTROL LIMITS		ANALYSIS FREQUENCY
		CONCENTRATION	pH	
Aqueous Degreaser	Brulin 815GD	8 - 20% by volume	—	Monthly
	Brulin 815GD-NF	5 - 30% by volume	—	
	Daraclean 212	8 - 20% by volume	—	
De-ionized water for initial make-up	Total Dissolved Solids	12 ppm maximum	5.0 to 8.0	
Tap water rinse	Total Dissolved Solids	350 ppm maximum	4.5 to 8.0	