STANDARD OVERHAUL PRACTICES MANUAL

GENERAL CLEANING PROCEDURES

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To: All holders of GENERAL CLEANING PROCEDURES 20-30-03.

Attached is the current revision to this STANDARD OVERHAUL PRACTICES MANUAL

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STANDARD OVERHAUL PRACTICES MANUAL

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INTRODUCTION

1. General

A. The instructions in this manual tell how to do standard shop procedures during maintenance functions from simple checks and replacement to complete shop-type repair.

B. This manual is divided into separate sections:

(1) Title Page

(2) Transmittal Letter

(3) Highlights

(4) Effective Pages

(5) Contents

(6) Revision Record

(7) Record of Temporary Revisions

(8) Introduction

(9) Procedures

C. Refer to SOPM 20-00-00 for a definition of standard industry practices, vendor names and addresses, and an explanation of the True Position Dimensioning symbols used.

D. The data is general. It is not about all situations or specific installations. Use it as a guide to help you write minimum standards.

E. If the component overhaul instructions are different from the data in this subject, use the component overhaul instructions.

GENERAL CLEANING PROCEDURES

1. INTRODUCTION

A. The data in this subject comes from these Boeing Process Specifications:

BAC5408, Vapor Degreasing

BAC5625, Surface Treatments for Ferrous Alloys (Replaces BAC5751)

BAC5744, Manual Cleaning (Cold Alkaline, Solvent Emulsion and Foam Cleaners)

BAC5748, Abrasive Cleaning

BAC5749, Alkaline Cleaning

BAC5750, Solvent Cleaning

BAC5753, Cleaning, Descaling and Surface Preparation of Titanium and Titanium Alloys

BAC5758, Cleaning, Descaling and Surface Preparation of Nickel and Cobalt Base Alloys

BAC5763, Emulsion Cleaning and Aqueous Degreasing

BAC5766, Steam Cleaning (withdrawn)

BAC5770, Cleaning, Descaling and Surface Preparation of Copper and Copper Alloys

BAC5833, Cleaning Beryllium

D6-7127, Cleaning Interiors of Commercial Transport Aircraft

B. This data is general. It is not about all situations or specific installations. Use this data as a guide to help you write minimum standards.

C. Refer to SOPM 20-00-00 for a list of all the vendor names and addresses.

2. GENERAL

A. Some of the materials specified in these procedures can cause injury to persons if they get it on skin or in eyes. Be sure to use eye and skin protection and obey safety precautions.

B. All cleaning materials to be used on oxygen or hydraulic system components must be for those systems.

C. Be careful when you clean and do related work around windows, plastics, access doors to integral fuel tanks, fuel cells or electrical components. Materials used in these areas can be damaged by the agents you use.

D. Steam clean only the landing gear components, removed cowling or other very dirty parts that do not have electrical or electronic components or other parts that could be damaged by steam.

E. Types of dirt you could find:

(1) Oils, such as hydraulic oils, lubrication oil

(2) Semisolids, such as greases, heavy rust preventives

(3) Solids, such as mud, carbonized oils, corrosion products.

3. VAPOR DEGREASING

WARNING: TRICHLOROETHYLENE IS TOXIC AND A MILD ANESTHETIC. AVOID PROLONGED OR REPEATED CONTACT WITH THE SKIN OR BREATHING OF SOLVENT VAPOR. FULL FACE RESPIRATORY EQUIPMENT AND PLASTIC OR RUBBER GLOVES AND APRONS MUST BE WORN WHEN MANUALLY FLUSHING PARTS EITHER EXTERNALLY OR INTERNALLY WITH LIQUID SOLVENT.

(WARNING PRECEDES)

CAUTION: DO NOT VAPOR DEGREASE TITANIUM OR TITANIUM ALLOY PARTS IF THEY WILL BE IN TEMPERATURES OF 550°F OR HOTTER DURING SUBSEQUENT WORK OR ON THE AIRPLANE.

A. General

NOTE: Vapor degreasing of oxygen and hydraulic tubing assemblies must be done carefully to prevent injury to persons or damage to parts. Be sure to refer to local regulations which could control the release of vapors.

NOTE: Aqueous degreasing per BAC5763, Type 2 can be used as an option to this procedure, but not on honeycomb core.

(1) Put the degreaser in a well ventilated room and away from drafts that could go over the top of the unit. Keep it covered when not used.

(2) Water in the degreaser causes malfunctions and also causes trichloroethylene to decompose. Do not try to degrease wet parts. Do not let water condense on the cooling coils.

(3) When nonmetallic spacers or holders are specified, use nylon, polyethylene or other material that will not become soft or melt in trichloroethylene. Do not use wood, cloth, rope or equivalent materials.

(4) Use racks that drain quickly and fully. Stay away from thick, heavy racks that could drain away or soak up heat, or which could push away the vapor when the racks are lowered.

(5) After degreasing, parts must have no visible oil, grease, or pockets of solvent.

(6) Heat the unit slowly until the liquid starts to boil in the sump.

(7) Keep the vapor level at approximately 2/3 of the height of cooling coils or condensing area.

(8) Control the temperature of the water at the exit of the cooling coils and cooling jacket at 90-120°F. Do not let the water temperature be low enough to cause moisture to condense on any part of cooling jacket where it can come into the degreaser.

(9) Do not put too much work in the degreaser.

(10) Monitor the water separator for satisfactory operation. Drain if necessary.

(11) If your degreaser has extra heater units to let you clean large metal parts, turn the units on one minute before you put the part in the vapor zone and turn them off immediately after the work is completely in the vapor and the vapor level comes back up.

B. Materials (Chlorinated solvents) (Ref 20-60-01)

(1) Tetrachloroethylene (Perchloroethylene), Technical, O-T-236

(2) 1,1,1-Trichloroethane (Methyl Chloroform), MIL-T-81533

(3) Trichloroethylene, BMS 11-6 Types 1 and 2

C. Procedure

(1) Put the parts in the rack to let the solvent easily drain from parts.

(2) Lower the work into the degreaser slowly, not more than 12 feet per minute. If your equipment cannot move this slowly, use the slowest rate possible, because faster rates will cause more vapor to be released into the atmosphere. Also, refer to local regulations which could control the release of such vapors.

(3) For light dirt on parts use the vapor method as follows:

(a) Lower parts into the vapor. Be sure to refer to local regulations which could control the release of the vapor.

NOTE: If your degreaser has only the vapor phase, the parts must be removed, cooled, and run through again until clean.

(b) Hold the work in the vapor until no more solvent condenses on the parts. To remove pockets of solvent, put the parts or the rack at an angle.

(c) Slowly remove the parts from the degreaser. Let the liquid drain from the parts. Be sure to refer to local regulations which could control the release of the vapors.

(d) Put the parts through the procedure again if cleaning is not satisfactory. Let the parts cool to room temperature before you clean them again.

(4) For heavy dirt or dirt that dissolves slowly, use this warm liquid-vapor method:

(a) Hold parts in warm liquid (condensate) until some of the dirt becomes soft or comes off.

(b) Move the parts to the vapor phase and do Paragraph 3.C.(3)(b), Paragraph 3.C.(3)(c) and Paragraph 3.C.(3)(d) above. Keep the parts below the vapor line for best results.

(5) For parts with heavy dirt or dirt that does not dissolve, use this vapor-flush-vapor method:

(a) Hold the work in the vapor until no more solvent condenses on the parts.

(b) Flush dirt away with clean liquid solvent. Do not use solvent directly from the boiling sump. Keep nozzle and parts at least 6 inches below vapor line. Point the nozzle downward onto the parts.

(c) Move the parts to the vapor phase and do Paragraph 3.C.(3)(b), Paragraph 3.C.(3)(c) and Paragraph 3.C.(3)(d) above.

D. Oxygen System Components

(1) Fittings and Protective Metal Caps and Plugs

(a) Put the fittings in the vapor or liquid phase of the degreaser for a minimum of 12 minutes. Maximum descent rate is 12 ft/min. If your equipment cannot move this slowly, use the slowest rate possible, because faster rates will cause more vapor to be released into the atmosphere. Also, refer to local regulations which could control the release of such vapors.

(b) While the parts are in the vapor phase, fully wash all fittings with a pressurized stream of chlorinated solvent.

(c) Put the parts at an angle to let pockets of entrapped solvent drain out.

(d) Slowly remove the parts from the degreaser. Be sure to refer to local regulations which could control the release of the vapors.

(e) Let the parts drain. Put the parts or the basket at an angle to help. Do not use compressed air or gas to remove the solvent.

(f) Examine the cleaned parts to make sure they are clean. If necessary, clean them again. Let the parts cool to room temperature before you do the procedure again. Use cotton gloves on cleaned fittings and protective metal caps.

(g) Immediately after they are dry, give cleaned parts protection per SOPM 20-70-01.

(2) Tube Assemblies

CAUTION: DO NOT PUT THE ASSEMBLIES IN THE BOILING CHAMBER OF THE DEGREASER.

(a) Put the tube assemblies in the liquid phase of the degreaser for a minimum of 10 minutes. Maximum descent rate is 12 ft/min. If your equipment cannot move this slowly, use the slowest rate possible, because faster rates will cause more vapor to be released into the atmosphere. Also, refer to local regulations which could control the release of such vapors.

(b) Move the basket to the vapor phase, and put the parts or the basket at an angle to drain the solvent. Let the tube assemblies stay in the vapor phase for a minimum of 5 minutes.

CAUTION: DO NOT USE SOLVENT FROM THE BOILING SUMP OF THE DEGREASER.

(c) With chlorinated solvent, internally flush all tube assemblies until there is a continuous flow from the other end of the tube assembly for a minimum of 1 minute. Keep parts at least 6 inches below the vapor level.

(d) Put the parts at an angle to drain the solvent.

(e) Slowly remove the parts from the degreaser. Be sure to refer to local regulations which could control the release of the vapors.

(f) Let the parts drain. Put the parts or the basket at an angle to help. Do not use compressed air or gas to remove the solvent.

(g) Examine the tubes to make sure they are clean. Clean them again if necessary.

(h) Immediately install protective plugs or caps to give the tube interiors protection from contamination.

NOTE: Until the tubes are capped or plugged, use clean cotton gloves on the cleaned tubes.

(i) Give the tubes protection and put them away with standard industry practices and the instructions in SOPM 20-44-02 and SOPM 20-70-01.

E. Hydraulic Tube Assemblies

(1) Flush the tubes with liquid solvent, when necessary, to remove deposits of dirt, chips, etc. on the outer surface of the tubing. Keep nozzle and parts 6 inches below the vapor level. Do not use solvent directly from the degreaser sump.

(2) For tubes 0.5 inch outside diameter or smaller, flush until there is a continuous flow from the other end of the tube for 1 minute minimum. For tubes larger than 0.5 inch outside diameter, flush until there is a continuous flow from the other end of the tube.

(3) Put the parts in the warm liquid (condensate) phase for a minimum of 10 minutes.

(4) Move the basket to the vapor phase. Hold the parts in the vapor for a minimum of 5 minutes or until solvent stops condensing on parts.

(5) Put the parts at an angle to drain the solvent.

(6) Slowly remove the parts from the degreaser. Be sure to refer to local regulations which could control the release of the vapor.

(7) Let the parts drain. Put the parts on the basket at an angle to help. Do not use compressed air or gas to remove the solvent.

(8) If necessary, clean the parts again. Let the parts cool to room temperature before you do the procedure again.

4. SOLVENT CLEANING

A. You can use this procedure to clean metals, painted surfaces and plastic parts (but not windows).

B. Methods of cleaning include manual cleaning, immersion and spray and flush.

C. Materials

NOTE: Equivalent substitutes can be used.

(1) Acetone, technical (SOPM 20-60-01)

(2) Butyl alcohol (SOPM 20-60-01)

(3) Cee Bee A-916, V71361

(4) Citra-Safe, V0K209

(5) Cleaning solvent (SOPM 20-60-01)

(a) BMS 11-7

(b) CDG-110, V0STM5

NOTE: A 1:1 mixture (by weight, +/-2%) of aliphatic naphtha and isopropyl alcohol is an acceptable substitute.

(c) CDG-211, V0STM5

NOTE: A 2:1:1 mixture (by weight, +/-2%) of aliphatic naphtha, isopropyl alcohol, and denatured ethyl alcohol is an acceptable substitute.

(d) FCC-55, V0STM5

NOTE: A 1:1 mixture (by weight, +/-2%) of aliphatic naphtha and methyl propyl ketone is an acceptable substitute.

(6) Compound, fingerprint remover – MIL-C-15074 (SOPM 20-60-01)

(7) Cotton gloves, lightweight, white, knitted

(8) DBE, DBE5, DBE-5 SPG, V18873

(9) Diethylene glycol monobutyl ether (butyl carbitol), V80524

(10) Diethylene glycol monohexyl ether (hexyl carbitol), V80524

(11) Ethyl alcohol, denatured, 95% (SOPM 20-60-01)

(12) Ethyl 3-ethoxyproprionate, technical, V74364

(13) Ethylene diacetate, technical, V74364

(14) 2-Ethylhexyl acetate, technical, V74364

(15) Extra Solv, V0TZ07

(16) Fluorinated solvents

(a) Freon TES, V18873

(b) Freon TF, V18873

(c) Genesolv D, V40991

(d) Genesolv DES, V40991

(e) Trichlorotrifluoroethane – MIL-C-81302, Type 1

(17) FO 145 Special Tee Solvent, V01490

(18) Isopropyl alcohol (SOPM 20-60-01)

(19) Ketate, V80524

(20) Methyl ethyl ketone (MEK) (SOPM 20-60-01)

(21) Methyl isobutyl ketone (MIBK) (SOPM 20-60-01)

(22) Methyl propyl ketone (MPK) (SOPM 20-60-01)

(23) M.O.K., technical, V19630 or V36701

(24) Naphtha/petroleum distillates

(a) C-1470 solvent blend, V29672 or V86024

(b) P-D-680, Type 1, 2 or 3 (SOPM 20-60-01)

(c) Aliphatic naphtha (SOPM 20-60-01)

(d) Mineral spirits (SOPM 20-60-01)

(25) n-Octanol, technical

(26) 1, 2-Propylene glycol

(27) Soft-bristle fiber brush – Bay Bristle, V96383

(28) Tetrachloroethylene (perchloroethylene) (SOPM 20-60-01)

(29) Toluene (SOPM 20-60-01)

(30) 1,1,1 - Trichloroethane (methyl chloroform) (SOPM 20-60-01)

(31) Trichloroethylene (SOPM 20-60-01)

(32) Wedco 3500, V0VMT4

(33) Winsol solvent blend No. 1 or SR-350, V62976

(34) Wipers – BMS 15-5, Class A and B

(35) Wipers, oil absorbing

(a) P-110 pads, Powersorb Universal Sorbent, V76381

(b) TO151 pads, Powersorb General Purpose Oil Sorbent, V76381

(36) Xylene (SOPM 20-60-01)

D. General

WARNING: WITHOUT PRECAUTIONS, THE CHEMICALS USED IN SOLVENT CLEANING CAN BE DANGEROUS TO PERSONS AND EQUIPMENT.

(WARNING PRECEDES)

CAUTION: DO NOT USE CHLORINATED SOLVENTS ON TITANIUM AND TITANIUM ALLOYS WHICH WILL BE IN TEMPERATURES OF 600°F (316°C) OR HOTTER DURING SUBSEQUENT PROCEDURES OR ON THE AIRPLANE. DO NOT LET SOLVENTS STAY ON THERMOPLASTIC MATERIALS. MOST THERMOPLASTICS (ACRYLIC, POLYCARBONATE, POLYSULFONE, ABS, ETC.) ARE SOLVENT SENSITIVE. USE ONLY SOLVENTS AND CLEANERS SHOWN IN TABLE 2 WHEN YOU CLEAN THERMOPLASTIC MATERIALS. DO NOT USE SOLVENTS ON COMPOSITE SURFACES THAT HAVE ONLY STATIC CONDITIONER FILLER 28-C-1 ON THEM. DO NOT LET SOLVENT FLOW INTO FAYING SURFACES OR BONDED JOINTS. DO NOT LET SOLVENT TOUCH CONTROL CABLES OR LUBRICATED SURFACES.

(1) Solvent cleaning will not remove such contamination as scale, corrosion products, paint and stains.

(2) Use clean gloves or suitable hooks or tongs on cleaned parts or surfaces.

CAUTION: DO NOT CONTAMINATE OR DAMAGE OTHER PARTS OR SURFACES WHEN YOU USE COMPRESSED AIR.

(3) Keep solvent out of faying surfaces, crevices, cracks, or other confined spaces. If solvent goes in, remove it with compressed air or hot air oven. Compressed air used to dry parts must be filtered to remove moisture, oil and solid particles.

(4) Paints, plastics, polymeric materials, adhesives, and equivalent materials must be fully cured before cleaning.

Table 1: Solvents for Metals and Coatings

	Method			Surface	
Solvent	**General Clean**	**Final Clean**	**Hydraulic Fluid and Fuel**	**Metal**	**Coatings**
Alcohols					
Ethyl alcohol	X	X		X	X
n-Butyl alcohol	X	X		X	X
Isopropyl alcohol	X	X		X	X
n-Octanol *[1]	X	X		X	X
Naphthas/Petro~leum Distillates					
C-1470	X			X	X
P-D-680, Type 1, 2 or 3	X		X	X	X
Aliphatic naphtha	X	X	X *[2]	X	X
Extra Solv	X			X	X
Mineral Spirits	X			X	X

Table 1: Solvents for Metals and Coatings (Continued)

Solvent	Method			Surface	
	General Clean	Final Clean	Hydraulic Fluid and Fuel	Metal	Coatings
Chlorinated Solvents *[3]					
1,1,1 - Trichloroethane and MEK, 1:1	X	X		X	*[4]
Ketones					
Acetone	X			X	*[4]
Butyl alcohol ASTM D1007, 56-60%	X			X	*[4]
Methyl ethyl ketone (MEK)	X	X		X	*[4]
Methyl isobutyl ketone (MIBK)	X	X		X	*[4]
MIBK and MEK, 3:2	X	X		X	*[4]
MEK and Sec-butyl alcohol, 42:58	X	X		X	*[4]
MPK	X	X		X	*[4]
Fluorinated Solvents					
MIL-C-81302, Type 1	X	X		X	X
Freon TES *[5]	X			X	
Genesolv DES *[5]	X			X	
Freon TF *[5]	X			X	
Genesolv D *[5]	X			X	
Aromatics					
Toluene	X			X	*[4]
Xylene	X			X	*[4]
Aliphatic, Non-Petroleum					
Citra-Safe *[1]	X	X		X	X

Table 1: Solvents for Metals and Coatings (Continued)

Solvent	Method			Surface	
	General Clean	Final Clean	Hydraulic Fluid and Fuel	Metal	Coatings
Nonhalogenated Mixtures					
MIL-C-15074	X			X	
Acetone and butyl alcohol, 1:1	X			X	X
Ethyl alcohol and water, 2:3	X		X	X	X
Ketate	X	X		X	*[4]
MEK and toluene, 1:1	X	X		X	*[4]
BMS 11-7	X	X		X	X
Cee Bee A-916	X			X	
Isopropanol and Toluene, 3:2	X	X		X	*[4]
Isopropyl alcohol and Toluene, 3:2	X	X		X	*[4]
Wedco 3500	X			X	
Esters *[1]					
Ethyl 3-ethoxyproprio˜nate	X			X	*[4]
MOK *[5]	X			X	
2-ethylhexyl acetate	X			X	
Ethylene diacetate *[5]	X			X	
DBE -series *[5]	X	X		X	*[4]
Glycols, Glycol Ethers *[1]					
1,2-propylene glycol *[5]	X			X	X
Diestone DLS	X	X		X	X
Diestone HFP	X	X		X	X

Table 1: Solvents for Metals and Coatings (Continued)

Solvent	Method			Surface	
	General Clean	Final Clean	Hydraulic Fluid and Fuel	Metal	Coatings
Diethylene glycol monohexyl ether *[5]	X			X	*[4]
Diethylene glycol monobutyl ether	X	X		X	*[4]

*[1] Low toxicity, low vapor pressure

*[2] Use TT-N-95 Type 2 (or equivalent) only

*[3] These solvents contain chlorinated hydrocarbons. Do not use these solvents on titanium or titanium alloys which will be in temperatures of 550°F or hotter during subsequent procedures such as stress relief, or when used on the airplane.

*[4] Use on solvent-resistant finishes only.

*[5] Approved for use in confined areas.

Table 2: Cleaners for Polymeric Materials

GENERIC NAMES/COMPOSITION	EXAMPLES OF TRADE NAMES	CLEANER
Polynvinyl Chloride (PVC)	Boltaron	Naphtha
Polyacetal	Delrin	
Melamine, Phenolic Resin	Formica	
Acrylic	Lucite, Plexiglass	
Acrylic-Polyvinyl Chloride	Kydex 100	
Cellulose Acetobutyrate (CAB)	Tenite II	
Polyamide	Nylon	Alcohols, naphtha, ketones, BMS 11-7, esters, or 1,1-propylene glycol
Aramid	Nomex, Kevlar	Naphtha, isopropyl alcohol
Acrylonitrile-Butadiene-Styrene (ABS)	Royalite (50 Series), Cycolac	Denatured alcohol, isopropyl alcohol, naphtha
Polycarbonate	Lexan	Denatured alcohol, Naphtha
Polysulfone	Royalite (520 Series)	
Polytetrafluoroethylene (PTFE)	Teflon	Alcohols, Ketones, Naphtha TCA, Fluorinated Solvents, BMS 11-7, esters, 1,1-propylene glycol
Polyvinyl Fluoride (PFV)	Tedlar	
Polyester	Vibrin, Mylar, Dacron	
Vinyl		Naphtha
Rubber/Vucanized Elastomers		Denatured alcohol, isopropyl alcohol, acetone
Silicone Rubbers	RTV, silastic	

Table 2: Cleaners for Polymeric Materials (Continued)

GENERIC NAMES/COMPOSITION	EXAMPLES OF TRADE NAMES	CLEANER
Epoxy, phenolic, and polyester Composite Laminated Structures	Fiberglass/Epoxy Fiberglass/Phenolic Fiberglass/Polyester Graphite/Epoxy Graphic/Phenolic Kevlar/Epoxy	Citra Safe, MEK, Acetone, 1:1 mixture 1,1,1-TCA and MEK or BMS 11-7
BMS 8-124 Nonmetallic Honeycomb Core		Isopropyl alcohol
Phenolic	Micarta	Isopropyl alcohol, naphtha
Polyetherimide and Polyetherimide blends	Ultem 1000, 2000, 8000, 9066	Naphtha, isopropyl alcohol or acetone
	Ultem 9065	Naphtha, isopropyl alcohol acetone or MEK
Polyether ketoneketone Polyetheretherketone	Declar and Declar-T PEEK	Naphtha, isopropyl alcohol acetone, or MEK, or BMS 11-7
Polyphenylsulfone	Radel	Naphtha, alcohols, or diethylene glycol monobutyl ether
Polyurethane thermoplastics	ABCO 2449, Estane, RTP	Isopropyl alcohol
Crystalline polyamides	Nylon 6, 6/6, 6/10, 6/12	Alcohols, ketones, toluene or naphtha
Amorphous polyamides (nylon)	Nylon 6/11	Naphtha or detergent and water

E. General cleaning

NOTE: This method is used to remove dirt when subsequent cleaning is required by overhaul instructions. Use this method when preclean or precleaning is specified.

(1) Remove loose dirt, unwanted grease, or oil by wiping, scrubbing, or other physical means. Oil absorbing wipers will help oil removal without a solvent. Be careful not to smear the dirt over a larger area than necessary.

(2) Get the applicable solvent for the material or coating to be cleaned. The solvent can be used again as necessary to remove the contamination.

(3) Clean the surface by one or more of these three steps. Repeat as necessary to remove the dirt.

(a) Wet surface with solvent and wipe or scrub with a wiper, sponge, or brush.

(b) Put the part in solvent and let the dirt soak. If necessary, wipe or scrub surface with a wiper, sponge, or brush.

(c) Spray or flow the solvent on the surface to help in cleaning or rinsing.

(4) Rinse surface with clean solvent and clean wipers.

(5) Wipe up excess solvent and let the surface drain dry.

F. Final Cleaning

NOTE: This method is used when a thoroughly cleaned surface is required for subsequent procedures such as painting, adhesive bonding.

(1) If necessary, clean per Paragraph 4.E.

(2) Get the applicable solvent for the material or coating to be cleaned. Mixtures of the applicable solvents can be used. Do not final clean with solvents which have more than 50 ppm of non-volatile solids.

(3) Soak a clean wiper with solvent. Apply the solvent to the wiper; do not put the wiper into the solvent container.

(4) Rub the surface with the solvent soaked wiper. Immediately wipe dry. Do not let the solvent evaporate from the surface.

(5) Do Paragraph 4.F.(4) again until the wiper shows no dirt. Frequently change dirty wipers for clean ones.

(6) Examine for complete cleanliness as follows:

(a) With reflected light, examine the surface. The surface must have no dirt, corrosion, oil, grease or unwanted matter.

(b) When wiped with a clean, dry, white or light-colored lint-free wiper, the parts must not put contamination on the wiper or change its color.

(7) Clean the parts again by this procedure, if necessary.

(8) Give the cleaned surfaces protection from dust, fingerprints, or other contamination.

G. Spot Cleaning on Solid Surfaces

(1) Remove loose dirt, grease, or oil with a clean wiper. Be careful not to make the dirty area larger or rub the contamination into the surface.

(2) Use a clean wiper wet with solvent. Make it into a pad to control the area it will touch.

(3) Rub this wet pad around the outside edge of the spot and gradually go into the center. Change to a clean surface of the wiper, or to a clean wiper, as the dirt is collected.

(4) Clean again until the spot is gone.

(5) Dry with a clean, dry wiper. Clean solvent can be permitted to dry by evaporation or with compressed air.

H. Spot Cleaning on Fabric

(1) Put a clean, dry absorbent wiper under the spot on the fabric material.

(2) Let the solvent go through the fabric into the dry wiper. Change the wiper frequently to put a clean, dry surface under the spot.

(3) When the stain is gone, use clean, dry wipers to dry the area. Do not rub.

I. Removal of Hydraulic Fluid, Fuel, and Soils

NOTE: Manual alkaline cleaning per Paragraph 6. can be used instead of this procedure. When paint, adhesive, sealant, or other protective finish is to be applied, this procedure must be followed by final cleaning per Paragraph 4.F.

(1) Use one of the following solvents:

CAUTION: DO NOT LET P-D-680 OR TT-N-95 SOLVENTS GET ON CONTROL CABLES OR LUBRICATED AREAS.

(a) P-D-680 Type 1, 2, or 3 or TT-N-95, Type 2

CAUTION: DO NOT LET THESE TWO SOLVENTS GET ON CONTROL CABLES, LUBRICATED AREAS, ACRYLIC, PLASTIC, DECALS, OR NON-SKYDROL-RESISTANT FINISHES.

(b) Tetrachloroethylene, or 1,1,1-trichloroethane.

(c) 40 percent ethyl alcohol in water.

NOTE: The cleaning efficiency of this alcohol-water mixture is limited. Oily contamination is removed by flushing action rather than by dissolving. A slight oily film could remain.

(2) Soak a clean wiper with solvent and wring out excess solvent. If you use the alcohol-water mixture, the wiper must be thoroughly saturated and not wrung out. A soft-bristle brush can be used on rough surfaces, such as epoxy walkway coating.

(3) Rub the surface with the wet wiper or brush to remove the hydraulic fluid, fuel, or dirt. Do not let solvent get into faying surfaces.

(4) With a clean wiper, immediately wipe dry all surfaces touched by the solvent.

5. FINGERPRINT REMOVAL

A. General

(1) Use fingerprint removal compound MIL-C-15074, isopropyl alcohol, or a mixture of equal volumes of acetone and isopropyl alcohol. Oil-absorbing wipers can be used without solvent to remove most fingerprints from nonporous surfaces.

(2) Use tongs, clean gloves, or equivalent protection on the parts.

B. Small Parts

(1) Put the parts into the solution per Paragraph 5.A.(1) and shake them for 2 minutes.

(2) Shake the parts in two successive clean portions of naphtha (Table 1) for 1 minute each.

(3) Drain excess solvent.

(4) Wipe parts dry with clean, dry cloth or dry them with clean, dry compressed air.

(5) Give the cleaned parts protection from dust, fingerprints or other contamination. Wrap if necessary.

C. Large Parts

(1) Final clean per Paragraph 4.F. with the solution specified in Paragraph 5.A.(1).

(2) Rinse at least twice with clean naphtha (Table 1).

6. ALKALINE CLEANING

WARNING: ALKALINE CLEANING MATERIALS USUALLY REACT WITH MUCH FORCE WHEN MIXED WITH WATER. CONCENTRATED SOLUTIONS CAN BADLY BURN SKIN AND EYES. WEAR FACE SHIELDS AND PROTECTIVE CLOTHING WHEN YOU USE THESE MATERIALS. OBEY ALL SAFETY PRECAUTIONS.

A. General

(1) Alkaline cleaning is used to clean surfaces when a water-break-free surface is specified by procedures such as those which apply organic or inorganic finishes. A water-break-free surface is a surface which keeps a continuous water film for at least 30 seconds after the surface was sprayed or immersion rinsed in clean water colder than 100°F.

(2) Cleaning methods

(a) Method 1 – Soak cleaning - generally used for all metals. The surface action of the cleaner does most of the work, because there is not much agitation of the solution.

(b) Method 2 – Spray cleaning - a good cleaning method because there is forced agitation of the solution on the surface of the part.

(c) Method 3 – Electrolytic cleaning - preferred for cleaning metals before plating. A very good method because there is much agitation of the solution on the surface of the part.

(3) Visually examine the surfaces of the parts to make sure they do not have grease or oil. This will keep to a minimum the contamination of cleaning tanks and solutions, and make the alkaline cleaning work better. To remove oil and grease, vapor degrease, emulsion clean, manually solvent clean, or manually clean the surfaces. Be sure to fully dry the parts to prevent contamination of the alkaline cleaner with solvent.

(4) Put all parts in positions or in the racks to make sure there is a good flow of solutions over all of the surfaces. Do not let parallel flat surfaces touch each other.

(5) When possible, after you use a heated solution, include a water-fog curtain above the rinse tank, to not let the solution dry on the part.

(6) If the parts are made of BMI reinforced composite, be sure to use the special Method 2 procedure in Paragraph 6.H.

B. Materials

NOTE: Equivalent substitutes can be used.

(1) Alkaline Cleaners – Refer to Table 3 for the recommended cleaners for each method.

(2) Abrasive Materials

(a) Pumice grade FF

(b) Pumice detergent compound – Diversey-Wyandotte F1013, V83339

(c) Tripoli powder

(3) Brushes, plater

(4) Cleaning pads – Scotch-Brite, Type A, I or S, V76381

(5) Wetting Agents

(a) Nacconol 90G, V87570 (Replaces Nacconol 90F)

(b) Surfactant 9N9, V36701

(c) Other nonionic water-soluble detergent per MIL-D-16791, Type 1

(6) Wipers – BMS 15-5, Classes A and B

(7) Sodium chromate, technical

C. Preparation of Compounded-Formula Cleaner Solutions

NOTE: For periodic-reverse cleaners, refer to Paragraph 6.D. thru Paragraph 6.G. For caustic-soak cleaner, refer to Paragraph 6.H.

(1) For the cleaner to be used, refer to Table 3 for the concentrations and temperatures ranges.

(2) Fill the tank approximately 1/2 full of cold water.

(3) Add the compounded cleaner to the middle of the concentration range. Add the cleaners slowly and mix until they dissolve. These alkaline materials will give out heat as they dissolve.

(4) Add water to the operating level.

(5) Heat the solution to the correct temperature range. Make analyses and adjust the solution as necessary. Mix well after you add the chemicals to the solution.

(6) Mix all cleaning solutions after they are not used a long time, or after you add chemicals or water, to make sure the concentration stays constant.

D. Preparation of Enprep Periodic-Reverse Cleaner Solutions

(1) Fill the tank approximately 1/2 full of water.

(2) For each 10 gallons of final solution, slowly apply 25 pounds of Enprep 214 cleaner solution over the water surface. Mix well.

NOTE: As an alternative to Enprep 214, you can use 15 pounds of Enprep 114 and 7.5 pounds of sodium cyanide.

(3) Heat the solution to the correct temperature, add water to the operating level and mix well.

(4) Make analyses and adjust the solution as necessary. Refer to Table 3 for the concentration and temperature ranges.

(5) When the Enprep 214 solution causes smut on the parts, dummy plate at 1 to 2 volts (in the plating polarity) overnight with a corrugated sheet of mild steel.

E. Preparation of Trisodium Phosphate - Glutomic (TSPG) Cleaner Solutions

NOTE: This solution can be operated at 80°F or 130°F.

(1) Fill a cleaned tank to the 3/4 level with water. Slowly add these chemicals. Mix well after you add each chemical.

	Amount per gallon of final solution	
Temperature of Operation	**80°F**	**130°F**
Sodium hydroxide	14 oz	14 oz
Trisodium phosphate	2 oz	7 oz
Glutamic acid	6 oz	6 oz
Wetting agent	0.10 ml	0.10 ml

(2) Add water to the operating level.

(3) Make analyses and adjust the solution to be in these limits:

Temperature of Operation	**80°F**	**130°F**
Sodium hydroxide	10-14 oz/gal	10-14 oz/gal
Trisodium phosphate	1-2 oz/gal	5-7 oz/gal
Glutamic acid	4-6 oz/gal	4-6 oz/gal

Temperature of Operation	80°F	130°F
Wetting agent	70-90°F	120-140°F

(4) To use the solution again after it was cooled, heat the solution to the correct temperature and mix until all of the chemicals are dissolved again.

F. Preparation of Isoprep 172 Cleaner Solution

(1) Fill the tank approximately ½ full of water.

(2) For each 100 gallons of solution, add 35 gallons of Isoprep 35 liquid concentrate.

(3) Add water to the operating level. Stir the solution as you add the water.

(4) Heat the solution to the operating temperature.

(5) Make analyses and adjust the solution as necessary. Refer to Table 3 for the concentration and temperature range. Control the temperature to within 10 degrees of the value you set.

G. Preparation of Anodex Cleaner Solution

(1) Fill the tank approximately ½ full of water.

(2) For each gallon of final solution, add 12 ounces of Anodex NP2 cleaner and stir continuously.

(3) Add water to the operating level and mix fully.

(4) Make analyses and adjust the solution as necessary. Refer to Table 3 for the concentration and temperature range.

H. Preparation of Caustic-Soak Cleaner Solution

(1) Fill the tank approximately 1/2 full with water.

(2) For each gallon of final solution, apply 1 pound of sodium hydroxide over the water surface. Apply it slowly and mix well.

(3) Heat the solution to the operating temperature. Add water to the operating level and mix well.

(4) Add 0.1 ounce (fluid or dry) of wetting agent for each gallon of final solution. Mix well.

(5) Make analyses and adjust the solution as required. Refer to Table 3 for the concentration and temperature limits.

Table 3: Alkaline Cleaner Selection and Control

Cleaner	Vendor	Solution Control		Metal to be Cleaned						Remarks
		Conc. Oz/gal	Temp °F	Fe	Al	Ti	Mg	*[1]	*[2]	
Immersion Cleaners, Heavy Duty Soak (Formerly Category A)										
ACI Cleaner 153	V1DZU6	2-4	140-160	X	X					
Ardrox 6471	V23373	10-12	130-140		X					
Cee Bee J-84A	V71361	5-12	180 min	X						

Table 3: Alkaline Cleaner Selection and Control (Continued)

Cleaner	Vendor	Solution Control		Metal to be Cleaned						Remarks
		Conc. Oz/gal	Temp °F	Fe	Al	Ti	Mg	*[1]	*[2]	
Cleaner 36	V99987	5-12	180 min	X		X	X		X	
Isoprep 177	V89138,~ V99442	6-12	180-190	X		X	X		X	
Magnus 361	V1KS82	5-12	180 min	X						
Nuvat	V83339	5-12	180 min	X		X	X		X	*[3]
Turco 4181	V61102	16-48	190-200	X						*[4]
Turco HTC	V61102	5-12	180 min	X		X	X		X	
Turco 4829 LT	V61102	5-12	120-160	X		X	X			
Vitro-Klene	V61102	5-12	180 min	X		X	X		X	
Immersion Cleaners, Medium Duty Soak or Electrolytic (Formerly Category B & K)										
Clepo 26E	V92269	5-12	160-190	X			X		X	
Distel 12	V71410	5-8	180-195	X						
DW-F.S.	V71410	8-12	140-180	X		X	*[5]	*[5]	X	
Isoprep 58	V89138, V99442	6-12	170-200	X		X	*[5]	*[5]	X	
Maxamp	V83339	5-12	140-180	X		X	*[5]	*[5]	X	
Metalex W Special	V76071	5-12	160-190	X		X	*[5]	*[5]	X	
M&T48~ WT	V12941, V27201	5-12	160-190	X		X	*[5]	*[5]	X	
North~ west EC-111	V71361	5-12	160-190	X		X	*[5]	*[5]	X	
Oakite 90	V44389	5-12	160-190	X		X	*[5]	*[5]	X	

Table 3: Alkaline Cleaner Selection and Control (Continued)

Cleaner	Vendor	Solution Control		Metal to be Cleaned						Remarks
		Conc. Oz/gal	Temp °F	Fe	Al	Ti	Mg	*[1]	*[2]	
Panther N-Ergy 5010 and sodium hydroxide, 1:4 by weight	V26264	6-10	180-212	X		X	*[5]	*[5]	X	
Phosphosilicate	*[6]	5-12	160-190	X		X	X	Cu	Ni	
Phosphosilicate	V7R005	5-12	160-190	X		X				
Immersion Cleaners, Medium Duty Soak (Formerly Categories C, CL, D, DL)										
Aero Clean 1200	V55208	12-16	150-170			X				
Alkaline Cleaner L8410	*[7]	4-8	140-160		X					
Altrex	V83339	5-8	140-180	X	X	X	X	X	X	*[8]
Altrex 24	V83339	5-8	120-130		X		X			
Altrex 1097	V83339	5-8	160-190	X	X	X	X	X	X	
Aquatone A-1	V03133	3.5-5	160-175		X					
Ardrox 6333	V23373	8-10	130-140	X	X	X	X			
Ardrox 6333	V23373	10-20	140-160	X		X	X			*[9]
Armakleen M-Aero	V90038	10-20	100-160	X	X	X	X	X	X	
Cee Bee A54	V71361	6-8	135-145	X	X	X		X	X	

Table 3: Alkaline Cleaner Selection and Control (Continued)

Cleaner	Vendor	Solution Control		Metal to be Cleaned						Remarks
		Conc. Oz/gal	Temp °F	Fe	Al	Ti	Mg	*[1]	*[2]	
Dara Clean 283	V04552	8-15	120-150	X		X				
Detrex ALSW	V17125	5-8	150-170	X	X	X	X	X	X	*[8]
Formula 815GD	V94058	11.5-36.0	100-175	X	X	X	X	X	X	*[5]
Inpro Clean 3000	V44389	5-8	130-140		X		X			
Isoprep 44	V89138, V99442	6-8	135-145	X	X	X	X	X	X	
Isoprep 44L ND	V89138, V99442	6-8	135-145	X	X	X	X			
Isoprep 44L ND	V89138, V99442	7-15	120-160	X		X	X			
Isoprep 500L	V89138, V99442	3-10	110-140	X		X				
Liquid Vitrok~ lene	V61102	4-8	120-140	X		X				
Oakite DZL	V44389	3-6	120-140	X		X				
Oakite 61B	V44389	5-8	160-190	X	X	X	X	X	X	*[10]
Oakite 164	V44389	5-8	120-190	X	X	X	X	X	X	*[8]
Pacific SP112 or SP112-LF	V93965	5-8	135-145	X	X	X		X	X	*[8]
Parco 2087X	V84063	8-12	160-195	X		X				
Penn~ walt 2476	V99987	6-8	135-145	X	X	X		X	X	*[8]

Table 3: Alkaline Cleaner Selection and Control (Continued)

Cleaner	Vendor	Solution Control		Metal to be Cleaned						Remarks
		Conc. Oz/gal	Temp °F	Fe	Al	Ti	Mg	*[1]	*[2]	
Pennwalt A-27	V99987	5-8	160-190	X	X	X		X	X	*[8]
Ridoline 322	V84063	5-8	160-190	X	X	X	X	X	X	*[8]
Ridoline 57	V84063	4.5-6.5	115-125		X					
Ridoline 909	V71410	5-8	160-190	X	X	X	X	X	X	
Super Bee 300LF	V71361	8-25	105-175	X	X	X	X	X	X	*[11]
Turco 2623	V61102	6-8	135-145	X	X	X		X	X	*[8]
		5-8	160-175	X	X	X	X	X	X	*[8]
Turco 4090 (Airlion)	V61102	5-8	160-190	X	X	X		X	X	*[8]
Vari-Kleen	V89138, V99442	7.5-10.0	120-140	X		X				
Immersion Cleaners, Light Duty Soak (Formerly Categories E, F, FL)										
Aldet	V83339	4-6	140-155		X					*[12]*[13]
Aldet	V83339	4-8	120-145	X	X	X		X		*[12]
Cleaner A-38	V99987	4-8	140-160		X					
Clepo 83-M	V92269	4-6	150-170		X					*[12]*[13]
Gillite 0650	V1KS82	2-4	130-170	X						
Magnuspray 51080	V1KS82	3-5	100 max	X						
Oakite 166	V44389	5-8	120-140		X					*[12]*[13]
Ridoline 53	V84063	2-6	140-180		X					*[12]

Table 3: Alkaline Cleaner Selection and Control (Continued)

Cleaner	Vendor	Solution Control		Metal to be Cleaned						Remarks
		Conc. Oz/gal	Temp °F	Fe	Al	Ti	Mg	*[1]	*[2]	
Ridoline 57	V84063	4.5-6.5	115-125		X					
Ridoline 57	V84063	1-5	120-200		X	X		X		
Ridoline 153	V84063	1.5-2.5	140-158		X					
Turco Alumi~clean F with Additive	V61102	4.5-6.0	130-180		X					
Turco 4215	V61102	4-6	140-155		X	X			X	*[12]*[13]
Turco 4215NC~LT	V61102	5-8	120-140	X	X	X		X	X	*[12]*[13]
Turco 4215S	V61102	4-6	140-155	X	X	X		X		*[13]
XP-131	V60420	4-6	140-155		X					*[13]
Immersion Cleaners, Caustic Soak (Formerly Category G)										
Sodium hydro~xide	———~—	13-18	170-190				X			Re~moves graphite
Spray Cleaners, Light Duty (Formerly Categories H, J)										
ALK-660	*[11]	5-10 Vol%	60-120	X	X	X		X	X	*[14]
Chem Clean 1004	V23373	2.0-8.0 (1.4-5.5 Vol%)	90-150	X	X	X				
Dara~clean 211	V04552	0.01-0.10	Room							*[15]
Fleetline JC5	V44389	0.01-0.10	Room							*[15]
Isoprep 39	V89138, V99442	1-4	140-170		X					
KC 270	V2R358	2.0-3.8	90-150	X	X	X				

Table 3: Alkaline Cleaner Selection and Control (Continued)

Cleaner	Vendor	Solution Control		Metal to be Cleaned						Remarks
		Conc. Oz/gal	Temp °F	Fe	Al	Ti	Mg	*[1]	*[2]	
Oakite 161	V44389	0.75-2.5	170-190	X	X	X		X	X	
Spray Altrex	V83339	0.75-2.5	170-190	X	X	X		X	X	
Terj	V72008	0.75-2.5	170-190	X	X	X		X	X	
Turco 4215	V61102	0.75-2.55	145-180	X	X	X		X	X	*[12]
Turco 4215 NCLT	V61102	1-4	120-140	X	X	X		X	X	*[12]
Turco 4215 S	V61102	0.75-2.25	145-180	X	X	X		X	X	*[12]
Spray Cleaners, Heavy Duty (300 psi or more) (Formerly Category M)										
Hazzit	V83339	0.1-2.0	Room	X	X	X		X	X	Re~moves metal chips
Ridoline 50L	V84063	0.1-2.0	Room	X	X	X		X	X	
Electrolytic Cleaners, Heavy Duty, Periodic Reverse (Formerly Category KC)										
Anodex NP-2	V76071	8-16	140-190	X						
Enprep 114, NCLN	V02258	16-32 8-16	130 max	X		X			X	
Enprep 214	V02258	24-48	130 max	X		X			X	
Isoprep 172	V89138, V99442	30-40 (Vol%)	140-180	X						Cd: 100-250 asf *[12]
TSPG	———~—	Ref par. E	70-90	X					X	Cd: 100-250 asf
TSPG	———~—	Ref par. E	120-140	X					X	Cd: 50-200 asf

*[1] Be-Cu, Cd, Cu, Pb, Ag, Sn, Zn, and solder

*[2] Cr, Co, Au, Mo, Ni, and stainless steel

*[3] For nonferrous parts, use 160°F minimum

Table 3: Alkaline Cleaner Selection and Control (Continued)

*[4] Only for ferrous alloys less than 180 ksi.

*[5] Soak only

*[6] Refer to PSD 6-70.

*[7] A Chinese material. Refer to PSD 6-79.

*[8] Do not deionize rinse water used with these cleaners

*[9] Nickel alloy 625

*[10] For energy conservation, use 6-8 oz/gal concentration at 135-145°F

*[11] Refer to BAC 5749.

*[12] Silicate - free

*[13] This cleaner can be operated at concentrations up to 8 oz/gal maximum and temperatures up to 185°F. But the solution must not etch or cause corrosion of the metal surface. A 1 x 2 x 0.050 inch aluminum specimen must not change weight by more than 60 milligrams after 24 hours in the solution at operating conditions. Refer to BAC 5749 for further information.

*[14] Carbon-fiber reinforced bismaleimide (BMI) parts and assemblies.

*[15] Composites BMS 8-212, BMS 8-256, BMS 8-276, but not honeycomb parts.

I. Method 1 – Soak Cleaning

(1) Mix all cleaning solutions again after they are not used for a long time, and after you add chemicals or water, to make sure the concentration stays constant.

(2) Put the parts fully into the cleaning solutions. When possible, shake the parts during the procedure. You can use ultrasonic methods.

(3) Let the parts soak until the dirt is removed and the surface is water break free after the rinse. If necessary, remove dirt and ink marks with alkaline cleaner, solvents, Grade FF pumice or tripoli powder.

J. Method 2 – Spray Cleaning

NOTE: This method is not to be used on magnesium parts.

(1) Light Duty

(a) Metals

1) Spray clean until the contamination is removed and the surface is water-break-free after the rinse.

2) Keep a constant flow of solution at 10-80 psi through a minimum of 90 percent of the nozzles at all times.

(b) BMI composite parts and assemblies

1) Use ALK-660 cleaner as indicated in Table 3.

2) Spray the solution on the parts and let it soak approximately 5 minutes. If necessary, use plater brushes, Scotch-Brite pads or BMS 15-5 wipers and apply more cleaner. Do not let the cleaner dry on the surfaces or collect in pockets.

3) Fully rinse as shown in par. (9)(b) below.

4) Clean and rinse again as necessary until the contamination is gone from the surfaces.

5) Keep a constant flow of solution at 10-80 psi through a minimum of 90 percent of the nozzles at all times.

(c) Epoxy composite parts

1) Spray the solution on the parts and let it soak approximately 1-5 minutes. If necessary, use plater brushes, Scotch-Brite pads or BMS 15-5 wipers and apply more cleaner. Do not let the cleaner dry on the surfaces or collect in pockets.

2) Be sure to clean along rows of fastener holes on each side of the part to remove such unwanted matter as chips and drill lubricant from the holes.

(2) High pressure

(a) Adjust the nozzle pressure to 300-400 psi.

(b) Spray on the solution and then the rinse water, but do not let the part surfaces stay in the spray for more than 10 seconds at a time.

(c) Spray rinse at line pressure.

(d) Visually examine the parts to make sure all metal chips and other solid particles are gone. Clean again if necessary.

K. Method 3 – Electrolytic Cleaning

NOTE: This method is preferred for parts which are to be subsequently plated.

(1) Make electrical connections to the parts. Use a sufficiently large contact area to let the current flow without local heating or metal damage.

(2) Make your selection of cleaner, prepare the solution per par. B. above, and clean the parts per steps (3) and on which follow.

(3) Enprep periodic-reverse-clean procedure for low alloy steel, chromium, cobalt, molybednum, and titanium.

(a) Put the parts in the solution. Start cathodic for 10 to 15 seconds then switch to anodic for 15 to 20 seconds. Use approximately 25-100 amps per square foot, at 6 to 9 volts.

(b) Continue the periodic reverse cleaning for 5 to 10 minutes or until descaled and water break-free surface is obtained. You can use Scotch-Brite pads or pumice or tripoli powder to help remove the dirt, but this must be followed by periodic reverse cleaning.

CAUTION: ALWAYS END WITH ANODIC CLEANING.

(c) Switch to anodic cleaning at 2.5 to 5.0 volts for 2 to 5 minutes.

(4) Enprep periodic-reverse-clean procedure for nickel

(a) If the surfaces have smut, anodically clean for 5 minutes maximum at 30-75 amps per square foot. Then switch to cathodic for 3 seconds at 25-75 amps per square foot. Then switch back to anodic for 10-15 seconds at the same current. Do not use voltage control.

(b) Continue this as required. Then remove loose dirt with Type S Scotch-Brite pads.

(5) TSPG periodic-reverse-clean procedure for low alloy steel, corrosion resistant steel, nickel and chromium.

NOTE: This solution can be operated at 80°F or 130°F.

(a) If the solution is used at 80°F, periodic reverse clean at 100-250 amps per square foot. Use a 20-second anodic cycle and then a 10-second cathodic cycle. Continue this as necessary. For scale removal, 5-20 minutes will be necessary. For activation before plating, 1-2 minutes will be necessary. Always complete the procedure on the anodic cycle.

(b) If the solution is used at 130°F, periodic reverse clean at 50-200 amps per square foot. Use a 20-second anodic cycle and then a 10-second cathodic cycle. Continue this as required. For scale removal, 5-10 minutes will be necessary. For activation before plating, 1-2 minutes will be necessary. Always complete the procedure on the anodic cycle.

(6) Isoprep 172 periodic-reverse-clean procedure for low alloy steel, corrosion resistant steel, nickel and chromium

(a) Put the parts completely in the solution.

(b) Periodic reverse clean at 25-70 amps per square foot, with the part alternately anodic for approximately 20 seconds and cathodic for approximately 10 seconds. Always start and end on the anodic cycle. Use only current control. Then the voltage will typically be 1.7-4 volts dc.

(c) On low alloy steel, for removal of heavy scale or rust, 5 to 15 minutes will be necessary. For activation of abrasive cleaned surfaces, 4 to 10 minutes will be necessary.

(d) On PH steel, for removal of heavy scale or rust, 5 to 20 minutes will be necessary, along with a light abrasive cleaning. For activation of abrasive cleaned surfaces, 3 to 10 minutes will be necessary.

(7) Anodic Cleaning

(a) Put the parts completely in the electrolytic solution.

(b) Anodically clean for 1 to 10 minutes at the indicated current density:

1) Cobalt, nickel – 5-10 amps per square foot

2) Ferrous, silver, tungsten or their alloys – 5-50 amps per square foot

3) Copper – 5-15 amps per square foot for 5-15 seconds. As an option, you can switch to cathodic for 5-15 seconds.

(c) Do not use acid activation after this anodic cleaning-activation step.

(8) Rinsing

(a) Metal parts

1) Parts can be spray rinsed or immersion rinsed after they are alkaline cleaned. Do not immersion rinse parts from alkaline solutions in tanks used to rinse parts from acid solutions, unless there is a sufficient flow of water into the tank to be sure that insoluble materials stay mixed in the solution and do not collect on part surfaces.

2) When you rinse the parts, do not let the cleaner dry on the surfaces. Make sure you hit all surfaces of the parts with the spray. Parts must be water-break-free after the rinse.

3) A spray rinse is recommended before the immersion rinse to remove cleaner and to prevent dried cleaner. In the immersion rinse, soak the parts for 5 minutes or more, and shake the part or the rinse water to help remove the cleaner.

(b) Composite parts

1) Rinse a minimum of three times with clean water, 120 degrees F. or cooler. Spray the water on the parts with pressure of 200 psi maximum, or flush the parts. In areas which could collect water, rub with a clean wet cloth or sponge. Wring out the cloth or sponge with fresh water and wipe the surfaces a minimum of two more times. Be sure to rinse all holes for fasteners.

2) Examine the surfaces for complete removal of contamination. Clean again if necessary.

3) Spray rinse the parts. Do not let cleaner dry on the parts. Make sure you hit all surfaces of the parts with the spray. Water break free surfaces are not necessary, but if the rinse water makes beads on the surfaces it is a sign of incomplete contamination removal.

(9) Post Rinse

(a) Dry the metal and composite parts unless a wet procedure immediately follows. Keep the parts dry and free from oils, grease, fingerprints or other contamination. Wrap parts in paper if necessary.

(b) Unless a wet procedure follows, composite parts must be fully dried, by ambient air or heated air, or for a maximum of 30 minutes in a dryer with air no hotter than 140 degrees F.

7. EMULSION CLEANING (IMMERSION AND SPRAY)

A. Emulsion cleaners are used to remove heavy soils, oil and grease from parts or to prevent carryover of contaminants into subsequent processing tanks. This is Type 1 cleaning per BAC5763.

B. Materials

(1) Aerowash, V71410

(2) Turco 3878 (Formerly Emul-Klene), V61102

(3) Turco 3878 LF-NC (Formerly Emul-Klene LTNF), V61102

(4) Turco Jet Clean C, V61102

(5) Formula 28, V89138 or V99442

(6) Cee-Bee A-7X7, V71361

(7) Cee-Bee A-7X7 LF, V71361

(8) Solvent – Aliphatic naphtha, TT-N-95, Type 1 (Replaces BMS 3-2 Type 1) (Ref SOPM 20-60-01)

C. Preparation of solution (For each 100 gallons of final solution)

(1) Add 10 gallons of water to tank.

(2) Slowly add quantity of cleaner shown in Table 4 and mix fully.

(3) Slowly add 64 gallons of solvent and mix fully.

NOTE: As an option, these cleaners can be used without solvent: Turco Jet Clean C, Turco 3878, and Turco 3878 LF-NC.

(4) Add water as necessary to make 100 gallons of final mixture and mix fully.

Table 4: Emulsion Cleaning Solution Makeup and Control

	IMMERSION CLEANING		SPRAY CLEANING			
CLEANER	MAKEUP *[1]	CONTROL *[2]	MAKEUP *[1]	CONTROL *[2]	TEMP °F	AGITATION
Aerowash	20	18-20	20	18-20	Ambient	Fast
Turco 3878	20	18-20	Do not use		140 Max	Med.
Turco Jet Clean C	25	20-30	25	20-30	Ambient	Med.
Formula 28	12	10-12	Do not use		Ambient	Slow
Cee Bee A-7X7	25	20-25	Do not use		140 Max	Med.

Table 4: Emulsion Cleaning Solution Makeup and Control (Continued)

CLEANER	IMMERSION CLEANING		SPRAY CLEANING		TEMP °F	AGITATION
	MAKEUP *[1]	CONTROL *[2]	MAKEUP *[1]	CONTROL *[2]		
Cee Bee A-7X7 LF *[3]	15	10-25	Do not use		120-140	Fast
Turco 3878 LF-NC *[3]	15-25	10-25	Do not use		140 Max	Med. to Fast

*[1] Gallons of cleaner per 100 gallons final solution.

*[2] Volume percent cleaner in the solution.

*[3] Approved to use in Turbulator (V61102). Then keep the temperature above 120°F to minimize foam.

D. Immersion Cleaning

(1) Put parts in the solution for 5-30 minutes as necessary for the dirt to be removed.

(2) Unless tank solutions are vigorously agitated, lift out and put parts back into the solution again and again during the procedure to remove all oils and greases.

(3) Rinse fully, best in warm water (90-140°F), for 5 minutes minimum. A spray or agitated immersion rinse is best to help emulsification and dirt removal.

(4) Continue with other procedures as quickly as possible after emulsion cleaning.

E. Spray Cleaning

(1) Spray parts with cleaning solution for 5-20 minutes. Parts must be in racks to let the spray touch all portions of parts.

(2) Rinse fully, best in warm water (90-140°F), for 5 minutes minimum. A spray or agitated immersion rinse is best to help emulsification and dirt removal.

(3) Continue with other procedures as quickly as possible after emulsion cleaning.

F. After this procedure, the surfaces must be free from all grease, oil, grease pencil marks and other organic contamination. Because this Type 1 emulsion cleaning is usually followed by other cleaning procedures, a water-break-free surface is not necessary at this time.

8. MANUAL CLEANING (COLD ALKALINE, SOLVENT EMULSION AND FOAM CLEANERS)

A. This manual cleaning of surfaces with liquid water base alkaline cleaners, solvent emulsion cleaners, and foam cleaners comes from BAC5744. This procedure can be used on all metals, plastic, and painted surfaces.

B. Materials

(1) Calla 301 or 301A, V19457

(2) Cee Bee A-410B, V71361

(3) Cee Bee 280, V71361

(4) Cee Bee 280TC, V71361

(5) Cleaners per MIL-C-25769

(6) DuBois C-1102, V72008

(7) Formula 28, V89138 or V99442

(8) Hydrex 09, V8V521

(9) Intex 8201, V78304

(10) Intex 8239, V78304

(11) Metaclean AC, V98364

(12) Navee 427, V56883

(13) Oakite 202, V44389

(14) Oakite 204, V44389

(15) Pacific B-82, V93965

(16) Pennwalt 2271R, V99987

(17) Solvent P-D-680 (Ref SOPM 20-60-01)

(18) Tec No. 1, V25227

(19) Tec 82-2, V25227

(20) Turco Jet Clean C, V61102

(21) Turco Jet Clean E, V61102

C. General

CAUTION: BE SURE NOT TO LET CLEANERS OR RINSE WATER GET INTO INTERFACES BETWEEN TOOLS (SUCH AS LIFT FITTINGS) AND THE PART. FLUIDS CAUGHT BETWEEN TOOLS AND PARTS WILL CAUSE CORROSION OF METAL SURFACES.

CAUTION: CONCENTRATED CLEANERS CAN CAUSE DETERIORATION OF PAINTED SURFACES, CADMIUM PLATING AND ALUMINUM ALLOYS. WE DO NOT RECOMMEND CONCENTRATED CLEANERS ON THE COMPLETED AIRPLANE, OR ON PAINTED SURFACES.

(1) Use equipment such as power brushes, nonatomizing liquid spray, or low pressure liquid flush.

(2) Mask off all areas not to be cleaned. This includes lubricated or waxed surfaces. Use a water resistant maskant such as polyethylene sheet, grease proof paper, or laminated waterproof paper. Use masking tape when necessary.

(3) Dry the cleaned surfaces unless wet processing immediately follows. Keep the surfaces dry and free of all contamination when they will get conversion coating, paint or sealant.

D. Method 1 - General Cleaning with Water Base Alkaline Cleaners

(1) Mix the cleaning solution per Table 5.

(2) Apply the cleaning solution. For large assemblies, use nonatomizing spray equipment, swabs, or brushes. For small areas, use clean rags, brushes, or sponges. Do not clean too large an area at one time.

(3) Let the cleaners soak for approximately 5 minutes. Do not let the cleaner dry on the surface. Scrub if necessary, and apply more cleaner if the dirt is not gone.

(4) Rinse fully with clean water. Warm water (120°F maximum) is recommended. Rinse three or more times. Apply water by pressure spray or flush with water if possible. For confined areas, small touchup, or where water could be caught, rinse with a clean wet cloth or sponge. Wring out the cloth or sponge with clean water and rinse again two or more times.

(5) Look for remaining dirt on the surface during the rinse. Look for water breaks if a water break free surface is specified.

(6) Clean again if necessary.

(7) Dry the surfaces unless wet processing immediately follows.

Table 5: Manual Cleaning Solutions

	Dilution Ratio (Number of Volumes of Water Added to One Volume of Cleaner)		
	Light Soil	**Moderate Soil**	**Heavy Soil**
Calla 301 or 301A	10	4	3
Cee Bee A-410B *[1]	–	*[2]	–
Cee Bee 280	10	4	2
Cee Bee 280TC *[3]	–	*[2]	–
Cleaners per MIL-C-25769	10	6	3
DuBois C-1102	10	4	3
Formula 28 *[4]	10	4	2
Hydrex 09	10	6	3
Intex 8201	20	10	2
Intex 8239	20	10	*[2]
Metaclean AC	10	4	2
Navee 427 *[5]	10	2	2
Oakite 202 *[6]	10	4	2
Oakite 204	10	4	2
Pacific B-82	7	3	2
Pennwalt 2271R	10	3	2
Tec No. 1	10	4	2
Tec 86-2	–	–	3
Turco Jet Clean C *[7]*[4]	20	5	3
Turco Jet Clean E	–	–	3

*[1] Do not use on surfaces painted with EC 843 Corogard.

*[2] Use full strength. Do not dilute.

*[3] For cleaning of polish residue from aluminum skins only.

*[4] Can be used undiluted for cleaning before manual chemical conversion treatment. Do not let this cleaner dry on parts, because stains could result.

*[5] Do not let the solution touch acrylic plastics. Deterioration can occur.

*[6] Use this cleaner on titanium only.

*[7] Do not use on exterior decorative areas painted with BMS 10-4 enamel (obsolete).

E. Method 2 – Heavy Duty Cleaning using Solvent Emulsion Cleaners

CAUTION: CONCENTRATED CLEANERS WILL CAUSE PAINTED SURFACES TO DETERIORATE AND CAN ATTACK CADMIUM PLATING AND ALUMINUM ALLOYS UNLESS USED WITH DISCRETION. USE OF CONCENTRATED CLEANERS ON COMPLETED AIRCRAFT, OR PAINTED SURFACES, IS NOT RECOMMENDED.

(1) This method of cleaning shall be used for cleaning and/or precleaning of areas and surfaces containing heavy concentrations of soil, grease or carbon deposits. It will not produce a water break free surface.

(2) Mask off all areas not to be cleaned.

(3) Static ground all aircraft or large assemblies.

(4) Mix one part by volume alkaline cleaner with two parts water and five to six parts solvent. Vigorously agitate solution until thick creamy emulsion is formed.

(5) Thoroughly mix solution before each application.

(6) Apply solution with swabs, brushes or sponge.

(7) Allow cleaner to soak for 5 to 10 minutes. Do not allow cleaners to dry on surface. Scrub if required and reapply cleaner if soil has not been removed.

(8) Thoroughly rinse, then check surfaces for complete soil removal during rinsing. Reclean and rinse as necessary.

(9) Dry parts unless subsequent wet processing is to follow.

(10) On parts to be painted and all parts that require a water break free surface, reclean per Method 1 (Paragraph 8.D. above).

(11) Dry surfaces except where wet processing immediately follows.

F. Method 3 – Foam Cleaning

(1) Foam cleaning is used where prolonged contact without drying or draining is required. Cleaning by this method is similar to Method 1 except in the application of the cleaner.

(2) Fill tank of a foam generator with a solution of 1 part alkaline cleaner mixed with 10-20 parts water. If foam generator is not available, produce foam from same solution by whipping or other means of agitation.

(3) Apply heavy coating of foam to all soiled areas. Surface may be wet with water before applying foam.

(4) Allow cleaner to soak 5-15 minutes. Do not allow cleaner to dry on surface. Scrub if required and reapply cleaner if soil has not been removed.

(5) Thoroughly rinse per Paragraph 8.D.(4). Check surface for complete soil removal during rinsing. Reclean and rinse as necessary.

(6) Check for water breaks if a water break free surface is required.

(7) Dry surface except where wet processing immediately follows.

G. Method 4 – Cleaning Interior Surfaces of Vessels or Tubes

(1) When the interior surfaces are partially accessible, manual cleaning methods can be used to supplement other methods of cleaning. For vessels or tubes that cannot be shaken or inverted, follow procedure except completely fill the vessel and agitate the solvent or solution if possible. If agitation is impractical, allow the solvent or solution to contact the surfaces for at least 5-10 minutes.

(2) If the interior surface is coated with excess oil or grease and vapor degreasing is not practicable, remove the unwanted oil or grease by flushing with solvent. Then fill the vessel or tube 1/4 to 1/3 full with solvent and shake or agitate the solvent to wet all surfaces. Drain the used solvent.

(3) Mix alkaline cleaner per Table 5. Use dilution ratio for heavy soil unless it is known that the soil on the interior surface can be removed with a more dilute solution.

(4) Plug holes as required to retain liquid cleaner.

(5) Fill vessel or tube 1/4 to 1/3 full with cleaning solution. Use appropriate methods to invert or shake the parts. Be sure to wet all surfaces. Allow cleaner to contact surfaces for at least 5 minutes.

(6) Drain used cleaner from the part. Repeat preceding step with fresh cleaning solution.

(7) Rinse thoroughly with clean water, preferably warm (120°F maximum).

Rinse until the water does not appear foamy (three times minimum).

(8) Dry surface except where wet processing immediately follows.

H. Method 5 – Immersion Cleaning

(1) When the part can be put into a solution, make a solution of alkaline cleaner per Table 5 and let the part soak in it for 5 minutes minimum. Scrub if necessary. Soak the part again if necessary. Do not let the cleaner dry on the surface of the part.

(2) Fully rinse with clean water, preferably warm (120°F maximum).

(3) Examine the surface for complete dirt removal during rinsing, and for water breaks if a water break free surface is specified. Clean again and rinse as necessary.

(4) Dry the surface unless wet processing immediately follows.

9. ABRASIVE CLEANING

A. General

WARNING: DO NOT BREATHE ABRASIVE DUSTS. PROVIDE VENTILATION AS REQUIRED.

(1) Preclean the parts before you abrasive clean them.

CAUTION: DO NOT VAPOR DEGREASE OR USE CHLORINATED SOLVENTS ON TITANIUM PARTS THAT WILL BE IN TEMPERATURES OF 600°F (316°C) OR ABOVE DURING SUBSEQUENT WORK OR ON THE AIRPLANE.

(a) Metal parts – vapor degrease, manual solvent, emulsion, or alkaline clean, as applicable.

(b) Plastic, wood, or painted parts – manual solvent, emulsion, or alkaline clean as applicable.

(2) Penetrant examine, if specified, before blast cleaning.

(3) Be careful not to blast local areas too much. Use fine abrasives and low air pressure on thin or low strength sections.

(4) When you blast plastic laminates, be careful not to remove material down to the glass fibers. Adjust the nozzle-to-work distance, air pressure and nozzle traverse rate as necessary to prevent damage.

(5) When you blast clean before plating or painting, use abrasives that are without contamination such as grease, plastics or silicones.

(6) Do not let corrosion-resistant steel, and nickel and cobalt base alloys, become contaminated during abrasive cleaning.

(a) Corrosion resistant steel, nickel and cobalt base alloys can all use the same abrasives. Use only nonmetallic abrasives on these metals. Label these abrasives "For Use on Corrosion Resistant Steel and Nickel and Cobalt Base Alloys Only."

(b) Use completely different abrasives on titanium, molybdenum, columbium, tantalum, and tungsten.

(7) Glass Beads

(a) For precision cleaning, glass beads must be spherical. Broken beads are abrasive and cause faster material removal as the parts are blast cleaned. Screen the beads as necessary to remove broken beads.

(b) Recommended air pressures are as follows:

Ferrous, nickel, cobalt, titanium, and tungsten alloys	40-60 psi
Aluminum alloys	30-50 psi
Magnesium alloys	10-40 psi
Reinforced plastics	10-20 psi

B. Dry Abrasive Cleaning

(1) Preclean as necessary.

(2) Mask as required, with materials resistant to the abrasive blast, such as wood, rubber, vinyl tape, or Teflon tape.

(3) Get the abrasive. Recommended abrasives for steels heat treated to 220 ksi and over are 100-180 grit aluminum-oxide, garnet, zirconia-alumina, novaculite silica, or 170-400 mesh glass beads. For class 3 chrome plating (SOPM 20-42-03), 80-120 grit abrasive of these materials is recommended. BAC5748 gives more details.

(4) Dry abrasive blast.

(5) Remove all grit and other contamination from the part.

(6) Clean with clean, dry, filtered air.

(7) When subsequent processing cannot be completed in 24 hours (4 hours for steel heat treated 220 ksi or over) give the parts protection immediately after cleaning. Use water soluble rust preventive compounds such as Oakite 98 (V44389) or Wyandotte R-2 (V89339), or preservative oil such as Oakite Special Protective Oil (V44389) or per 20-44-02, Type 3, Class 2, Grade B.

C. Wet Abrasive Cleaning

CAUTION: DO NOT USE WET ABRASIVE BLASTING ON STEEL HEAT TREATED 220 KSI OR ABOVE.

(1) Preclean as necessary.

(2) Mask as necessary.

(3) Get the abrasive. BAC5748 gives recommended selections.

(4) Wet abrasive blast.

(5) Rinse metal parts with water or clean with clean, dry, filtered air. Do not use air pressure over 50 psi.

(6) Dry parts unless more wet processing immediately follows. Keep parts clean. Wrap parts or apply protective coatings as necessary.

10. STEAM CLEANING

A. This procedure covers steam cleaning where special equipment is used to discharge a mixture of steam and hot cleaning solution under pressure. The discharge provides for pressure blast washing to remove soil.

CAUTION: DO NOT STEAM CLEAN STEEL PARTS HEAT-TREATED ABOVE 220 KSI. THIS RESTRICTION APPLIES TO BARE METAL, AND CADMIUM OR CADMIUM-TITANIUM PLATED PARTS.

B. Except as noted, steam cleaning is acceptable on most bare metals and some painted surfaces. It is used especially for removing heavy soils from assemblies.

C. Steam cleaning equipment usually includes a steam generator, mixing tank, controls, discharge nozzles, and all associated hoses.

D. General

(1) After cleaning, the surfaces must be free of oil, grease, dirt, and other soil.

(2) When you mask windows or cavities, or to protect other parts, use materials that are strong enough, when wet, to withstand direct blast from nozzle.

WARNING: RESTRAINING FORCE IS REQUIRED TO DIRECT DISCHARGE NOZZLE. BE SURE THAT OPERATOR IS FIRMLY STATIONED BEFORE TURNING NOZZLE ON.

CAUTION: STEAM CLEANING CAUSES DAMAGE TO SOME PAINTED SURFACES. CLEAN ONLY SURFACES AS AUTHORIZED IN SPECIFIC OVERHAUL INSTRUCTIONS AND DO NOT ALLOW OVERSPRAY TO CONTACT RESTRICTED SURFACES.

E. Cleaning

NOTE: The following are general instructions on use of steam cleaning equipment. Use instructions furnished with equipment, or techniques for special cleaning problems, to supplement general instructions.

(1) Fill mixing tank with 2 to 4 ounces of steam cleaning compound (Ref SOPM 20-60-01) per gallon of water.

(2) Adjust equipment so that discharge from nozzle is mixture of steam, water and cleaning solution at approximately 0.2 to 0.5 ounce per gallon. Check by noting that total discharge from nozzle is approximately 10 times volume of dilute cleaner solution used.

(3) Hold nozzle at an angle of approximately 45 degrees and 8 to 10 inches from surface being cleaned. Nozzle may be held at greater distance for removing light soil or for rinsing.

(4) Move nozzle over surface at approximately 6 inches per second. Several rapid passes are better than one slow pass.

(5) Clean only as large an area as can be kept wet with cleaner starting with lower surfaces and working up. Do not allow cleaning solution to dry on metal surfaces.

(6) Rinse surface with condensate or warm water. Rinse at least three times.

(7) Determine adequate rinsing by touching wet surface with red litmus paper. If paper turns blue, rerinse until no blue color is obtained.

NOTE: Check for adequate rinsing, especially at faying surfaces and other places where cleaner may be entrapped.

(8) Allow surface to drain dry.

F. Removal of BMS 10-17 Coating

(1) BMS 10-17 is a water soluble antiscuff and anticorrosion coating, sometimes applied to spare aluminum alloy sheets and panels for shipment and storage. BMS 10-17 coating shall be removed before or immediately after assembly of the part.

(2) Remove BMS 10-17 coating as follows:

(a) Adjust equipment so that discharge from nozzle is mixture of steam and cleaner solution, with a concentration of 0.2 to 0.5 oz/gal cleaning compound in solution at nozzle.

(b) Direct steam cleaning solution from nozzle at an angle approximately 45 degrees to, and at a distance of 8 to 12 inches from, surface being cleaned.

(c) Speed of pass over area shall be approximately 6 inches per second. Do not direct steam at one place on surface for any length of time. Several rapid passes are better than one slow pass.

(d) Starting from lower surfaces and working up, work only as large an area as can be kept wet with cleaner solution.

(e) Rinse each of these areas, including those areas splashed with cleaner solution, with steam condensate, pressurized hot or cold water.

(f) Scrub surface lightly with brush while surface is still wet, to remove white residue.

11. CLEANING OF INTERIOR PAINTED AND PLASTIC SURFACES

A. This procedure is used for removing soft or cured soils on all interior plastics and painted surfaces except windows. Refer to Document D6-7127 for more data.

CAUTION: USE ONLY THE CLEANING MATERIALS SPECIFIED. OTHER MATERIALS COULD DAMAGE PLASTICS. THE DAMAGE COULD BE IMMEDIATE BUT NOT DETECTABLE VISUALLY.

B. Materials

(1) Detergent Cleaners

Cleaner (1 part)	Water (parts minimum)
Spraywhite E, V89138 or V99422	10
Clean Quick, V74188	64
Glo Do-All Formula, V34364	30
Orvus W.A. Paste, V74188	30
Winsol SE-700, V62976	20
Calla 301A, Lemon or Standard, V19457	3
Winsol APC-120WX or APX-120WX, V62976	32

Other detergent cleaners can be used if they are acceptable in the polycarbonate crazing test of par. C.

(2) Solvent Cleaners

(a) Aliphatic Naphtha – TT-N-95

(b) Freon TF, V18873

(3) Miscellaneous Materials

(a) Wipers (cheesecloth, gauze, cotton cloths, rymple cloth) – BMS 15-5, Class A

(b) Sponges, cellulose – L-S-626

(c) Hand brush, soft fiber

C. Polycarbonate Crazing Test

(1) Test specimens – Two Lexan 9600-116 sheets 0.055-0.065 inch thick

(2) Equipment

(a) Cylinder with 10.2-inch outside diameter

(b) Cotton swatches

(3) Test Procedure

(a) Load each specimen to give it an outer fiber stress of 2000 psi. You can get this stress if you wrap the test specimen around the 10.2-inch diameter cylinder.

(b) Give the edges of the specimen protection from the cleaner to be tested.

(c) With each specimen under stress, put an absorbent cotton swatch wet with the undiluted cleaner to be tested on one specimen. Put another cotton swatch wet with the diluted cleaner on the other specimen. Be careful not to let the cleaners touch the edges of the specimens.

(d) After 10 minutes, remove the load and the cotton swatches. Examine the specimens for cracks or crazing.

(e) If the specimens have signs of cracks or crazing, the tested cleaner is unacceptable.

D. Opaque Plastics and Painted Surfaces

(1) Regular Cleaning

(a) Make detergent solution per par. B.(1) above.

(b) Apply the detergent solution with a sprayer or a sponge.

(c) Let the solution stay on the surface 30 seconds to 2 minutes. Then wipe with a damp cloth.

(d) Rinse the surface with a clean wiper soaked with clean water.

(e) Wipe the surface dry with a clean dry cloth.

(2) Spot Cleaning of Soft or Uncured Dirt

(a) If applicable, remove excess dirt with a dry wiper. Do not smear or spread the dirt or force the dirt into textured or perforated surfaces, or joints or seams.

(b) Make detergent solution per par. B.(1) above.

(c) Apply the detergent solution to the dirty area with a hand sprayer or a sponge.

(d) Carefully wipe the area clean. When you clean textured surfaces, use a soft fiber brush. Lightly scrub the dirty area to remove dirt from recessed areas.

(e) Rinse the area with a sponge wet with clean water.

(f) Wipe the area dry with absorbent paper toweling, with parallel strokes. If the dirt is not gone, use the procedure for cured or set dirt in par. D.(3) below.

(3) Spot Cleaning of Cured or Set Dirt

CAUTION: DO NOT USE THIS PROCEDURE ON ABS, ACRYLIC, POLYCARBONATE, POLYCARBONATE LAMINATES, OR POLYSULFONE PLASTICS, BECAUSE THE SOLVENTS USED COULD PERMANENTLY DAMAGE THESE PLASTICS.

(CAUTION PRECEDES)

CAUTION: DO NOT USE THIS PROCEDURE TO CLEAN AREAS PAINTED WITH WATER-BASED PAINT, BECAUSE THE SOLVENTS WILL DAMAGE SUCH PAINT. IF DETERGENTS CANNOT REMOVE CURED OR SET DIRT FROM THE WATER-BASED PAINTED SURFACE, THEN THE SURFACE MUST BE PAINTED AGAIN. NAPHTHA CAN BE USED, BUT THE PARTS MUST BE REMOVED FROM THE AIRPLANE.

(a) When you use this procedure, keep to minimum the time the solvent is on the surface. Do not use too much solvent.

(b) Apply trichloroethane, tetrachloroethylene, or Freon TF solvent to a wiper.

(c) Put the wiper on the dirty area and wipe carefully. The dirt will usually become soft.

(d) Apply more solvent to the wiper as necessary.

(e) On textured surfaces, after the solvent was applied to the dirt, scrub the area carefully with a soft fiber brush.

(f) Carefully wipe the area with a wiper wet with solvent.

(g) After the dirty spot is removed, clean the area with detergent per step D.(1) above, to remove remaining dirt and solvent.

(4) Spot Cleaning of Solvent-Sensitive Parts

(a) Use this procedure to clean ABS, acrylic, polycarbonate, and polysulfone surfaces, if solvent is necessary to remove the dirt.

(b) As applicable, blot up excess dirt with wipers. Be careful not to spread the dirt.

WARNING: USE ALIPHATIC NAPHTHA WITH SUFFICIENT VENTILATION AND WEAR PROTECTIVE GLOVES. DO NOT APPLY THIS SOLVENT WITH AIR SPRAY. DO NOT USE ALIPHATIC IN THE AIRPLANE. THIS SOLVENT IS VERY FLAMMABLE.

(c) Wipe the dirty spot only with a wiper wet with Freon TF (except use aliphatic naphtha only on surfaces painted with water base paint).

(d) After the dirty spot is removed, clean the area with detergent per par. D.(1) above, to remove remaining dirt and solvent.

E. Translucent and Transparent Plastic Surfaces Except Windows

CAUTION: DO NOT WIPE OR RUB THE SURFACE WITH A DRY CLOTH, BECAUSE THAT WILL CAUSE SCRATCHES AND STATIC ELECTRICITY. DO NOT USE ABRASIVE CLEANERS ON DUST COVERS. DO NOT LET OTHER SOLVENTS TOUCH THE PLASTIC SURFACES, OR PERMANENT DAMAGE COULD OCCUR.

(1) Wipe the surface lightly with a cloth wet with Freon TF or detergent.

(2) Rinse the surface with a cotton flannel wiper wet with water.

(3) Dry the surface with a clean cotton flannel wiper wet with water. Do not rub the surface after the plastic is dry.

(4) To remove a light dust layer or static charge, wipe the surface with a clean cotton flannel wiper wet with water.

12. CLEANING, DESCALING AND SURFACE PREPARATION OF FERROUS ALLOYS

A. This section summarizes processes for removal of scale and contamination from ferrous alloys (which includes passivation of corrosion resistant steels), and for the preparation of ferrous alloys for plating or other finishing operations. Refer to BAC5625 for details.

B. General

(1) Before you use acid processing solutions on parts heat treated 180 ksi or higher (160 ksi or higher if externally threaded), make sure the parts were stress relieved per SOPM 20-10-02. Unless specified, this stress relief is not necessary on CRES A286, 300-series, and 17-7PH (CH-900 condition).

(2) Put parts fully into the processing solutions to prevent localized attack. Assemblies with faying surfaces can be immersion processed if all joints are sufficiently sealed or if they are:

(a) Corrosion-resistant steels when BAC5625 Method II, Procedures A or C are used.

(b) Welded corrosion-resistant steel assemblies with open faying surfaces but without heat scale.

(3) Surfaces must be water-break-free following immersion in any processing solution or rinse except following vapor degreasing, solvent cleaning or emulsion cleaning.

NOTE: A water-break-free surface is a surface which 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.

(4) Rinse parts free of active materials immediately following each processing step (with the exception of vapor degreasing).

(5) Unless specified by overhaul instructions, after acid processing, give a hydrogen embrittlement relief bake to all parts heat-treated 180 ksi or higher (160 ksi or higher if externally threaded) at 350-400°F for 3 hours minimum. This bake requirement is not applicable to:

(a) Parts to be plated immediately

(b) Sheet material less than 0.125 inch thick

(c) Parts which will be baked for the same or a longer time at the same or a higher temperature during subsequent processing, e.g., brazing or adhesive bonding

(d) Corrosion resistant steels 300-series and A286

(e) Steels 15-5PH, 17-4PH, and 17-7PH, or other PH steels below 200 ksi

(f) Steel 17-7PH in the CH-900 condition

(g) Corrosion-resistant steels passivated or decontaminated in nitric acid processing solutions (Solution 14 and 22 in BAC5625).

(h) Carburized parts and hardened 440A, B, or C CRES parts. Bake these parts at 250-300°F for 5 to 8 hours.

WARNING: THE SOLUTIONS THAT CONTAIN CYANIDE SALTS ARE VERY POISONOUS. DO NOT LET ACID GET INTO THE SOLUTIONS. DO NOT GET SOLUTIONS IN EYES, ON SKIN, OR ON CLOTHING. DO NOT BREATHE THE MIST OR VAPOR. KEEP FROM HEAT, SPARKS AND OPEN FLAME. WASH HANDS BEFORE YOU EAT OR SMOKE.

(WARNING PRECEDES)

CAUTION: JOINTS WITH LARGE EXPOSED AREAS OF BRAZING ALLOY CAN BE DAMAGED IN LESS THAN 5 MINUTES. TO BE SURE PARTS WILL NOT BE DAMAGED, TRY THE PROCEDURE ON TEST JOINTS FIRST.

(6) When necessary, brazed parts can stay in nitric acid solutions for a maximum of 5 minutes.

C. Parts Requirements

(1) After these procedures, the surfaces must not have grease, oil, pencil marks, fingerprints, foreign metal, heat-treat scale, thermal discoloration or other contamination, unless otherwise specified by the overhaul instructions. If the parts are unsatisfactory, they must be abrasively processed per BAC5625 Method IV or V, or chemically reprocessed (within total descaling or decontamination time limits).

(2) Thickness of the metal after descaling must not be less than the minimum thickness permitted by the applicable overhaul instructions.

13. CLEANING, DESCALING AND SURFACE PREPARATION OF TITANIUM AND TITANIUM ALLOYS

A. Scope

(1) This topic gives general procedures and precautions to remove scale and contamination from titanium and titanium alloys, and to clean and prepare titanium alloys for welding, finishing, and machining operations. For more details, refer to BAC5753.

(2) BAC5753 also tells when to etch the titanium parts. The preferred method to remove more than 0.003 inch of metal per side is to chemical mill per BAC5842.

B. General

(1) During descaling or etching with nitric-fluoride etch solutions:

(a) Rack the parts so that they do not touch other metals. Parts can touch each other on edges.

CAUTION: BE SURE TO USE RACKS AND EQUIPMENT OF CORRECT MATERIAL. PARTS CAN GET PITS OR OTHER DEFECTS BY GALVANIC ACTION WHEN THEY TOUCH DISSIMILAR METAL.

(b) Use fixtures (such as racks, clamps and baskets) made as follows:

1) Metallic, and made of HS25, or Hastelloy X, or 300-series corrosion-resistant steel or Carpenter 20 alloy.

2) Nonmetallic, and made of PVDC, Koroseal, polypropylene, Teflon, polyethylene, or PVC.

3) Coated with the same nonmetallic materials as in 2) above. The coating must be continuous and must not let the solutions soak through to the base metal of the fixture.

(2) Do not put assemblies in the nitric-fluoride etch solutions unless:

(a) Adhesive - bonded joints have the faying surfaces completely sealed by a fillet bead.

(b) Joint areas are masked with BAC5034, Type 1, Class 2 or other temporary coatings (SOPM 20-44-02).

(3) Bare metal surfaces must be water-break-free after they were in any final rinse, unless specified by overhaul instructions. (Parts with coatings are not required to be water-break-free until coatings are completely removed.) Clean parts again if they have water breaks.

NOTE: A water-break-free surface is a surface which keeps a continuous water film for at least 30 seconds after it was sprayed or immersion rinsed in clean water at a temperature below 100°F.

CAUTION: VAPOR DEGREASING OF TITANIUM IS LIMITED BY SOLVENT IF THE PARTS WILL BE IN HEAT HIGHER THAN 550 DEGREE F. SUCH PARTS MUST BE ACID CLEANED AFTER VAPOR DEGREASING. DO NOT VAPOR DEGREASE ASSEMBLIES OF TITANIUM THAT COULD KEEP SOLVENT INSIDE. THIS INCLUDES ASSEMBLIES THAT ARE ADHESIVE BONDED, MECHANICALLY FASTENED, TACK WELDED, OR SPOT WELDED.

(4) If the titanium parts will be in heat higher than 550°F during subsequent processing or service, they can be vapor degreased only with these solvents:

(a) Perchloroethylene or 1,1,1-trichloroethane (methyl chloroform). Then acid clean the parts per BAC5753 Method 1 or 2.

(b) Trichloroethylene. Then acid clean the parts per BAC5753, Method 2 only.

(5) If the titanium parts will not be in heat higher than 550°F, you can vapor degrease them with any approved solvent. Acid cleaning to remove the degreaser residue is not necessary.

(6) Give the cleaned parts protection from oil, grease and fingerprints when parts are to be welded, heat-treated, hot-formed, bonded, or painted. If parts or material are to be otherwise fabricated or assembled, special handling for cleanliness is not required.

C. Parts Requirements

(1) After processing, surfaces must have no grease, oil, pencil marks, fingerprints, foreign metal contamination, heat-treat scale, or oxidation contamination, unless permitted by the overhaul instructions.

(2) All parts must have a 63 microinch or smoother surface finish after processing, unless specified by the overhaul instructions.

(3) The thickness of the metal after descaling must not be less than the minimums given by the overhaul instructions.

(4) After cleaning, all parts must have no pitting, notching or nonuniform etching.

(a) Reject pitted or notched parts if the remaining metal thickness is not within the dimensions specified by the overhaul instructions. Pitting damage frequently occurs because unwanted matter comes onto the parts before heat treatment. Notching damage can occur because of galvanic action when titanium parts are in point or line contact with dissimilar metals during etching.

(b) Reject parts for nonuniform etching if surfaces are preferentially etched deeper than that permitted by the overhaul manual instructions, or if raised areas or islands are higher than 0.001 inch. Nonuniform etching occurs when heat-treat scale is not completely removed by scale conditioning or flash etching before the significant etching. Islands can also occur where titanium surfaces touch racking materials during etching. Sanding per BAC5748 can be used as part of the normal cleaning procedure to decrease or remove islands to meet the maximum height requirement.

(5) If the overhaul instructions cut or machine the titanium parts, these limits are also applicable:

(a) Parts must be rejected if the width of the pit or notch is less than 10 times the depth.

(b) Parts must be rejected if surfaces are preferentially etched to a depth greater than 0.0005 inch, or raised areas or islands are higher than 0.0005 inch. Sanding per BAC5492 may be used as part of the normal cleaning procedure to reduce or remove islands to meet the maximum height requirement.

14. CLEANING, DESCALING AND SURFACE PREPARATION OF NICKEL AND COBALT BASE ALLOYS

WARNING: MANY OF THE ABRASIVES AND CHEMICALS USED IN THIS PROCEDURE ARE FLAMMABLE, CORROSIVE OR TOXIC. REFER TO FIRE, INDUSTRIAL HYGIENE AND SAFETY ORGANIZATIONS, FACILITIES, FOR SAFE OPERATION OF EQUIPMENT AND VENTILATION.

A. This topic gives general procedures and precautions for the removal of scale and contamination from nickel and cobalt base alloys, and to prepare these alloys for plating or other finishing operations. For details, refer to BAC5758.

B. General Procedures

(1) Completely immerse parts in processing solutions to prevent localized attack, unless otherwise specified in overhaul manual.

(2) Do not process assemblies by immersion if these assemblies have faying surfaces.

(3) Surfaces must be water-break-free following immersion in any processing solution or rinse except following vapor degreasing, solvent cleaning or emulsion cleaning. Parts which develop water breaks shall be recleaned per BAC5749 (Ref Paragraph 6.).

NOTE: A water-break-free surface is a surface which 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.

(4) Rinse parts free of active materials immediately following each processing step with the exception of vapor degreasing or solvent cleaning.

CAUTION: THE INTEGRITY OF EXPOSED BRAZING ALLOY JOINTS MAY BE JEOPARDIZED IN CONSIDERABLY LESS THAN 5 MINUTES IF EXCESSIVE BRAZING ALLOY IS REMOVED. IN CASE OF DOUBT, SIMULATED JOINTS SHOULD BE RUN TO DETERMINE APPROPRIATE IMMERSION TIMES.

(5) When required, brazed parts may be immersed in solutions containing nitric acid for up to 5 minutes.

C. Parts Requirements

(1) After processing, surfaces shall be free from all soils, grease, oil, pencil marks, fingerprints, foreign metal contaminants, heat-treat scale and other contamination, unless otherwise specified in overhaul manual. Parts not meeting these requirements shall be abrasively processed per BAC5758 Type III or chemically reprocessed provided that the total allowable descaling or decontamination time has not been exceeded.

(2) Parts to be resistance welded shall conform to the surface requirements of the applicable section of BAC5977.

(3) Parts which have become pitted and burned are unacceptable.

15. CLEANING OF BERYLLIUM

A. These deoxidizing and etch cleaning procedures for beryllium come from BAC5833.

(1) Deoxidizing (Methods 1 and 3) gives clean surfaces for subsequent procedures.

(2) Etch cleaning (Methods 2 and 4) is usually specified after machining (Ref SOPM 20-10-09) to remove surface twinning and microscopic cracks. The selection between Methods 2 and 4 is optional. But Method 2 is slower and gives a more highly polished surface. The matte finish made from Method 4 is recommended for brazing.

B. Materials

NOTE: The concentrations of chemicals as given can have a tolerance as permitted by commercial practice.

(1) Nitric acid, 40° Baume', technical, O-N-350

(2) Hydrofluoric acid, 70%, technical, O-H-795

(3) Sulfuric acid, 66° Baume', technical, O-S-809

(4) Phosphoric acid, 85%

(5) Chromic acid, technical, O-C-303

(6) Ammonium bifluoride, purified flake

C. General

CAUTION: BERYLLIUM PARTS CAN BREAK. DO NOT HIT THEM.

(1) Put parts in the racks to let cleaning and rinsing solutions touch all part surfaces and then drain. Do not let the parts touch, scratch, or hit each other.

(2) See that surfaces are water-break-free after they were in the processing solution or rinse. Make sure they have no water stains or contamination after they dry.

D. Solution Makeup and Control

(1) Beryllium Pickle solution (used in Methods 1 and 2)

(a) For each 100 gallons of final solution, make the following additions in the order specified.

1) Put approximately 35 gallons of water into the tank.

2) Add 29 gallons of nitric acid.

3) Add 4.5 fluid ounces (6.0 ounces avoirdupois or 170 grams) of hydrofluoric acid.

4) Fill tank to the 100-gallon level with water and mix thoroughly.

(b) Control solution as follows:

1) Nitric acid: 30-35 oz/gal

2) Hydrofluoric acid: 0.030-0.042 oz/gal

3) Maintain solution at room temperature.

(2) Sulfuric - Chromic - Phosphoric Acid Etching Solution (Used in Methods 2, 3, 4)

(a) For approximately 100 gallons of final solution, make the following additions in the order specified.

1) Put 4.5 gallons of water in the tank.

2) Add 93 pounds of chromic acid and thoroughly mix until dissolved.

3) Add 87.5 gallons of phosphoric acid.

4) Add 4 gallons of sulfuric acid.

5) Carefully stir the solution until thoroughly mixed.

(b) Control solution as follows:

1) Sulfuric acid: 8-11 oz/gal

2) Chromic acid: 14-17 oz/gal

3) Phosphoric acid: 160-175 oz/gal

4) Temperature: 100-110°F

(3) Ammonium Bifluoride - Phosphoric Acid Solution (used in Methods 3, 4)

(a) For each 100 gallons of final solution, make the following additions in the order specified.

1) Put approximately 75 gallons of water in the tank.

2) Add 85 pounds of ammonium bifluoride and mix until completely dissolved.

3) Add 10 gallons of phosphoric acid and mix.

(b) Control solution as follows:

1) Ammonium bifluoride: 10.0-13.7 oz/gal

2) Phosphoric acid: 17.6-22.0 oz/gal

3) Temperature: 70-100°F (For fast metal removal, 90-100°F is recommended.)

E. Method 1 Deoxidizing

(1) Vapor degrease per Paragraph 3. This step may be omitted if parts are not greasy or oily and surfaces are water-break-free after rinsing.

(2) Alkaline clean and rinse per Paragraph 6., Method 1, type C or D.

(3) Deoxidize in beryllium pickle solution (Paragraph 15.D.(1) above). Remove 0.25-0.75 mil (0.00025-0.00075 inch) material per surface.

(4) Rinse thoroughly in cold water and dry.

(5) Keep parts dry and free of fingerprints and other contaminants by wrapping in polyethylene film, if parts are contamination-sensitive or will later be brazed.

F. Method 2 Etch Cleaning

(1) Vapor degrease, alkaline clean, and deoxidize per Paragraph 15.E.(1), Paragraph 15.E.(2) and Paragraph 15.E.(3) above.

(2) Rinse thoroughly in cold water.

(3) Etch in sulfuric-chromic-phosphoric acid solution (Paragraph 15.D.(2) above). Remove 1.5 mils (0.0015 inch) material per surface. Total metal removal, after both baths, shall be 2.0-3.0 mils (0.002-0.003 inch) per surface.

(4) Rinse and wrap, as necessary, per Paragraph 15.E.(4) and Paragraph 15.E.(5) above.

G. Method 3 Deoxidizing

(1) Vapor degrease and alkaline clean per Paragraph 15.E.(2) and Paragraph 15.E.(3) above.

(2) Deoxidize in ammonium bifluoride phosphoric acid solution (Paragraph 15.D.(3) above). Remove 0.25-0.75 mil (0.00025-0.00075 inch) material per surface.

(3) Rinse thoroughly in cold water.

(4) Put in sulfuric-chromic-phosphoric acid solution (Paragraph 15.D.(2) above) for a few seconds to remove smut.

(5) Rinse and wrap, as necessary, per Paragraph 15.E.(4) and Paragraph 15.E.(5) above.

H. Method 4 Etch Cleaning

(1) Vapor degrease and alkaline clean per Paragraph 15.E.(1) and Paragraph 15.E.(2) above.

(2) Etch in ammonium bifluoride phosphoric acid solution (per Paragraph 15.D.(3) above). Remove 2.0-3.0 mils (0.002-0.003 inch) material per surface.

(3) Rinse thoroughly in cold water.

(4) Rinse and wrap, as necessary, per Paragraph 15.E.(4) and Paragraph 15.E.(5) above.

I. After cleaning, make sure that the thickness of the parts is not less than the minimum permitted by overhaul instructions. Reject parts with cracks, oxidation, or damage such as pitting, excessive etching, intergranular attack, warping, or distortion.

16. CLEANING OF VACUUM WASTE LINE TUBING

A. This procedure is applicable to CRES and titanium waste line tubing that is removed from the airplane. The procedure uses a weak acid solution to remove the layer of built up waste from inside the line.

B. Materials

(1) Phosphoric acid, 15%

(2) Vinegar, 100 grain (10% acetic acid strength)

(3) Honey Bee Cleaner 60, V71361

C. Fill the removed lines with phosphoric acid, vinegar, or Honey Bee Cleaner 60 solution, or soak the lines in the solution. Let stand as necessary to loosen and remove the layer of built-up waste. If you put the lines into the solution, be sure to give protection to plastic labels on the tubing. Then fully flush the lines with water.

D. As a check on the removal of the layer, lightly hit the lines with a coin or equivalent metal object. A clean line will give a sharp ringing sound. A line with a layer of built-up waste will give a dull, muffled noise.

17. AQUEOUS VAPOR DEGREASING

A. This procedure for aqueous alkaline and solvent/emulsion degreasing comes from BAC5763, Type 2. This procedure can be used on aluminum (with or without chemical conversion coating or anodize), magnesium, nickel-based, copper-based, ferrous, and titanium alloy parts and electroplated steel. This procedure is optional to the vapor degreasing procedure of BAC5408 (Paragraph 3.). Do not use this procedure or honeycomb core. Vapor degreasing per BAC5408 (Paragraph 3.) is preferred for oxygen system tubing and fittings.

B. Materials

(1) Amberclean L12, V0ZQL5

(2) Axarel 56, V18873

(3) Biogenic SE373, V13091

(4) Biogenic SE374, V13091

(5) Formula 815GD, V94058

(6) Formula 1990GD, V94058

(7) Daraclean 212, V04552

(8) Daraclean 235, V04552

(9) Daraclean 282, V04552

(10) KC-270, V2R358

(11) Primaclean 1050, V71361

(12) Super Bee 300LF, V96717

C. Agent Selection – See Figure 1.

D. Solution preparation and control – See Figure 2.

E. Immersion Aqueous Degreasing (for all but oxygen system components)

(1) Put the parts in the solution. To help remove all oils and greases, parts can be pulled out and put back in.

(2) Remove the parts from the solution. Put the parts on the rack at an angle to remove pockets of caught solution.

(3) Rinse the parts in warm water, 90-140°F, for 5 minutes minimum. A 2-minute spray rinse is acceptable if the spray hits all part surfaces directly.

(4) Examine the part to see if all dirt was removed. Put the parts through the procedure again if necessary.

(5) If the parts will get more chemical treatment, continue with that immediately. Do not let the parts dry.

(6) If the parts will not get more chemical treatment, dry the parts in air, at room temperature or heated. Give the parts protection from contamination.

F. Immersion Aqueous Degreasing for Oxygen System Components

(1) Tubing

(a) Put the tubes in the solution.

(b) While the tubes are in the solution, flush solution through the tubing at a minimum flow rate of 10 feet per second for a minimum of 10 minutes. Or, as an option, make sure all air is removed from the tubing and use ultrasonic agitation for a minimum of 2 minutes.

(c) Remove the tubing from the solution. Drain the solution from the tubing.

(d) Rinse the tubing in warm water at 90-140°F. Flush water through the tubes at a minimum flow rate of 1 foot per second for a minimum of 5 minutes. Or, as an option, make sure all air is removed from the tubing and use ultrasonic agitation for a minimum of 2 minutes. The total rinse time must be a minimum of 5 minutes.

(e) Rinse the exterior of the tube for 5 minutes. You can use an immersion or spray rinse.

(f) Dry the tubing with room temperature or heated air.

(g) Give the clean tubing protection from contamination. Refer to SOPM 20-70-01 for more instructions.

(2) Fittings

(a) Put the fittings in the solution.

(b) Make sure the solution is mixed, pumped, or has ultrasonic agitation, or move the parts around in the solution.

(c) Remove the parts from the solution. Drain the solution from the parts.

(d) Rinse fully in warm water, 90-140°F. Move the parts around in the rinse water, pump the water, spray it on the parts, or use ultrasonic agitation. Rinse for a minimum of 5 minutes.

(e) Examine the cleaned parts. Put them through the procedure again if necessary.

(f) Dry the fittings. Give them protection from contamination. Refer to SOPM 20-70-01 for more instructions.

G. Aqueous Spray Degreasing

(1) Spray parts with the solution.

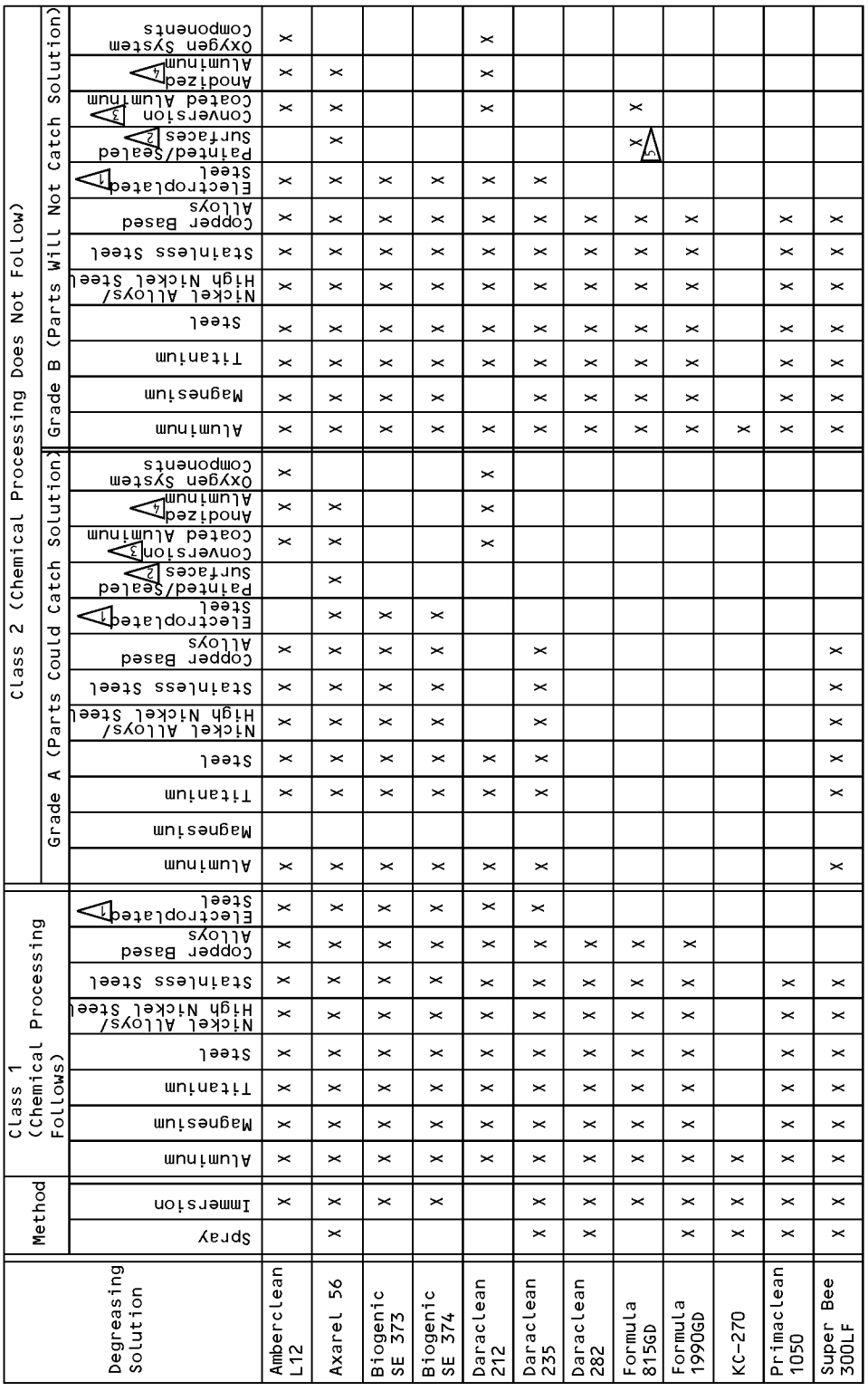
(2) Remove pockets of solution caught in the parts.

(3) Rinse the parts with warm water, 90-140°F, for 5 minutes minimum. A 2-minute spray rinse is acceptable if the spray hits all part surfaces directly.

(4) Examine the parts to see if all dirt was removed. Put the parts through the procedure again if necessary.

(5) If the parts will get more chemical treatment, continue with that immediately. Do not let the parts dry.

(6) If the parts will not get more chemical treatment, dry the parts in air, at room temperature or heated. Give the parts protection from contamination.



Degreasing Solution	Class 1 (Chemical Processing Follows) Method		Class 1 (Chemical Processing Follows)											Class 2 (Chemical Processing Does Not Follow) Grade A (Parts Could Catch Solution)											Class 2 (Chemical Processing Does Not Follow) Grade B (Parts Will Not Catch Solution)										
	Spray	Immersion	Aluminum	Magnesium	Titanium	Steel	Nickel Alloys/ High Nickel Steel	Stainless Steel	Copper Based Alloys	Electroplated Steel [1]	Aluminum	Magnesium	Titanium	Steel	Nickel Alloys/ High Nickel Steel	Stainless Steel	Copper Based Alloys	Electroplated Steel [1]	Painted/Sealed Surfaces [2]	Conversion Coated Aluminum [3]	Anodized Aluminum [4]	Oxygen System Components	Aluminum	Magnesium	Titanium	Steel	Nickel Alloys/ High Nickel Steel	Stainless Steel	Copper Based Alloys	Electroplated Steel [1]	Painted/Sealed Surfaces [2]	Conversion Coated Aluminum [3]	Anodized Aluminum [4]	Oxygen System Components
Amberclean L12		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X			X	X	X	X		X	X	X	X	X		X	X	X
Axarel 56	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	
Biogenic SE 373		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X					X		X	X	X	X	X	X			
Biogenic SE 374		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X					X		X	X	X	X	X	X			
Daraclean 212			X	X	X	X	X	X	X	X	X		X	X							X	X	X		X	X	X	X	X	X		X	X
Daraclean 235	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X				X	X	X		X	X	X	X	X	X		X	X
Daraclean 282	X	X	X	X	X	X	X	X	X					X									X		X	X	X	X	X	X			
Formula 815GD		X	X	X	X	X	X	X	X					X									X		X	X	X	X	X	X	[5] X		
Formula 1990GD	X	X	X	X	X	X	X	X	X					X									X		X	X	X	X	X	X			
KC-270	X	X	X										X										X										
Primaclean 1050	X	X	X	X	X	X	X	X	X					X									X		X	X	X	X	X	X			
Super Bee 300LF	X	X	X	X	X	X	X	X	X				X	X	X	X	X						X		X	X	X	X	X	X			

[1] Electroplated ferrous alloys above 180 KSI, but not nickel or chrome plated parts. For electroplated ferrous alloys below 180 KSI, and all nickel and chrome plated parts, refer to the column about the base metal.

[2] A 45-hour minimum cure is necessary first for surfaces primed, topcoated, or which have BMS 5-95 Class F-1 sealant with or without BMS 10-11 Type 1 primer topcoat. BMS 5-95 Class C-20 sealant must be cured to 10 Rex A hardness per ASTM D 2240. BMS 5-95 Class B-1/2 or B-2 sealant must be cured to 30 Rex A hardness per ASTM D 2240.

[3] A 48 hour minimum cure is necessary first for 5000 or 6000 series aluminum. Do not aqueous degrease other aluminum alloys unless the parts will be painted.

[4] Only for sealed chromic acid anodize, boric-sulfuric acid anodize, and sulfuric acid anodize.

[5] Only for painted surfaces and BMS 5-95 class B-1/2 and B-2 sealants.

Aqueous Degreasing Agent Selection
Figure 1

CLEANER	IMMERSION CLEANING		SPRAY CLEANING		TEMP °F	AGITATION
	MAKEUP [1]	CONTROL [2]	MAKEUP [1]	CONTROL [2]		
AMBERCLEAN L12 [6]	25	8-30	DO NOT USE		150 MAX	MED [5]
AMBERCLEAN L12 [7]	25	22-28	DO NOT USE		135-150	PUMP RECIRCULATION
AXAREL 56	20	5-100	20	5-25	150 MAX	MED [4]
BIOGENIC SE 373	20	15-25	DO NOT USE		65-95	SLOW [3]
BIOGENIC SE 374	20	15-25	DO NOT USE		65-95	SLOW [3]
DARACLEAN 212 [6]	10	8-25	DO NOT USE		175 Max	MED [5]
DARACLEAN 212 [7]	10	8-15	DO NOT USE		135-150	PUMP RECIRCULATION
DARACLEAN 282	10	8-25 [8]	5	3-12	110-175 [8]	MED.
FORMULA 815GD	10	8-25	DO NOT USE		100-175	MED [5]
FORMULA 1990GD	15	8-25	5	3-25	110-175	MED.
PRIMACLEAN 1050	10	8-20	5	3-20	100-175	MED.
SUPER BEE 300LF	10	8-25	5	3-25	105-175	MED.

[1] GALLONS OF CLEANER PER 100 GALLONS FINAL SOLUTION.

[2] VOLUME PERCENT CLEANER IN THE SOLUTION.

[3] USE ONLY A MINIMUM OF PHYSICAL AGITATION OR PUMP RECIRCULATION TO PREVENT EMULSION SEPARATION. DO NOT USE AIR AGITATION.

[4] WHEN USED IN AN EMULSION STATE, WE RECOMMEND AN OPERATING TEMPERATURE OF 120°F TO PREVENT PHASE SEPARATION.

[5] PHYSICAL AGITATION OR PUMP RECIRCULATION IS BEST. AIR AGITATION CAN BE USED, BUT IT COULD CAUSE TOO MUCH FOAM AND LOSE THE ORGANIC INGREDIENTS.

[6] FOR OTHER THAN OXYGEN SYSTEM COMPONENTS.

[7] FOR OXYGEN SYSTEM COMPONENTS ONLY.

[8] FOR MAGNESIUM, MAXIMUM CONCENTRATION MUST BE 12% AND THE MAXIMUM TEMPERATURE MUST BE 150°F.

Aqueous Degreasing Solution Makeup and Control
Figure 2

18. CLEANING OF COPPER AND COPPER ALLOYS

A. Materials

(1) Cuprous cyanide, 70 percent copper minimum, 0.20 percent insoluble matter maximum, plating grade

(2) Fluoboric acid, 48-50 percent, plating grade

(3) Sodium cyanide, 97 percent NaCN minimum, plating grade

(4) Sodium hydroxide, flake or granulated, technical – O-S-598

(5) Hydrochloric acid, 20° Baume', technical

(6) Sulfuric acid, 66° Baume', technical – O-S-809

(7) Chromic acid (chromium trioxide) – O-C-303

(8) Nitric acid, 40° or 42° Baume', technical – O-N-350

(9) Sodium dichromate dihydrate, technical – O-S-595

B. Solution Preparation

WARNING: SOME OF THESE SOLUTIONS CONTAIN CYANIDE AND ARE VERY POISONOUS. DO NOT BREATHE VAPOR OR MIST. DO NOT LET SOLUTIONS TOUCH EYES, SKIN OR CLOTHING. KEEP CYANIDES AWAY FROM HEAT, SPARKS, AND OPEN FLAMES.

(1) Cyanide Holding Bath (BAC5625 Solution 11A)

(a) Add approximately 4/5 the total amount of water to the tank.

(b) Add 31 pounds of sodium cyanide and 10 pounds of sodium hydroxide for each 100 gallons final solution.

(c) Fill the tank with water to the operating level.

(d) Control the solution at 4-5 oz/gal sodium cyanide and 1-2 oz/gal sodium hydroxide.

(e) Use this solution at room temperature.

(2) Uninhibited Hydrochloric Acid Solution (BAC5625 Solution 19)

(a) Add approximately 2/3 the total amount of water to the tank.

(b) Add 14 gallons hydrochloric acid for each 100 gallons final solution.

(c) Add water as necessary to fill the tank to the operating level.

(d) Use this solution at temperatures from room temperature to 140°F.

(e) Metal contamination limits – Iron, 1 oz/gal maximum.

(3) Copper Strike Solution

(a) Fully clean the tank. Then add approximately 3/4 the total amount of water required.

(b) Add 37 pounds sodium cyanide, and 22 pounds cuprous cyanide per 100 gallons of final solution. Stir until completely dissolved.

(c) Fill the tank with water to the operating level.

(d) Control the solution at 2.0-4.0 oz/gal copper metal, 0.5-2.0 oz/gal free sodium cyanide, and 0.1-0.5 oz/gal sodium hydroxide.

(e) Use this solution at room temperature, or control it at 120-150°F.

(4) Nitric-Sulfuric Acid Solution

(a) Put 40 gallons of water in a tank. Add 32 gallons of sulfuric acid and 12 gallons of 40° Baume' nitric acid or 11 gallons of 42° Baume' nitric acid per 100 gallons of final solution. Then fill the tank with water to the operating level.

(b) Control the solution at 50-80 oz/gal sulfuric acid, 10-15 oz/gal nitric acid, and 2.5 oz/gal maximum copper.

(c) Use this solution at room temperature.

(5) Chromic-Sulfuric Acid Solution

(a) Put 60 gallons water in a tank. Add 25 pounds of chromic acid, and 12 gallons of sulfuric acid per 100 gallons of final solution. Then fill the tank with water to the operating level.

(b) Control the solution at 3.0-4.0 oz/gal chromic acid, 22-30 oz/gal sulfuric acid, and 2.0 oz/gal maximum copper.

(c) Use this solution at room temperature.

(6) Sodium Dichromate - Sulfuric Acid Solution

(a) Put 60 gallons of water in a tank. Add 33 pounds of sodium dichromate, and 12 gallons of sulfuric acid per 100 gallons of final solution. Then fill the tank with water to the operating level.

(b) Control the solution at 4.5-6.0 oz/gal sodium dichromate dihydrate, 22-30 oz/gal sulfuric acid and 2.0 oz/gal maximum copper.

(c) Use this solution at room temperature.

(7) Sulfuric Acid Solution

(a) Put 60 gallons of water in a tank. Add 10 gallons of sulfuric acid per 100 gallons of final solution. Then fill the tank with water to the operating level.

(b) Control the solution at 19-26 oz/gal sulfuric acid, and 4 oz/gal maximum copper, except, to treat copper on circuit boards, control the copper at 1 oz/gal maximum.

(c) Use this solution at room temperature (100°F maximum).

(8) Fluoboric Acid Solution

(a) Put 60 gallons of water in a tank. Add 22 gallons of fluoboric acid per 100 gallons of final solution. Then fill the tank with water to the operating level.

(b) Control the solution at 13-20 oz/gal fluoboric acid, and 1.5 oz/gal maximum copper.

(c) Use this solution at room temperature.

C. Cleaning Copper and Copper Alloys

(1) Vapor degrease, solvent clean, or emulsion clean per Paragraph 3., Paragraph 4., or Paragraph 7., if necessary.

(2) Alkaline clean per Paragraph 6.

(3) Rinse.

(4) Air-water blast to remove loose scale as needed.

(5) Remove scale or oxide by one of these steps:

(a) To remove heavy red-oxide scale, put the parts in nitric-sulfuric acid solution for 15-60 seconds.

(b) For moderate red-oxide scale immerse in chromic-sulfuric acid solution for 4-7 minutes, or in sodium dichromate-sulfuric acid solution for 4-7 minutes.

(c) For mild oxide put the parts in sulfuric acid solution for 1/2 to 2 minutes.

(6) Rinse in cold water.

(7) If scale is not completely removed, do Paragraph 18.C.(4), Paragraph 18.C.(5), and Paragraph 18.C.(6) again.

(8) Hot water rinse and dry.

(9) Lead and lead-tin soldered parts (process silver soldered parts as shown for the alloy)

(a) Dip in fluoboric acid for 5 to 60 seconds.

(b) Rinse in cold water.

(c) Copper strike for approximately 4 minutes at 4-6 volts. Be sure to use a different tank for this copper strike to prevent lead contamination of the plating tanks.

(d) Plate as specified.

(10) Alloys which contain more than 0.7 percent lead

(a) Immerse in fluoboric acid solution for 4-6 minutes

(b) Rinse in cold water.

(c) If the parts will be plated in an alkaline solution, put them in cyanide holding bath for 15-60 seconds.

(d) Rinse in cold water.

(e) Plate as specified.

(11) Copper, bronze, brass, aluminum-bronze, phosphor-bronze, monel, and alloys which contain less than 0.7 percent lead

(a) Rinse in cold water.

(b) If the parts will be plated in acid solution, put them in sulfuric acid solution or fluoboric acid solution for 15-60 seconds. Fluoboric acid is preferred when plating in a fluoboric acid bath.

(c) If the parts will be plated in an alkaline solution, put them in cyanide holding bath for 15-60 seconds.

(d) Rinse in cold water.

(e) Plate as specified.