BOMBARDIER
Toronto Site
PROPRIETARY INFORMATION

PPS 31.03

PRODUCTION PROCESS STANDARD

CLEANING OF CARBON AND LOW ALLOY STEELS

Issue 18
- This standard supersedes PPS 31.03, Issue 17.
- 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.

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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for cleaning carbon and low alloy steel parts.

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. Similarly, the procedure and requirements specified in this PPS are not applicable when use of a BAPS, MPS, LES or P. Spec. is specified.

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 BAERD GEN-018 - Engineering Requirements for Laboratories.

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

3.3 PPS 13.13 - Personal Protective Respiratory Equipment.

3.4 PPS 13.26 - General Subcontractor Provisions.

3.5 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.6 PPS 16.20 - Temporary Corrosion Protection of Carbon and Low Alloy Steel Parts.

3.7 PPS 17.02 - Abrasive Blasting.

3.8 PPS 24.01 - Aluminum Wire Spray Coating (M1).

3.9 PPS 24.02 - Ion Vapour Deposited Aluminum Coatings (M2).

3.10 PPS 27.06 - Decorative Surface Finishes.

3.11 PPS 30.04 - Steel Heat Treatment - Carbon and Low Alloy Steels.

3.12 PPS 31.02 - Cleaning Processes for Aluminum and Aluminum Alloys.

3.13 PPS 31.04 - Degreasing Processes.

3.14 PPS 31.07 - Cleaning and Stripping of Painted Surfaces.

3.15 PPS 31.11 - Vapour Blast Cleaning.

3.16 PPS 31.17 - Solvent Usage.

3.17 PPS 33.02 - Removal of Metallic Coatings.

3.18 QDI-09-02 - Process Control - *Bombardier Toronto internal Quality procedure.*

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials

4.1.1 Acid cleaning solutions as specified in Table I.

4.1.2 Solvents as specified in PPS 31.17.

4.1.3 Steel wire wheel or brush, non-stainless steel (not previously used on corrosion resistant steel).

4.1.4 Steel wool, commercial type.

4.1.5 Abrasive paper or cloth, aluminum oxide, 180 - 220 grit.

4.2 Equipment

4.2.1 Bombardier approved safety chemical splash goggles.

4.2.2 Rubber gloves, boots and aprons.

4.2.3 Lint-free cotton gloves (e.g., DSC 422-1).

4.2.4 Immersion tanks for water rinse, alkaline cleaners and acid cleaners as listed in Table I. Immersion tanks shall be resistant to the chemicals and to the operating temperatures used (e.g., rubber or lead lined steel tank for Chloroclean 6156; lined carbon steel or acid resistant CRES for Turco acid cleaners). Tanks shall be equipped with temperature indicating, regulating and recording devices capable of controlling the chemical solution temperatures within ± 5°F and equipped with mechanical or air agitation.

4.2.5 Protective wrapping (e.g., Kraft paper).

4.3 Facilities

4.3.1 This PPS has been categorized as a Controlled Special Process according to PPS 13.39 and as such only facilities specifically approved according to PPS 13.39 are authorized to perform cleaning carbon and low alloy steel parts according to this PPS.

4.3.2 Bombardier subcontractors shall direct requests for approval to Bombardier Aerospace Supplier Quality Management. Bombardier Aerospace facilities shall direct requests for approval to the appropriate internal Quality Manager.

4.3.3 Facility approval shall be based on a facility report, a facility survey and completion of a qualification test program, if required. The facility report shall detail the materials and equipment to be used, the process sequence to be followed and the laboratory facilities used to show compliance with the requirements of this PPS. Any deviation from the procedure or requirements of this PPS shall be detailed in the facility report. Based upon the facility report, Bombardier Toronto Engineering may identify additional qualification and/or process control test requirements. During the facility survey, the facility requesting qualification shall be prepared to demonstrate their capability. Once approved, no changes to subcontractor facilities may be made without prior written approval from Bombardier Aerospace Supplier Quality Management.

4.3.3.1 For approval of subcontractor facilities to perform cleaning carbon and low alloy steel parts according to this PPS, completion of a test program and submission of suitable test samples representative of production parts may be required. Test samples shall meet the requirements specified by Bombardier Toronto Engineering.

4.3.3.2 All testing and evaluation specified herein shall only be performed by Bombardier Toronto Materials Laboratory or by laboratories accredited according to BAERD GEN-018.

5 PROCEDURE

5.1 Preparation of Solutions

5.1.1 Make-up and operate solution baths according to Table I.

TABLE I - SOLUTION MAKE-UP

BATH TYPE (NOTES 1 & 2)	BATH MAKE-UP	OPERATING TEMPERATURE
ALKALINE CLEANING SOLUTIONS		
Turco 4215 NC-LT	According to PPS 31.02	
ACID CLEANING SOLUTIONS		
Chloroclean 6156 (Brenntag Ltd.)	Step 1. Half fill the tank with tap water (Note 3). Step 2. Fill the tank to the operating level with Chloroclean 6156.	61 to 90°F
Turco #4409	Step 1. Half fill the tank with tap water (Note 3). Step 2. Fill the tank to the operating level with Turco #4409.	68 to 86°F
Turco #4368	Mix 1 part Turco #4368 to 8 parts tap water (Note 3).	61 to 140°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.
Note 2. Refer to paragraph 4.2.4 for tank requirements.
Note 3. Tap water shall not exceed a total solid requirement of 500 ppm.

5.2 In-Process Cleaning

5.2.1 Except as noted in paragraph 5.2.1.1, in-process cleaning of carbon and low alloy steels during fabrication consists of solvent cleaning according to PPS 31.17 or degreasing according to PPS 31.04 (See Flow Chart 1).

5.2.1.1 Before welding or brazing, abrasive blast clean parts according to PPS 17.02 or mechanically clean locally, in the areas to be welded or brazed, using a steel wire wheel, steel wool or abrasive paper to remove scale, oxide or rust. If surface finish requirements or close tolerances shall be adhered to, use glass bead media for abrasive blast cleaning.

5.3 Final Cleaning

5.3.1 Refer to Table II for the final cleaning method to use after fabrication and before the application of surface treatments such as plating, metallizing, phosphating and dry film lubricant.

TABLE II - FINAL CLEANING METHODS

MANUFACTURING OPERATION	FINAL CLEANING PROCEDURE
Parts having a final heat treated tensile strength range of 180 - 200 ksi that have been machined, cold formed, cold straightened or ground in the finish temper condition.	Stress relieve parts according to PPS 30.04 and then acid clean according to Flow Chart 3.
Parts having a final heat treated tensile strength range of 200 - 220 ksi or greater	Mechanically clean according to Flow Chart 4. Do not acid clean these parts.
After welding or brazing	Remove flux from parts by immersing in hot water (140 - 212°F) for a minimum of 10 minutes. Remove adhering particles by scrubbing with a nylon bristle brush.
Dry film lubricant coating (except manganese phosphate treated parts)	Vapour blast according to PPS 31.11.
Manganese phosphate treated parts	Degrease according to PPS 31.04.
Aluminum coating according to PPS 24.01 (M1)	Clean according to PPS 24.01.
IVD aluminum coating according to PPS 24.02 (M2)	Clean according to PPS 24.02.
Decorative surface finished parts contaminated with oil or grease.	Degrease according to PPS 31.04 or solvent clean according to PPS 31.17.
Before plating	Step 1. Degrease according to PPS 31.04 or solvent clean according to PPS 31.17. Step 2. Abrasive blast according to PPS 17.02. Step 3. Alkaline clean according to Flow Chart 2.
All other parts	Mechanically clean using steel wire brushes, steel wool or abrasive paper or cloth to remove localized discolouration or heat treat scale, followed by acid cleaning, if necessary, according to Flow Chart 3. OR Abrasive blast using aluminum oxide or glass beads according to PPS 17.02. Do not abrasive blast clean close tolerance machined parts using steel or cast iron grit abrasive media. OR Vapour blast clean according to PPS 31.11.

5.4 Stripping of Damaged or Defective Coating or Plating

5.4.1 Strip primer or paint (lacquer, epoxy or polyurethane) according to PPS 31.07.

5.4.2 Strip plating and metallic coatings according to PPS 33.02.

5.4.3 If necessary, strip manganese phosphate coated parts by acid cleaning according to Flow Chart 3.

5.5 Embrittlement Relief

5.5.1 Except as noted in paragraph 5.5.1.1, after acid cleaning, embrittlement relieve parts with a tensile strength range of 150 - 170 ksi or greater according to PPS 30.04 within 4 hours of cleaning.

5.5.1.1 If acid cleaning forms part of a plating operation and is immediately followed by plating, then embrittlement relief is not required after acid cleaning, except for parts such as coil springs that are stressed during plating.

5.6 Handling of Cleaned Parts

5.6.1 Always wear clean gloves when handling cleaned parts.

5.6.2 Ensure that the delay between cleaning and further processing is kept to a minimum. Wrap or interlace parts with Kraft paper to protect them from contamination. Protect decorative surface finished parts according to PPS 27.06 to prevent damage to the finished surfaces.

5.6.3 Except as noted in paragraph 5.6.3.1, protect parts that have been final cleaned and are to be placed in storage for a long period of time (i.e., 6 months or greater) or to be transported to a subcontractor for further processing, by coating with oil according to PPS 16.20.

5.6.3.1 Do not treat parts that are to be ion vapour (IVD) coated according to PPS 24.02 with oil. Wrap these parts in clean Kraft paper for protection against contamination or damage.

6 REQUIREMENTS

6.1 For the purposes of this PPS, the term “MRB” (Material Review Board) shall be considered to include Bombardier Toronto MRB and Bombardier Toronto delegated MRB.

6.2 After final fabrication operation and final cleaning as specified herein, all part surfaces shall be clean and exhibit a uniform surface appearance.

6.3 Evidence of scale, oxide or residual abrasive cleaning materials are cause to reject and re-clean the parts according to section 5.3.

6.4 Evidence of pitting, etching or surface erosion resulting from abrasive cleaning are cause to reject and refer such parts to MRB for disposition.

7 SAFETY PRECAUTIONS

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

7.2 Do not keep, handle, or eat food in the vicinity of chemical baths.

7.3 Do not use baths, including water baths, for heating or cooling food or drink.

7.4 Avoid ingestion of any of the materials specified herein. If ingestion occurs, obtain immediate medical attention.

7.5 Wash hands thoroughly after working with chemical baths.

7.6 Do not keep street clothes in the vicinity of chemical baths.

7.7 Wear rubber gloves, boots and aprons when operating chemical baths.

7.8 Avoid skin contact with chemical solutions. If skin contact occurs, wash the affected area with large quantities of clean water. If skin irritation occurs, immediately contact the Health Centre.

7.9 Operators who have any broken skin or open wounds on hands or wrists shall not work with chemical baths.

7.10 Wear safety glasses when working with the materials specified herein. Avoid eye contact with chemicals or solutions. If eye contact occurs, immediately flush eyes in a directed stream of water for at least 15 minutes while forcibly holding eyelids apart to ensure completed irrigation of all eye and lid tissue. Contact the Health Centre and a physician.

7.11 Ensure that sufficient ventilation is provided when using the chemical solutions specified herein. Consult the Health and Safety Department for the threshold limit values.

7.12 Operators shall wear protective respiratory equipment according to PPS 13.13 when operating chemical baths.

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

8 PERSONNEL REQUIREMENTS

8.1 This PPS has been categorized as a Controlled Special Process according to PPS 13.39. Refer to PPS 13.39 for personnel requirements.

9 MAINTENANCE OF SOLUTIONS

9.1 A sample of the alkaline and acid cleaning baths shall be tested at the analysis frequency specified in Table III by the Bombardier Toronto Materials Laboratory or a Bombardier approved laboratory. Thoroughly mix the solutions before sampling. Maintain records of the solution tests (e.g., according to QDI-09-02).

9.2 If solutions fail to meet the requirements specified in Table III, suspend the applicable process (i.e., alkaline cleaning or acid cleaning) until the solution has been re-adjusted to meet these requirements. Re-analyse the solution within 24 hours of any adjustment.

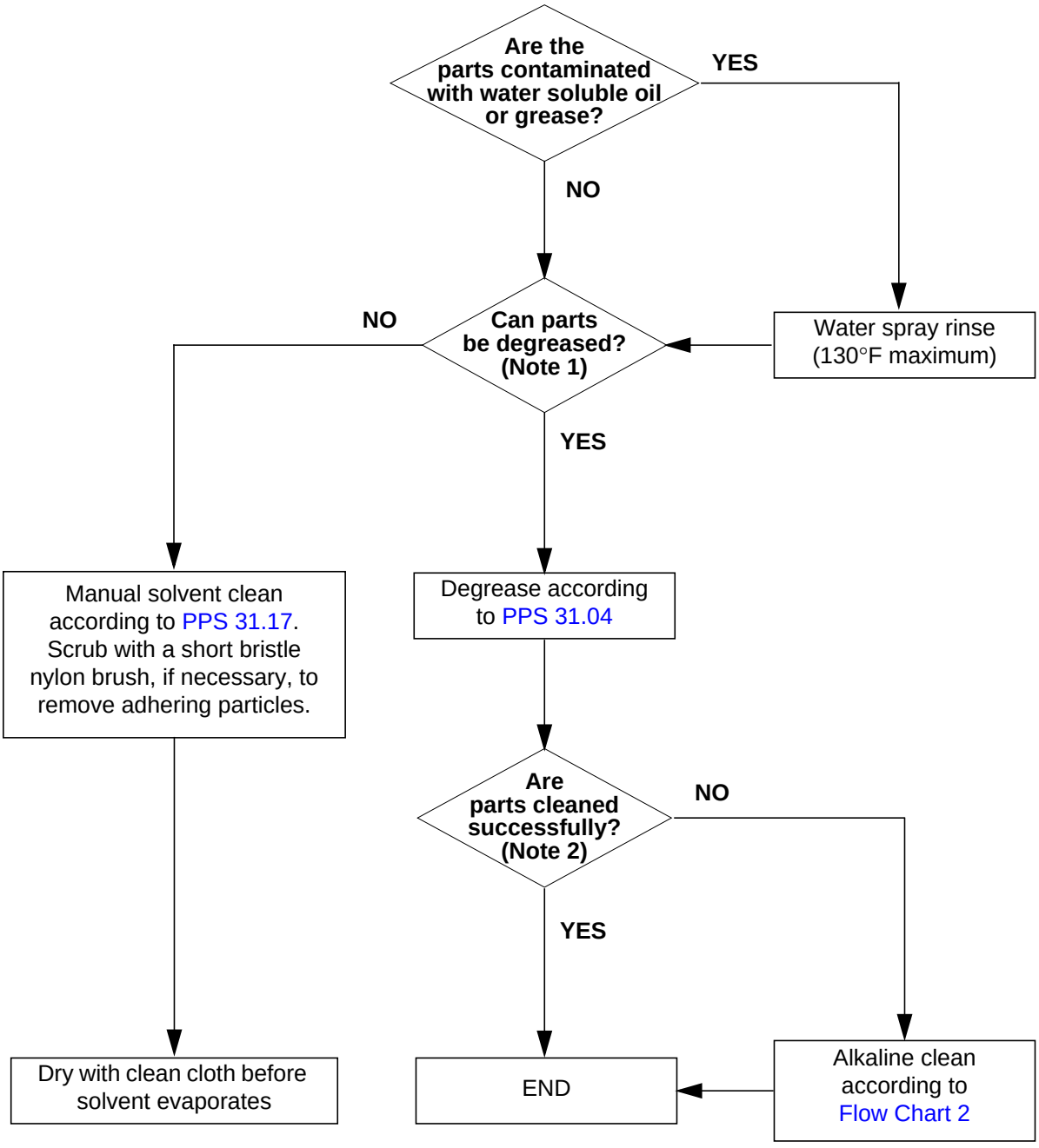
9.3 Drain, flush and replenish the tank according to Table I when the effectiveness of the bath is reduced, as evidenced by the presence of smut on clean parts when wiped lightly. If necessary, dispose of chemical solutions according to EHS-OP-005.

TABLE III - CONTROL OF SOLUTIONS

SOLUTION	SOLUTION COMPONENT	CONCENTRATION CONTROL LIMITS	ANALYSIS FREQUENCY (Note 1)	
			STANDARD	EXTENDED
ALKALINE CLEANING SOLUTIONS				
Turco 4215 NC-LT	Turco 4215 NC-LT	According to PPS 31.02		
	Turco 4215 additive			
ACID CLEANING SOLUTIONS				
Chloroclean 6156	Chloroclean 6156	50 ± 5% by volume	Weekly	Monthly
Turco #4409	Turco #4409	50 ± 5% by volume		
Turco #4368	Turco #4368	11 ± 2% by volume		

Note 1. If, over a 12 month period, it can be demonstrated (through SPC charts, etc.) that the concentration of the applicable solution component is well within the requirements specified, then the analysis frequency may be reduced from “standard” to “extended”. However, in the event that the solution component analysis fails the requirements specified, revert back to the “standard” analysis frequency until a controlled process can again be demonstrated.

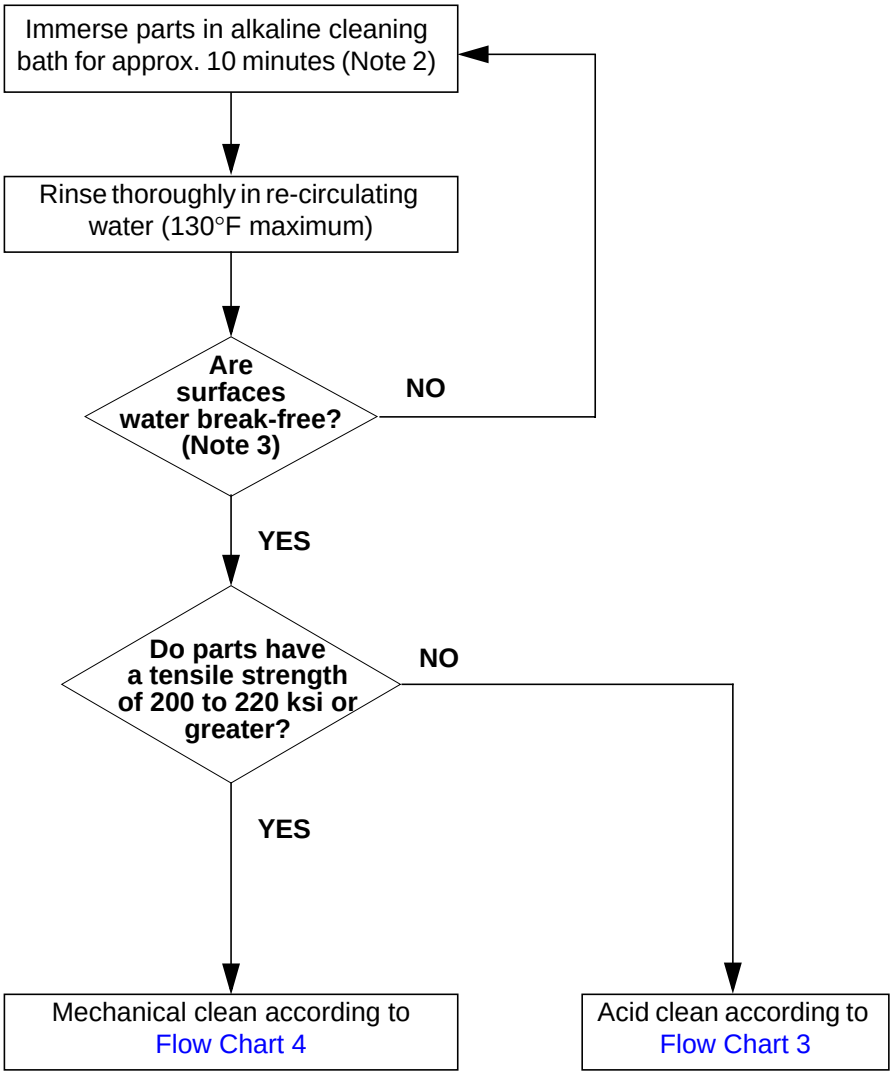
FLOW CHART 1 - DEGREASING



Note 1. Parts that cannot be degreased includes large assemblies, assemblies containing parts that may be attacked by vapour.

Note 2. Parts that are not cleaned successfully includes evidence of heavy oil, grease or soil.

FLOW CHART 2 - ALKALINE CLEANING (NOTE 1)

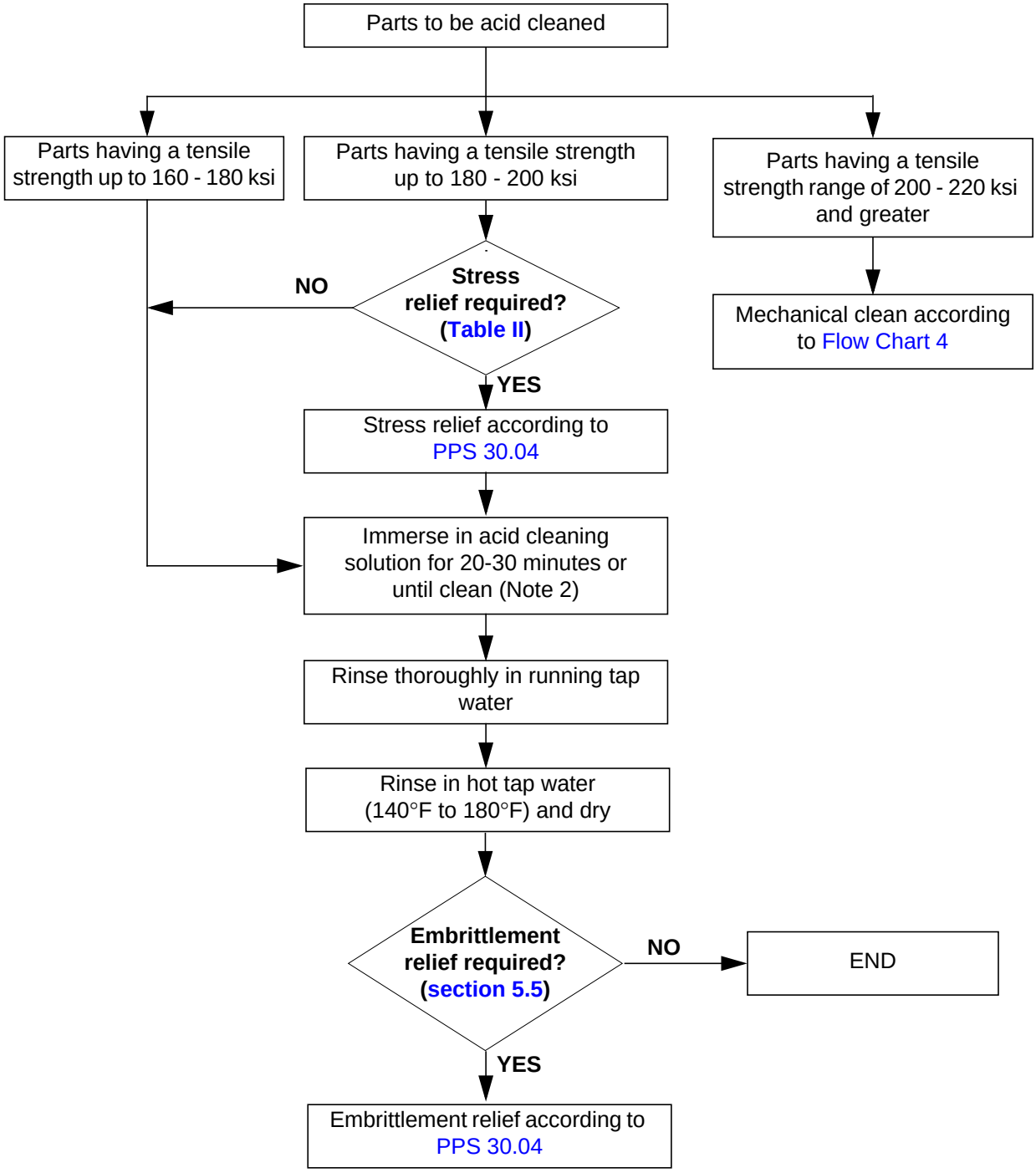


Note 1. Mechanical cleaning according to Flow Chart 4 shall be used when parts are too large for the acid cleaning tank or for assemblies that contain various alloys.

Note 2. Suspend parts so that adjacent parts do not touch, cleaning solution circulates freely between parts and the solution drains freely without entrapment in recesses and creation of air pockets.

Note 3. A water break-free surface is defined as a surface on which a water film will remain continuous for a period of at least 15 seconds without discontinuities or breaks.

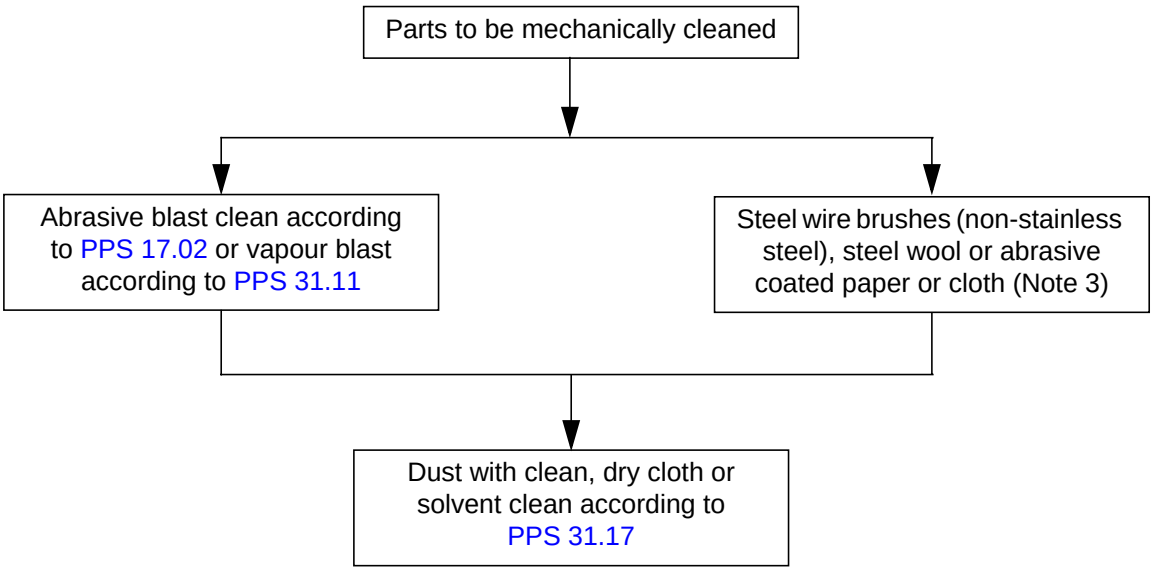
FLOW CHART 3 - ACID CLEANING (NOTE 1)



Note 1. Mechanically cleaning according to Flow Chart 4 shall be used when parts are too large for the acid cleaning tank or for assemblies that contain various alloys.

Note 2. Refer to Table I for make-up of acid cleaning solutions.

FLOW CHART 4 - MECHANICAL CLEANING (NOTES 1 & 2)



Note 1. Do not use steel or cast iron grit abrasive media for cleaning close tolerance machined parts.
Note 2. Do not mechanical clean decorative finish parts (SF Code).
Note 3. Abrasive coated material may be power driven, provided temperature rise produced by the abrading action is not detrimental to the part.

FLOW CHART 5 - FLUX REMOVAL